ALLAN R. CULLIMORE
158 GARFIELD PLACE
VILLAGE OF SOUTH ORANGE, N.J.

June 6, 1955

Mr. Ira A. Tumbleson
Newark College of Engineering
Newark, New Jersey

My dear Mr. Tumbleson:

Attached is the finished draft of the history of the Newark Technical School and the Newark College of Engineering. It has been looked over and checked for content by President Van Houten and myself.

It is thought that you may have some suggestions, after reading it through. If so, will you please pass them on. If I can have it back by the first of September, I think that will be entirely sufficient.

Let me thank you for your help in the matter and hope that this thing will prove acceptable and in the last analysis be useful as well.

Very sincerely yours,

Allan R. Cullimore

ALLAN R. CULLIMORE
President Emeritus
Newark College of
Engineering

ARC:psj
Att.

PREFACE

In attempting a project of this kind it is, of course, much more than the work of one man. In the case of this history there are many of us who have contributed to the project.

Mr. Ira A. Tumbleson, our Librarian, contributed material which touched on events up to the Civil War.

Professor Charles J. Kiernan handled the development of industry in Newark and the vicinity, and the development of education along technological lines from the Civil War to the beginning of the Newark Technical School and did a monumental job in working much of the material into shape.

Professor Robert Widdop handled the material having to do directly with relationships of the school to industry.

Professor James A. Bradley wrote of the development of the Newark Technical School.

Mr. Daniel R. Hall contributed the material bearing on the relation of the vocational schools to the School and the College.

Professor Robert E. Kiehl handled the material which had to do with the development of Newark and its institutions from the founding of the school to the present day.

The Chairman, Mr. Allan R. Cullimore, handled the matter of his own administration and acted as a general unifying or integrating agent.

The material since 1948 and the material on the graduate school was contributed very largely by President Robert W. Van Houten.

Some of this material was set aside in separate chapters and some, for reasons of clarity, was integrated with the material of the history without any attempt to segregate it. This, we think, made for a better and clearer picture than if we had artificially divided the material into particular minor projects or discrete segments.

INTRODUCTION

Things move fast in America. Forever the picture changes in industry, in education. Things are never static. So in reading this history perhaps it is well to recognize that in the old Technical School in the olden days plumbing was taught simply because at that time sanitary arrangements and bathtubs seemed to be fundamental in our conception of a high culture and a good thing for the American people. We needed plumbing then. We needed good plumbing and somebody had to be taught how to be a good plumber. That wasn't so many years ago, but at the present time the scene has changed. Bathtubs have become commonplace, at least in America, and our attention is turned to other things which are highly necessary to our development and our survival—automobiles, radios, television, automation. All have required sequentially more training on the part of those who develop and equip these services to mankind so that this little history should be judged on that basis as a history of change.

In Newark we have developed a type of education and a type of training which is designed to be helpful to the citizens of Newark and our community so that we may enjoy and profit by those things which make for a higher level of culture and which make it possible to live a more abundant life. This is by way of saying that education cannot be split up into small pieces, one segregated from the other, but the development of the human body and the human mind requires many types of training and of education. To provide one phase of this development is our problem, realizing that in the development we must not lose sight for a moment of the broad factors which cover and make necessary education in all fields.

So that this is intended to be a history of an institution which in its own sphere has tried and is still trying to meet the basic human problems of its locality and to make the community not only good, but always a better place in which to live.

In studying the development of American education as paralleling the cultural development of the people, it is almost impossible to draw a reasonable line of demarcation between the types of our American institutions. Our denominational colleges and our parochial schools and colleges with all shades of religious background have worked together in surprising harmony throughout their lifetimes. Their general philosophy with respect to their public responsibilities is in most cases parallel to the responsibilities of the state and publicly supported institutions.

Perhaps the word free public education should finally apply only to those schools which were constitutionally provided for, but the actual facts of the matter are that the free public schools, the vocational schools, state universities, and colleges of all kinds properly make up what we might call in the broad sense public education. In any case, whether a school is totally supported by public funds or partially supported, or its funds are augmented by public grants, or even if it only partakes of the public money through the avenues of research, it is still, for the purposes of discussion here, to be listed as a public school.

Most of our so-called free schools charge tuition for outsiders. Geographical limitations are sometimes the determining factor in the amount of support and we find ourselves confronted with a very real and practical dilemma when we try to speak of our public school system as consisting of free public schools rather than simply as public schools.

So that we may say, and I think with truth, that all of our American school system is at the present moment interested in developing and educating all classes and conditions of men and women, independent of their social position or of their financial competency, or even of their religious affiliations. It's well to realize this and we believe it to be a much sounder point of view than to assume a dividing line which in fact does not exist. By means of scholarships, loans, and other grants the way has been opened in most institutions to students of superior ability and it is almost impossible to say that in America a student may not secure an education if he's <u>particularly gifted</u>. This is not to say, however, that there are not many students of moderate attainments or above the average attainments who cannot secure a college education; but it seems most certainly true to say that there is nothing in the way of a gifted person to follow either a general or a professional education.

Perhaps all that it is necessary to do is to indicate briefly what part this type of American education plays in the industrial, economic, and material progress which is characterized by the development of America and our modern industrial system on a nation-wide level. This is a thing that has developed progressively from decade to decade. It is characteristic of America. SEE INSERT ATTACHED I think those who have traveled abroad immediately sense ~~the~~ THIS fundamental differences between the philosophy which characterizes the education in various European countries and the philosophy which animates us here in America. In individual situations here and abroad this is not, perhaps, too evident; but if a thorough search and a thorough investigation is made with eyes open and ears attuned to all levels of financial competency and to all kinds of educational projects, we

Here in America we take education for granted. This great system of public education extends through all the formal ranges and now we could almost say, that with our programs of adult education, it extends from the cradle to the grave. We take for granted too our great American heritage that we look for education primarily for our success. It is a part and parcel of everything that we do. Instead of being picked individuals for one reason or another, our great system here in America extends to all classes and conditions of men and women and one of the most astonishing things we notice in our immigrant population is their appreciation of this point of view and this philosophy and we are surprised at the alacrity with which they take advantage of a public education as offered in America.

Of course the various countries differ widely as to the opportunities for education but it can be said without fear of contradiction that overall and in all phases in no other country has the educational picture been as favorable to the people as it has been in America.

find that the people of America are particularly sensitive to the part that education has played in the development of their country and in their thinking and are in the main desirous of not only higher standards of living, but higher standards in the field of the intellectual and moral; and there is, I think, with us a growing realization, if we stop to think about it, that one of the primary factors in our material, moral, and intellectual progress rests in our systems of schools.

Until very recently it has hardly occurred to some Europeans and perhaps very few Asiatics that a high standard of living is possible for all the people in their countries. A very considerable mass of the people have been used to very humble circumstances; and while not altogether satisfied with their environment, it has never occurred to them that it can be changed through themselves and by their own efforts. These great masses of people seem to be entirely ignorant of what a high standard of living entails with respect, particularly, to personal energy and responsibility. They are not aware of the advantages of not only material progress, but of intellectual and moral progress; and while some people in some Asiatic countries perhaps even excel us in their concepts with respect to morals and religion and things emotional, a very low standard of living makes the attainment of these things and their cultivation on the part of all the people extremely difficult. They see or they pretend to see some of the disadvantages of a high standard of living and do not appreciate that intellectual, emotional, and moral values should be shared by everybody from the bottom clear to the top. The old class consciousness is hard to break down and the whole picture and the relation of its various factors was never brought home to them through a system of education which touches all the people.

In writing a modest history of any kind there should be a definite reason for it which is apparent and which serves as a motive to crystallize the material. In this case we want to show how in this particular metropolitan section of New Jersey--and perhaps in the state as a whole--the Newark Technical School and the Newark College of Engineering have been active and potent factors in the overall development of the community. There seems to be a little misunderstanding as to the role and as to the contribution of projects of this character as sometimes springs up between different types of educational projects, and we want particularly in this history to point out that this seeming antagonism as between arts and engineering is not only unwarranted, but not based really in fact.

There seems to be a feeling in some quarters that the arts college is different and has objectives some way antagonistic to technological institutions. As a matter of fact, they are both simply phases of the same general problem which faces our American culture and our American way of life. We may learn from our church, from our college, or from any other source, of the things which are worth most in this life and which we ought to cultivate. We can learn something of the background and the philosophies which activated the founders of America to pledge "their lives, their fortunes, and their sacred honor" to this way of life; but from whatever source this information and this inspiration for a broader and better life comes, there must be someone who points out the way to a fulfillment of this dream or this desire. How do we get the thing we want? What is the price of our liberty? We must recognize that one of the most fundamental things is to relieve people of some of the intolerable physical burdens which bear down so heavily upon great segments of the human race. We must have things to eat; we must have things to wear; we must have housing; and unless these needs are met, real cultural development is not possible. How they are to be met in our developing and expanding economic scene is the problem which comes to a technological institution. There is nothing in this philosophy at variance with the college of arts or with any other agency striving to sensitize Americans to their duties and their responsibilities.

It is a far cry from the old slavery of the Greeks and the Romans where the needs of the people were largely met by inefficient human labor with all its economic and moral drawbacks to a situation where the mind of man has managed to design and invent and perfect means which furnish to a very considerable number of the people luxuries not only comparable, but much superior to those enjoyed, for instance, by the most favored of the Greeks and the Romans. It does not change the picture at all to realise that while the level of culture of a favored few in these countries was high, and while the culture of a favored few is at an extremely high level in many of our Asiatic countries now, that we with our Western civilization are the first to make it possible for a <u>great mass</u> of the people to enjoy freedom from slavery.

This is not a simple matter and has not been a simple matter; and as the wants and even the needs of the people increase, the question of keeping pace with the material needs increases at an amazing rate. The work of the scientist and the engineer is primarily concerned with the problem of not only increasing the number of kinds of material machines, but also increasing their productivity so that their output may be more widely distributed. The importance of this is sometimes overlooked but we have accustomed ourselves to a general way of life which is absolutely dependent upon the facilities which have been made possible by technology. We need only to envision a long continued failure of our public utilities with no light or heat possible, the failure of our transportation system, and perhaps worst of all, the failure of our water supply and sewerage disposal. These things which are unknown to some parts of the earth have become commonplace with us and the engineer finds himself concerned primarily with the development of problems of this character which in the last analysis free a considerable number of the population by means of developments which vary through a very wide field.

On the material side there is a certain degree of fatalism about some of our neighbors which has grown up for centuries and is perfectly understandable when we think of the external environment, but this makes them rather insensitive to the fact that they have a right to the same living conditions which surround a family in a much higher income bracket. To be true, this right perhaps is not inherent in their mere existence, but in their capacity to contribute to the material and intellectual welfare of their communities. It seems to us, as we view the foreign scene, somewhat pitiful to see children who have grown to manhood and womanhood without the slightest chance to develop either themselves or join in the development of their communities or states.

There are three things which probably should be mentioned in connection with our school system. The first is that it is self-imposed. It is of our own choice. It encompasses all of us to a greater or lesser degree. It is something in which every taxpayer joins. It is not externally imposed but it is the essence of the American way of life, the American way of thought. It operates on the principle that in America brains are where you find them. ~~that they come up from the bottom as easily as they come down from the top and~~ It is tremendously important to us on all fronts that we attempt to use from the bottom clear to the top all the brains that we have in America. If we are to stay in the forefront of world economy, we must utilize every ounce of brains which are available no matter where they may be found.

So that, in the first place, our system of education as a whole brings to the people at large not only some of the higher and better things of life, but a knowledge that socially they have a right to shape their own ends and to enjoy, if they have a reasonable supply of energy, judgment, and competence, the right to considerably more than a bare subsistence.

We often hear it said that every boy in the United States is brought up to believe that he can be President. While this, it would seem, is literally true, and while it may have its disadvantages, it has tremendous advantage, particularly in the motivation and the morale of all our citizens. It keeps alive in their minds the possibility of moving from the low to the higher brackets of income and of intellectual pursuits and of moral stature as a perfectly normal procedure. The creation of this desire, the knowledge that there is a fair chance of fulfilling the desire, and the continued motivation and spurring of an American to his greatest endeavors has had and we hope is having a tremendous effect on the whole economy and on the spirit of our people--

upon their aggressiveness, their industry, upon their intellects, and their morals. This has characterised us from pioneer days. This in itself is a tremendous factor, a wonderful heritage, sure to be defended at all costs.

In conjunction with it we have seen and come to realise that with this promise of a higher standard of living we must do something to fulfill it. We must implement our people, our organisations of production and distribution, so that they can reasonably realise what has been promised and what they hope for; and hence we supplement our primary and secondary education by professional education, by business education, by courses in economics and curricula in other fields which attempt not only to develop the material, but the moral, intellectual, and spiritual side of life.

We have vocational schools on the secondary level, colleges and universities, technical schools, parochial and denominational schools, and these all have for their ideal the utilisation of every ounce of brains we have available. This multiplies manyfold the potential capacities of our youth who finally turn into captains of industry, doctors, lawyers, engineers, teachers, and what not. It multiplies manyfold the ease with which we implement our great economic and industrial machinery. In other words, by this education of our own choosing which touches us all, which is a part of our way of life, which is not imposed by any external factor, by this education we create the desire, we point out the possibilities—the possibilities of every man, woman, and child to raise his standard of living far beyond anything that was dreamed of half a century ago. We show them that there is not only a chance for life, but a chance for living abundantly. Then by the same system we make it practically possible to attain the thing which we have promised. We not only make it possible, but we point out the most direct, efficient, and effective ways to do this. It seems that the position we hold in the community of the world has been made possible directly by our system of education. The position we hold is, of course, the cause for much jealousy and perhaps it is entirely reasonable to suppose that we are looked down upon as material because we possess the material things in a great degree, but this does not preclude the possibility of the possession of other advantages in other fields.

This is not a situation limited to some parts of America—it is something that characterizes almost all of our communities. Some of us perhaps are a little more backward and need a little spurring, and some of us have gone forward and outdistanced our neighbors; but we are all sharers to some extent in this situation. So in developing some of the interesting things that have characterized the industrial and commercial development of Newark, it seems not only wise, but actually necessary, to link closely with its people, its industry, its commerce, its culture, and its way of life a thing which we must consider to be most important and that is its educational system and the correlation of that educational system from top to bottom with the material, economic, emotional, and moral development which has characterized this locality, remembering that this is not unique, but that the story here is the same as the story in many places. The story is, however, with us, in a sense an individual one—it involves certain people, certain industries, certain unique developments which have taken place here and which give a community its form and color. We have helped to make Newark and its subsidiary community what it is today, and the effect of our institution on the State as a whole has not been inconsiderable.

CHAPTER I

In The Beginning

Who can tell when engineering began? Many thousands of years ago when the human race had to concern itself primarily with using the earth and the products of the earth for survival, we may consider that engineering in its earliest form began. It is true that no one race and no single era may properly lay claim to the parenthood of engineering; but every race and every era and every phase of civilization, and even every climate, may be said to have made some significant contributions to the science which is acknowledged to be an important profession of this modern day, to ease the burdens and "benefit mankind."

We read that the ancient Chinese mariner steered his junk with the help of a seashell filled with oil, upon which floated a bit of reed, enclosing a magnetic needle which pointed always to the Southern Cross. Certainly some primarily basic acquaintance with principles of science seems indicated here.

Water was a source of survival for the ancient. He had to have water to irrigate his land, to quench his thirst, to keep his flocks and herds in good productive condition, and to have routes for his travel and commerce. Thus we find evidence in various parts of Asia, Europe, and Africa of chains of canals, storage lakes, wells and conduits of ancient origin. The arid sections of the land had to be irrigated by use of the sometimes complicated water systems. Ancient Judea had a tunnel over 1700 yards long constructed for the purpose of bringing water from the Virgins' Pool in the Kedron Valley to the Pool of Siloam. The city of Jerusalem was thus provided with water while the surrounding country was in possession of the enemy.

In Homer's[2] ILIAD, written three thousand years ago, the famous author of the ancients described the forging of a shield in words that may be said to have their counterpart in modern engineering specifications. Herodotus,[3] 2500 years ago, tells about what he learned from the Egyptians concerning the building of the pyramids. In a later book this same author relates the story of the bridge built by Xerxes across the Dardanelles, and the construction of the canal through Athos.

2-HOMER - Greek poet. Flourished about the 9th Century, B. C. Principal figure of ancient Greek literature. First European poet.

3-HERODOTUS - 484? - 425? B. C. Greek historian. Called the "Father of History."

A ~~Some~~ nineteenth century engineer~~s~~ found a parallel between that ancient work and that of General Grant in the campaign before Vicksburg.

Rome had her famous aqueducts outside the city. They varied in length from 10 miles to 60 miles, with most of the construction being underground. Remains of these and other famous Roman water supply systems are still in existence. One must agree that at least an elementary acquaintance with hydraulics must have been developed by early Roman engineers.

The engineer of ancient times had to use any method at hand to reach his objective. He had no physical laws scientifically established. He had no recourse to helpful formulae, or any theorem of Bernuoli; but when one considers the ancients had knowledge of and used the lever, the roller, the inclined plane--knew water seeks its own level, built dykes and dams--one must admit they left to posterity some well-established facts, discovered by methods that at best could be only empirical.

We read about the ancients and the ways they developed methods of overcoming obstacles of various kinds. They cut tunnels through mountains, directly through rock! What manpower must have been expended on these old works! Explosives were unknown then. The work had to be done by whatever ingenuity the leaders possessed. The Tombs of the Pharaohs, the Pyramids of Egypt stand as a lasting token of man performing the impossible. Small wonder we find evidence that in Egypt nearly 6,000 years ago there was a leader who bore the honored title of "Superintendent of Works."

Ancient stone bridges, the durable roads and aqueducts, the water supply systems, the temples, the amphitheaters and palaces were a feature of the Roman Empire when she ruled the world. But there was available no modern engineering formulae. The printed word, so necessary to modern contracts and specifications, was unknown. Everything had to be done with tremendous output of labor. Climate and geographical location had a great influence also on the early development of engineering. Countries that were arid had to survive by overcoming the terrible problem of scarcity of water. On the other hand, nations that did not have this water problem, such as ancient Greece, did not have to be concerned with water storage too greatly. Their problem was to overcome the difficulties arising in a country located on the sea which had to be used for travel and commerce. Hence it is no surprise for us to find that the natural surroundings of the Greeks turned their thoughts to roads and bridges and harbors. They had to overcome a water hazard in reverse.

Just a thought about some ancient road building. The early Romans mastered this art. "All roads lead to Rome" was no empty sentiment in those early days. It appears that military movements were the highest consideration in the construction of those ancient highways. The historian, Buchholz, reminded us that "wherever the conquering arms of the Romans were carried, through Gaul, into Germany, and over to Britain, through Greece into Asia Minor and India, to the very gates of Cathay, the engineer followed, and often led the way."

Yes, there are written and material records still in existence of the early engineering skill possessed by the ancient peoples of the earth. Military expediency demanded fortifications for defense, and devices to reduce fortifications. Cities had to be defended, and walls and moats often proved the last bulwark against annihilation by the enemy. Small wonder that the engineer of those early days was very close to the ruler of the nation, and that military engineering may be considered the oldest branch of the profession.

The Greeks made many contributions to the profession of engineering. Ctesibius[1] invented a two-cylinder force pump made of bronze. Hero invented a leveling and alignment instrument for use in surveying, and in addition he developed a steam jet engine. And most people in the modern day have some idea of how Archimedes became famous for his projectile hurling mechanism, the screw control for raising and lowering water levels, and for having developed the weight-water displacement theory. Archimedes surely was the earliest protagonist of "push button" engineering.

Architectural engineering, in turn, owes much of its early development to the Roman, Vitruvius,[2] who lived in the first century A. D.

1 - CTESIBIUS - 2nd Century B. C. Alexandrian Greek mechanical genius. Other inventions ascribed to him are a water clock and hydraulic organ.

2 - VITRUVIUS - Roman architect - (Marcus Vitruvius Pollio) 1st Century A. D

and wrote a thorough treatise on architecture. This work was the building and designing authority for many subsequent centuries. A famous contemporary of Vitruvius was Sextus Julius Frontinus,[1] soldier, and water commissioner of Rome. He wrote not only books on military strategy, but a very famous one describing in detail the Roman aqueducts and water supply systems.

Most of the ideas set down thus far concerning the very ancient peoples encompass the centuries before the Christian era. With the decline of the Roman Empire it appears that interest and activity in the arts and sciences also went into a decline. For ten centuries it appears that while the ancient roads and structures and water systems continued to serve humanity, no actual attempt, according to the historians, was made to develop new ideas and benefits accruing from the previous experiences and work of the engineer. The so-called Dark Ages,[2] the thousand years or more between the fall of the Roman Empire and the

1 - SEXTUS JULIUS FRONTINUS - Flourished 74 A. D. Roman administrator and writer. Probably water commissioner of Rome.

2 - APPROXIMATE TIME FROM THE FALL OF THE ROMAN EMPIRE, 476 A.D., TO THE RENAISSANCE PERIOD WHICH BEGAN IN THE 14TH CENTURY, A.D. ALSO KNOWN AS MIDDLE AGES.

coming of the Renaissance, were indeed years of darkness as regards human progress. Engineering was no exception. Just as did all kinds of learning, literature, the arts, even the habits, customs, and well-being of the people, suffer in those years, so did engineering suffer. But the coming of the Renaissance changed the picture. Here engineering, together with the arts, literature, education, and living conditions--all those things which add to the happiness and progress of both nations and individuals--enjoyed the development and encouragement so necessary to new and continued progress.

It's a little hard to distinguish the beginnings of engineering and the beginnings of science but it is interesting to note that very early in history there came into being the title of Pontifex Maximus which possibly, and perhaps probably, meant "The Master Bridge Builder;" and it is very interesting to note that many of the civil heads of the Roman Empire bore this title as did, and does to this day, His Holiness the Pope. While it is not necessarily proof, it is very interesting to speculate that engineering in the form of bridge building was recognized as an important adjunct of both lay and ecclesiastical life at such an early date.

The title of Pontifex Maximus goes back to the beginning of recorded history and it is indicated that one of the early legendary kings of Rome, Numa Pompilius, conferred upon one Claudius the title of Pontifex Maximus. It's interesting to note that his function was to arrange the funerals and it is conceivable that the bridge alluded to here was that structure which spans the great chasm between earth and heaven.

A little later in the Middle Ages, as the story goes, there was a group known probably as "The Order of the Bridge Builders." They were ecclesiastical in origin and wore white tunics with a red keystone as a symbol. They were called into action when any considerable arched structure was to be built. Their work was notable in the building of the great arch bridge over the Rhone at Avignon and they were in evidence at all the considerable structures in Europe. Whether or not the Pope was the titular head of this organisation or whether they had any connection with the title of Pontifex Maximus is not clear. The only thing that is clear is that even in that early day the building of bridges and other similar structures was of so much importance to the defense of cities it assumed somewhat the character of a profession and was not left in the hands of mere workmen. Perhaps this Society of Bridge Builders was the first of our great professional societies.

General William Barclay Parsons, in his book published in 1939, Engineers and Engineering in the Renaissance, wrote what is probably the finest work on the history of engineering of the Renaissance period. The major portion of the general's life was devoted to this study. He combed the libraries of Europe. He spent many months at the British Museum, and the Bibliotheque National in Paris, and finally visited the Vatican Library in Rome. Here the General found a tremendous amount of material concerning early engineering accomplishments; but it was difficult of access because of an almost complete lack of a cataloging system and modern library classification and arrangement. Parsons returned to this country and with the help of Nicholas Murray Butler of Columbia University succeeded in interesting the Carnegie Endowment for International Peace[1] in the matter of providing funds for the modernization of the Vatican Library. This was carried out with the help of outstanding American librarians, and with the approval and co-operation of the Vatican; and Parsons was thus able to complete his research and obtain access to a vast amount of valuable material that forms a major portion of his work.

In describing some of the factors that motivated this study of many years, Parsons pointed out that the modern world had practically no conception of the history of engineering. The world, he maintained, knew how cathedrals and churches and temples and bridges and roads were planned, but they had no knowledge of how they were actually constructed. How was it possible, he asked, when man's knowledge of the forces of nature was still so elementary, to control those forces sufficiently to reach the amazing heights that early engineer-

1 - ENGINEERS & ENGINEERING IN THE RENAISSANCE - W. B. Parsons 1859-1932
1939 The Williams & Wilkins Company
Introduction - Nicholas Murray Butler

ing did achieve? His research, his years of study, and finally the finished product, became a book that belongs with the literature of the ages.

The scope of the contribution of the Renaissance, especially in the field of engineering, was aided and stimulated by one of the greatest intellects of all time, Leonardo da Vinci.[1] Probably best know for his paintings of the priceless "Mona Lisa" and the "Last Supper," da Vinci was a military engineer and architect of the highest ability. He was outstanding not only as a painter, but as a sculptor and musician. His own writings, of 5300 pages, describing his experiences, his experiments, and his varied engineering works are valued records of his wide range of endeavors. His notes and sketches, his writings and drawings, form the permanent history of an outstanding engineer and artist. They have been reproduced for succeeding generations for study and guidance and unbounded admiration. How many of us know anything about his early experiments with flying machines?

1 - LEONARDO DA VINCI - 1452-1519. Perhaps the greatest engineer of all time. Supreme in many fields, his contribution to human progress is incalculable.

His was a dream that remained unfulfilled--but he knew that years to come would see man conquering the air. One of his old notebooks says: "If the heavy eagle on his wings stays up in rarefied air, if large ships under sail move over the sea, why cannot man also, clearing the air with wings, master the wind and rise up, a conqueror, on high?"

The apparatus he strove to perfect for his flying experiments resembled a bat. Destined never to fly, it remained a dream, but a dream that came true centuries later to the Wright brothers above the sands at Kitty Hawk, and had its ultimate realization in 1927 when Lindbergh[1] piloted his tiny monoplane, "The Spirit of St. Louis," non-stop from New York to Paris, while the world waited in silent prayer. The word aerodynamics has a modern connotation, but da Vinci, nearly 500 years ago, was the first man who knew much of this science.

It is not appreciated by many how closely art and technology or art and engineering were in the days, for instance, of the Renaissance. The greatest artists were the greatest engineers and the two were

1-LINDBERGH, CHARLES AUGUST, Master Airman. 1902-

necessarily hand in hand. The great engineering works of Michelangelo were just as truly engineering as architectural; and his design of the great Dome of St. Peter's in Rome without guidance from written principles or formulae was certainly one of the most tremendous engineering achievements the world has ever seen. It's true he had the great Dome of the Pantheon as a model and it would be interesting to know from what model the Pantheon was designed.

In the field of sculpture too, of course, the casting of the bronze was just as important as the cartoons and the drawings of the designer. It is said that it took Ghiberti only a few days to design the bronze doors of the Baptistry in Florence but that it took him twenty-one years to cast them. The artist not only drew and chiseled, but cast his work as well. The story is told in Florence of Michelangelo's twitting Leonardo as the man who could draw this picture of a statue of the Collioni but could not cast it.

Those of us who are interested in the development of engineering find it of very great importance in the development of fine arts for after all the artist had to be somewhat of an artisan as well. There had to be power behind Michelangelo's chisel; and in the negative sense, if Leonardo had only been satisfied with the then-current media, his "Last Supper" might have been saved for us in its original glory in Milan.

No reference to engineers of the past would be complete without some mention of Benvenuto Cellini,[1] born in 1500 A. D. He is acknowledged to be the greatest artist in gold, silver, and precious stones that ever lived. A practical mechanical engineer, his foundry work--the casting of huge bronze pieces--has never been surpassed. His own story, written by himself, of his bronze statues of the Medusa and Perseus, and the many obstacles and discouragements he had to overcome in casting these statues, is an inspiration for all sculptors, artists, and engineers of whatever era.

The list of individuals from the ancient and middle ages who had some significant part in the development of engineering is long

1 - CELLINI, BENVENUTO * Italian artist, sculptor, metalworker, author. 1500-1571 A. D.

and varied. Histories show the accomplishments of men who, by any measuring device, were outstanding in the field. But, one may ask, what is the importance of all this to a modern story which has for its theme the contribution of the Newark College of Engineering to modern scientific education? They did what we tried to do--to make the lot of man easier and life richer.

We must consider another very important fact. When 1492 came Christopher Columbus discovered a new continent. Here started the race for colonisation and conquest. The civilised nations of Europe contended for possession of the great new land. The many voyages to take possession of the western empire soon convinced the leaders in Europe that artisans, mechanics, and engineers were a prime necessity in the new world. Almost concurrently with the discovery of America the Renaissance in Europe was enjoying its most flourishing period. In the hundred years before and after Columbus' voyage of discovery history shows that Botticelli, da Vinci, Rubens, Raphael, Cellini, and many other famous men were at the height of their accomplishments in the arts and engineering.

Vespucci,[1] Pizarro,[2] Balboa,[3] Magellan,[4] Cortez,[5] Drake,[6] and Raleigh[7] followed in the footsteps of the Genoese on voyages of exploration and discovery to the new land to the west. In literature

1 - VESPUCCI, AMERIGO - 1454-1512. Italian navigator. Explored northeastern coast of South America (1499-1500). Explored coast of Brazil (1501-1502). America was named for him.

2 - PIZARRO, FRANCISCO - 1476-1541. Spanish Conquistador. Explored northwestern South America. Conquered Peru. (1523-1541)

3 - BALBOA, VASCO NUNEZ DE - 1475-1519. Spanish Conquistador. Crossed Isthmus of Panama and discovered Pacific Ocean (1513).

4 - MAGELLAN, FERDINAND - 1480-1521. Portuguese navigator. Discovered Strait of Magellan (1520) during circumnavigation of the globe. Although he did not complete the journey, he led the way and proved that the world curved.

5 - CORTEZ, HERNANDO - 1485-1547. Spanish Conquistador. Explored and conquered Mexico (1519-1527).

6 - DRAKE, FRANCIS, SIR - 1540?-1596. English navigator and admiral. First Englishman to circumnavigate the globe (1577-1580). Explored west coast of North America, sailing as far north, possibly, as the present state of Washington.

7 - RALEIGH, WALTER, SIR - 1552?-1618. English statesman and man of letters. Conceived and organized colonizing expeditions to America which ended tragically with the "lost colony" on Roanoke Island, Virginia.

Erasmus,[1] Cervantes,[2] Bacon,[3] Shakespeare,[4] and Ben Jonson,[5] were writing for the ages; and science itself had great impetus during the Columbian period when it provided men like Copernicus, Napier, and Galileo.

The Renaissance was thus flourishing in Europe. In the meantime the new world was being colonized. Slowly but surely European nations were obtaining footholds on the shores of America. Yet the process was a slow one for our histories show that the first permanent settlement was that by the English at Jamestown, Virginia, in 1607, 115 years after the first voyage of Columbus. Coupled with

1 - ERASMUS, DESIDERIUS - 1469?-1536. Dutch humanist.

2 - CERVANTES, SAAVEDRA, MIGUEL DE - 1547-1616. Spanish novelist, dramatist, and poet.

3 - BACON, FRANCIS - 1561-1626. English philosopher and statesman.

4 - SHAKESPEARE, WILLIAM - 1564-1616. English poet and dramatist.

5 - JONSON, BEN - 1572-1637. English dramatist and poet.

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this, and the landing of the Pilgrims 13 years later in 1620 at Plymouth Rock, the English appeared to have obtained a running start in the race to take possession of the new world. The French, Spaniards, and Dutch all followed and took possession of various sections of the country.

What significance may we draw from the fact that so many of the European nations combined to furnish the men and materials for the young continent? We know that among the nations of the old world the French were probably foremost in pure science, the Germans in technology, and the English in marine engineering, as would befit an island nation. Britain's sea commerce was her very lifeline, and her dominance of the world's oceans gave her leadership among nations of the earth. For centuries "Britannia Rules the Waves" was indeed no exaggerated statement--it was a fact.

CHAPTER II

In America

For us here in modern America, enjoying the world's highest standard of living, it may be well to ponder a little on the reasons so many natives of European countries set out to make a new home for themselves in the countries of the west. Their reasons were many and varied, as the historians show. Some came because of religious persecution; others came to escape oppression by their rules; while others, whom the world always has in great numbers, came seeking adventure. Whatever the reasons, they came, saw what was here, and through the years conquered. The marvel of it all would seem to be the welding of so many diverse elements into one country that has risen to the pinnacle of world leadership that is now the proud characteristic of the United States. And how did this come about? We must remember that the people who left their European homes to settle a new world had habits, customs, and religions of their own, each according to his country.

Even in the field of education we know that there was a great difference in methods and results. In Europe in the early days, and even in more modern times, the apprentice system was widely used. The Germans were noted particularly for this method of teaching trades and occupations to its youth. This fact carries a great deal of significance for modern technical education in the United States. Another important consideration, and a factor which probably had a great influence on engineering education of the present day, is the large number of prominent Americans of Colonial times and later who had some knowledge of engineering. In an uncharted world where millions of square miles of new territory had to be explored and developed, it is not to be wondered at that so many early Americans had a wide knowledge of pioneer engineering, surveying in particular. The most prominent that first comes to mind is George Washington himself. Most of us will recall reading that in his early days he completed much valuable surveying work in Virginia—in particular his survey of the vast Lord Fairfax estates—

and determining the exact boundaries of the land was a real undertaking.

The following extracts and excerpts are from Volume I, GEORGE WASHINGTON, by Douglas Southall Freeman, and some seem to be extremely pertinent and are made available by the courtesy of Mr. Allen P. Richmond, Jr. of the American Society of Civil Engineers:

"Describing the contents of his home at Ferry Farm in early youth, Freeman says: '...to George's eyes, doubtless, none of these things was comparable in interest to a tripod and certain boxes that Augustine Washington (father) himself had put carefully away in their appointed place. These were the surveying instruments which, with the rifle and axe, were the symbol of the extending frontier......'"

"'The Surveyor General was an appointee of the King or of the Governor until 1693. After that year the Visitors of the College of William and Mary discharged the functions of the office and appointed as many Surveyors as the Governor and Council thought 'necessary and convenient.' A qualified Surveyor could work anywhere in Virginia, but usually one such official was designated for each County, with authority to appoint deputies for whom he was responsible. Over all these men the General Assembly held a rein, because it fixed their fees. Their discharge of their duties, moreover, was under the general direction of the Governor and his official advisers. Compensation for each survey rose steadily through the years but the total reward for a year's labor of course varied according to the activity in the patenting or transfer of land in a given County....'"

"'The means of advancement were at hand. In the storehouse at home were the surveyor's instruments that had belonged to George's father. Across the river in Fredericksburg and elsewhere in the neighborhood lived men who knew how to use the surveyor's compass. Every County had its Surveyor; some of these men had deputies. From one or more of these officials George quickly learned in 1746-47 the elements of surveying and began to run lines at Ferry Farm or on the plantations of his kinsmen. The work entranced him. He could not do enough of it. By August 18, 1747, and perhaps before that date, when fifteen years and six months old, he had attained to the required standard of accuracy on simple assignments. Within a few weeks he was deft and soon proficient on surveys that were not unduly complicated. Probably as some friendly Surveyor's deputy he was compensated, though perhaps at less than the regular fee. One batch of his surveys at the beginning of October brought the boy £2, 3s. This was in cash, not in tobacco notes. The law specified the fees in terms of tobacco but George got cash when he could. It was welcome coin to a boy who already had money-making as one of his ambitions. Surveying not only had interest and yielded a profit, but it also offered excellent training. A good Surveyor had to be accurate and thorough. As George wanted to excel in surveying and in everything else he undertook, he painstakingly gave neatness and finish to surveys he made with the fullest care he knew how to display. (For these statements no specific source can be cited, but the supporting, inferential evidence is strong and clear in every surviving record of George's youth.)'"

"Shortly after his 16th birthday 'Chance now offered George, in the spring of 1748, an opportunity.... A surveying party was about to start for the remote South Branch of the Potomac.... James Genn, a veteran Surveyor, was to be in charge; the Proprietor was to be represented by George William Fairfax. Chainmen and other helpers were to be recruited on the frontier. If George cared to do so he could go with the party. In the work he would find training and a measure of just such adventure as the heart.... He probably was told that he might be allowed to do some of the surveying.....'"

"'......their expedition to the (Shenandoah) Valley....could be written down as compassing the most useful thirty-three consecutive days that George had ever spent. Doubtless he had acquired more of profitable knowledge in like time spent in his first surveying lessons, but he had learned gradually the elements of the surveyor's art.....'"

"'the success of George in his application for the surveyorship of Culpeper. On the last day of July, (1749) he completed the long ride to the tempprary quarters of the Court and presented his commission from the President and Masters of the College of William and Mary, who alone could commission County Surveyors. As this document was in proper order, George was directed to swear allegiance to the person and government of the King. Then, under oath, he disclaimed all allegiance to the issue of James II, or anyone professing descent from James. Next George took the 'test oath' of non-belief in transubstantiation, and finally the special oath of Surveyor, 'that he (would) truly and faithfully to the best of his knowledge and power, discharge and execute his trust, office and employment.' Being sufficiently sworn, George proceeded immediately to exercise his new authority. He surveyed 400 acres in Culpeper for Richard Barnes of Richmond County on July 22 and received promptly his fee of £2,3s.....'"

"'.....As a qualified County Surveyor, he could work anywhere he was engaged.... Work began on 2nd of November, 1749.....'"

Certainly the retreats across New Jersey, the victory at Trenton, the hardships of the Valley Forge winter, and the final realisation of victory on the peninsula at Yorktown all combined to emphasize a military genius that was supplemented by a quality of precision and accuracy in all things. And it requires no stretch of the imaginative processes for us to feel that Washington's early training in the art of surveying contributed mightily to the planning and successful carrying out of his military campaigns.

It's also interesting and worthy of note that George Washington had a very considerable part in the development of the western country through and because of his interest in highways. From the east to the west, that is, from the eastern seaboard to the region in western Pennsylvania where the Allegheny and the

Monongahela Rivers formed to join the Ohio, it was first the Pennsylvania Road which is described in the "PUBLIC ROADS OF THE PAST" published by the American Association of State Highway Officials:

"The Pennsylvania Road was the main trans-mountain route of the British Colonies in America because the Province of Pennsylvania was situated geographically so as to provide the shortest path over which our forefathers could pursue their primary objectives--a northwest short cut to China--while expanding their secondary objectives--home in the wilderness and trade with the Indians and the mother country. The pre-historic Indian Trail, known as the Allegheny Path, which slowly developed into the Pennsylvania Road, began at the Delaware Chief Shackamaxon's Indian village, on the site of the present city of Philadelphia, and rose and fell across the successive mountain passes and valleys to the junction of the Allegheny and Monongahela Rivers, and beyond."

Further, the same publication has this to say:

"In 1753 Washington crossed the Allegheny. In the wilderness far removed from the frontier settlements there were no canoe ferries at river crossings. Woodsmen improvised crude log rafts built from the forest trees. The logs were bound together with withes--slender flexible branches of willow or osier. This river crossing was the sequel to the action of a Frency army which had invaded the Allegheny River valley from Canada for the strategic purpose of gaining control of the Ohio River region so as to confine the British colonists to the narrow territory east of the Appalachian Mountains. Immediately upon learning of the invasion Governor Robert Dinwiddie of Virginia decided to challenge the bold attempt to seize territory claimed by the British Crown. His first problem was to find a suitable courier to carry an ultimatum across hundreds of miles of forest wilderness intervening between the Virginia settlements and Fort Le Boeuf (Waterford, Erie County, Pennsylvania), the nearest French outpost. Governor Dinwiddie solved the problem by choosing the 21-year-old Virginian who later became 'The Father of his Country.'"

"Major Washington set out from Williamsburg, Virginia, on

October 31, 1753. Proceeding to Will's Creek (Cumberland, Maryland) at the outskirts of the settlements, Washington employed as his guide the experienced woodsman, Christopher Gist. With four other companions the pair left Will's Creek on November 14 and followed the Delaware Indian Nemacolin's trail as far as Gist's plantation. Thence they rode their horses over the Catawba Trail and the Raystown Path to the Delaware Chief Shannopin's Indian town (Pittsburgh, Pennsylvania) where there was a crossing of the Allegheny River on the 'main road' from the Susquehanna River to the Ohio country. A considerable portion of this trail followed the subsequent location of the National Pike, now United States Route 40. They swam their horses across the Allegheny River and encamped for the night on the north side, probably at the foot of the present Monument Hill. Washington found the forks of the river well situated for a fort commanding the approaches from both the Allegheny and Monongahela Rivers. The hardy travelers continued their journey through Venango to Fort Le Boeuf near Lake Erie where Major Washington delivered

Governor Dinwiddie's note of warning to the French Commandant Lagardeur de St. Pierre. The French officer's courteous but firm rejection of the message was an incident leading to the outbreak of the French and Indian War.

"Leaving on December 16, 1753, for the return trip, Washington and his party paddled down the river in a French canoe to Venango where they arrived on December 22. Here the French induced the Indian helpers to desert. Washington and his white companions pressed forward on horseback. After three days progress was so slow that Washington decided to relinquish the horses and baggage to the custody of the interpreter, Van Braam. The resourceful Major struck out on foot with Christopher Gist by the most direct route homeward through the woods. Arriving at the northerly bank of the Allegheny River on December 29, they hastily assembled the crude raft of logs and poled across to the island (Herr's) in the river above Shannopin's Town. On the way over Washington fell into the icy waters but saved himself from drowning by clinging to the raft. They thawed out the Major's clothes and Gist's frozen fingers that night beside a camp fire lighted upon the island. The night was so cold that the surface of the river was frozen thick enough by the next morning to enable them to walk the remaining distance to Shannopin's Town across the ice. Thence the sturdy couriers tramped to John Fraser's place at the mouth of Turtle Creek. Major Washington returned to Williamsburg, Virginia, on January 16, 1754, and delivered to Governor Dinwiddie the refusal of the French commander to heed the warning. Washington's straightforward journal of the expedition, published at the order of the Governor, attracted favorable comment both throughout the Colonies and in the mother country across the sea."

Then we hear again of Washington in connection with Braddock's Road. It is interesting to note that Major George Washington was a military aide to General Braddock.

Benjamin Franklin[1] was another of the early Americans who

1 - FRANKLIN, BENJAMIN - 1706-1790 - American statesman, printer, scientist, and writer.

interested himself in science. In his autobiography Franklin tells of his experiments with a kite in Philadelphia which he sent aloft in an effort to show that electricity and lightning had the same properties. Probably best known for his work in Europe in securing French assistance in the early fight for the freedom of the American colonies, Franklin was also a pioneer scientist. Reports of his electrical experiments were sent to Europe, and referred to very often by European scientists as the "Philadelphia Experiment." At first highly skeptical of this unheard of principle, European scientists repeated these experiments and Franklin's conclusions were verified.

Alexander Hamilton[1] became famous as the first Secretary of the Treasury; but it must be appreciated that Hamilton's talents were many-sided. He might aptly be termed the first great American industrial executive, for his was the vision that in 1791 created the Society for Establishing Useful Manufactures. He recognized

1 - HAMILTON, ALEXANDER - 1757-1804 - American statesman and financier.

that the hard won independence of our new nation had to be developed to the point where the nation could be independent of the old world for manufactured goods. This could only be brought about by the young country's establishing its own plants and factories for producing a wide variety of goods. Hamilton's ideal was a vast emporium, equipped with every conceivable type of machinery, and employing thousands of workers; and the site selected was in our own New Jersey, at Great Falls, in the Passaic Valley. As might be expected there were many obstacles in this development. Ultimately it did get under way, but not on the magnificent scale that Hamilton envisioned. Nevertheless, it was the start of a manufacturing area in northern New Jersey which has stood unrivaled for many years for the quality and variety of its products. Alexander Hamilton owes most of his renown for his work as Secretary of the Treasury; but no one can deny that he possessed all the attributes of a modern industrial engineer.

Some time later Ulysses S. Grant, Commander of the Union Forces during the Civil War, showed that he had a good knowledge of engineering, as witness his campaigns that owed a great measure of success to his knowledge of fortifications and canals and military works of both attack and defense. His campaign before Vicksburg and the construction of docks and canals seem to confirm the fact that he studied the efforts of some of the earlier engineers, as previously mentioned.

Even Abraham Lincoln spent some time in his youth as a surveyor, and we know of at least one instance where he completed satisfactorily a large surveying job in Illinois.

Another famous name in engineering in years after Washington, Franklin, and Hamilton, and contemporary with Ulysses S. Grant, is that of Robert E. Lee. The famous Commander of the Confederate Armies in the Civil War who, by some authorities, ranks in military genius with Napoleon, Hannibal, and Alexander, was an engineer. A graduate of West Point with very high honors, he was assigned to the Corps of Engineers, United States Army. He designed a program for deepening and removing obstructions for the Mississippi River near St. Louis.[1] Generals Zachary Taylor and Winfield Scott, Commanders of the American Armies in the defeat of Mexico, had Lee with them as a Captain in charge of engineering plans for attack and defense. In their reports to the War Departments both Generals gave full credit for the successful conclusion of the campaign to Captain Robert E. Lee. The world, of course, knows the valiant fight he later made for the cause of the Confederacy, culminating in the surrender on that sad spring day at Appomatox. Those of us in engineering, education, and industry may well reflect on this man and the credit he brought to our honored profession.

All of this is just by way of indicating that engineering has always been closely allied with the welfare of the people on all levels and has been particularly necessary not only with respect to the "hewing of wood and the drawing of water," but has had a part, and a very important part, not only in wars but in

1 - R. E. LEE, A BIOGRAPHY, Vol. I, Douglas Southall Freeman
Charles Scribner & Sons, 1935

the field of civil life as well. The designing of structures or projects for the benefit of mankind has been a necessary and a constituent part of our development from the beginning. Its importance is often underestimated because it is not known and it is rather strange to us here in America to realise that George Washington, Thomas Jefferson, Abraham Lincoln, Alexander Hamilton, all leaders in the development of our democracy, have had considerably more than a casual interest in engineering.

To be sure that type of engineering was not the type we see on the ascendancy today. It was an engineering which characterized the needs of a pioneering people whereas today we are interested primarily in the engineering which has to do with a rather highly developed and perhaps artificial civilisation.

It is, however, to be observed that in building a democracy—a republic—the national welfare of the people was and still is of paramount importance. Things of the body as well as things of the mind and the spirit are important. In building our country in the early years our leaders had to in some sense be engineers, seeing to it that human bodies were clothed and sheltered and human beings were not starving or even hungry.

So we must keep up this work if the world is to go on.

As previously pointed out, it is our object in these pages to try to convey some impressions of early engineering, mention a few of the most noteworthy individuals in the arts and sciences, and to show how many people, famous in other fields, made definite contributions to the progress of engineering. Our ultimate aim, of course, is to help the reader try to understand that technical education in America, and the founding and development of the Newark Technical School and Newark College of Engineering in particular, did not come about by accident. And so on to Newark at last.

CHAPTER III

In Newark

Newark in its early days and ever since has been a center of manufactured products of all kinds, and her citizens were proud of this accomplishment. The entire country paid homage to Newark and her products, her inventors, her craftsmen, and her industrial leaders in many ways.

General Lafayette,[1] French hero and aide to Washington during the Revolution, stopped for a time in Newark during his triumphal tour of the country in 1822. He marveled at the display of products made in the city. President Andrew Jackson visited Newark in 1832 toward the close of his first term in the White House. No doubt he was mending his political fences for his contest for his successful second term as President; but a highlight of his visit was the industrial display arranged by the citizens. Afterwards they escorted him to see the inclined plane of the old Morris Canal which passed over High Street just a few hundred feet south of the present

1 - LAFAYETTE, MARIE PAUL, MARQUIS DE - French patriot - 1757-1834

site of the Newark College of Engineering. (Some of us will remember this canal even in our own time.)

Henry Clay,[1] Jackson's defeated opponent for the Presidency in 1832, visited Newark in 1833, and he was astonished to find such a wide variety of goods made in the city. In keeping with the leather tradition of the city he was presented with a saddle and trappings made especially for him as a reminder of his visit.

Newark citizens have always enjoyed parades, displays, and exhibitions. From Revolutionary time onwards every possible occasion was used by her citizens to exploit her products. She was, and still is, famous for the variety of her manufactured products. The industrial and commercial development of the city brought acclaim from near and far.

It is no wonder then that a city such as ours, blessed by outstanding inventors and industrial leaders, and realizing that her very progress depended on improving the quality of her various products—in improving the caliber of her mechanics and artisans—

1 - CLAY, HENRY - American Statesman - 1777-1852

should very early in her existence lay plans for developing new ideas in technical and mechanical instruction methods. Here was an ideal situation for the development of technical education. The city was the home of what was, in the middle of the last century, probably the most highly industrialized center in the United States. Her citizens recognized that to retain her position of eminence she must have ways and means of developing men who would carry on what might be called the "industrial tradition."

Newark enjoyed a dominant position in the entire nation for her productive methods. Her citizens realized that she could not stand still. There could be no resting on laurels. Once a halt was called retrogression must needs follow. So the watchword became, "Onward!" The citizens of Newark, of all shades of opinion on public and political matters, did rally to a unanimity of thought that the leadership of the city in industrial and commercial fields could only be maintained by the establishment of opportunity for technical education. Thus was born the idea of education for the artisans, the mechanics, the industrial workers of the city. Thus was created the first real effort for the establishment of a school such as ours.

With this objective the first step was taken prior to the outbreak of the Civil War. The Newark Industrial Institute was established in 1850 to provide technical training for apprentices in the many industries of the city. It was successful for some years, but the inroads on manpower caused by the calling of so many young men to the colors forced the Institute to close its doors.

Nevertheless, that war period, bringing grief and loss to so many families, did provide one development for the people. It was in 1862 that the Morrill Act was passed by Congress and signed by Abraham Lincoln. Here in Newark, a center of industry, the effects of this Act were perhaps not immediately apparent; but the Act and its provisions, its provision for educational opportunities for agricultural and mechanical arts, surely must have given much food for thought to the industrial leaders in Newark. Certainly the elevating of the mechanical arts to the dignity of a profession and providing the opportunity for a mechanic to become a technician, were all developments of a new philosophy engendered by the provisions of the Morrill Act. We may not be in a position to attribute the founding of the Newark Technical School directly to the Morrill Act; but we can be sure that the widespread change in the thinking about education, plus the natural needs of an industrial empire as encompassed within the very gates of the city of Newark, had a major share in the final steps which resulted in a dream's becoming a reality in 1881.

Professor Charles J. Kiernan has this to say of the period from the Civil War to the founding of the Newark Technical School:

"In any attempt to evaluate the history of an institution in terms of the factors influencing its establishment and development one is astonished at the many circumstances that must be considered. This is certainly the case with Newark Technical School and Newark College of Engineering. There were many things that undoubtedly had a salutary effect on (1) determining that a need for such a school existed; (2) establishing and developing the institution.

"We must go back many years to find the original roots of the institution that is now Newark College of Engineering. It must be remembered that Newark and its surrounding towns were very early in the 1800 era predominant in manufacturing pursuits. In those years displays and pageants in Newark definitely emphasized the mechanical theme. This did not appear to be so strange when it is realized that in the Revolutionary times one-third of the working population of Newark was employed in its leather industries and even then the city was acquiring fame for the diversity of its manufacturing products. The records show further that early Newark possessed a great many master mechanics and craftsmen who were blessed with inventive genius. The patent office records at Washington confirmed this fact and there was at least one decade in the last century when the patent office showed that Newark had contributed more useful inventions to industrial progress than any other city.

Newark early gave evidence of being a very fertile ground for technical education. This is well illustrated by the methods used to carry out Fourth of July celebrations. The salvos of artillery fire and the waving of flags and the traditional speech making of July 4 were, of course, followed out each year; but beyond all this a most important function of these celebrations was the occasion of the city's manufacturing interests to bring their products before the public by means of stages, floats, displays, and parades. As many as 50 such exhibits with workmen and owners showing the methods and techniques of their manufacture would often be a feature of such Fourth of July celebrations. Apparently Broad Street was the center of attraction in those early days.

"The city of Newark then, as now, was outstanding in the extent and variety of its manufacturing products and the city was fortunate indeed to have much inventive genius in her midst. The great inventions of Seth Boyden[1] who, among many accomplishments, built the first locomotive used on the Morris & Essex Railroad (now D; L. &. W.), and the early use of steam power as introduced in

1 - BOYDEN, SETH - Newark inventor. 1798 - 1870. Invented automatic cut off for steam engines, methods of manufacture of malleable iron, patent leather, and many other processes. Maker of locomotives, later in life he developed the Hilton strawberry still favorably known in Newark.

Newark by John C. Hedenburg back in 1829, and such developments as the diamond band saw, stove platforms, tea trays, and the Baxter steam engine were all perfected by Newark inventors.

"With all these considerations having a potent influence on early Newark, it is no surprise for us to learn that in the years proceding the Civil War, or about 1850, the Newark Industrial Institute was established in the city. According to old records, meetings were held and lectures given in the old Newark Academy on the corner of High and William Streets and the First Presbyterian Church on Broad Street. This school was organized to give technical training to young apprentices of the many industries which even at that early time were established in the city. Such well-known men as Dr. S. H. Pennington,[1] James B. Conger,[2] William Halsey,[3] and Seth Boyden were among the group interested in the institution, with ex-Governor Marcus L. Ward as its first president. With such prominent people sponsoring the institution one

1 - PENNINGTON, SAMUEL HAYES - 1806 - ? A man of learning himself, he seconded every effort to advance the cause of education. He was a member of the public school board of Newark for 17 years, 7 of which he was President.

is forced to wonder why its work was not continued. The answer must be in the fact that a large number of men left their civilian jobs to answer the call to the colors issued by Abraham Lincoln, just as in later wars large numbers of young men answered the call and a great many of those early Newarkers no doubt were among the ones who would normally have taken work at the Industrial Institute. Instead the young men found themselves in uniform under Grant, Sherman, and Meade, and many of them found their last resting place in the Battles of the Wilderness in the March through Georgia or the epic struggle at Gettysburg.

"During the Civil War, the cause of so many heartaches and so much grief throughout the nation, a very significant development for education took place in the passage of the Morrill Bill in the United States Congress. For a number of years prior to the Civil War Jonathan Baldwin Turner[1] of Illinois had been waging a campaign for the establishment of institutions of higher learning.

1 -

These institutions were to furnish education for young men who were in industrial and agricultural pursuits. Turner had pointed out in his early speeches that society needed only 5% of its men educated for the so-called professional classes which at that time included law, medicine, the arts and sciences, literature, and religion. Turner concerned himself with the remaining 95% of young men. He maintained, against tremendous odds, that an industrial and agricultural literature should be created and a new philosophy developed so that industrial and agricultural pursuits could properly be raised to the dignity of the professional status. He proposed that universities be established for the industrial and agricultural classes in each of the states and that subordinate institutions, lyceums, and high schools be established in the various towns and counties as adjuncts to the main universities.

"It was a long hard fight Turner and his followers made. There was well-organised opposition by traditional educators. Professor Turner himself wrote the legislative bill which was headed 'an act donating public lands to the several states and territories which may provide colleges for the benefit of agricultural and mechanical arts.' With the help of the United States representative, Richard Yates, a former student of Turner's, who afterwards became War Governor of Illinois, the bill was introduced into the United States House of Representatives. It was defeated the first time; and while on the second attempt it passed both the House and the Senate, President Buchanan affixed his veto to the Bill. This was in 1859.

"Prior to the important election of 1860 Turner contacted both Abraham Lincoln and Stephen A. Douglas,[1] famous adversaries for the presidency of the United States. From both these men he obtained a promise to sign the Bill should it progress again as far as the President's desk. With Lincoln elected in 1860 it was felt that definite progress toward passage could be made and Representative Morrill of Vermont was selected as the man best qualified

1 - DOUGLAS, STEPHEN A. - 1813 - 1861. In 1858 he opposed and defeated Lincoln for election as Senator from Illinois. He and Lincoln indulged in seven debates which brought to Lincoln a national reputation.

to take the proper legislative action to introduce the Bill again. This time it passed both House and Senate and was signed by Abraham Lincoln on July 2, 1862.

"When it is recalled that Professor Turner's aim was to establish industrial universities and that the land grant legislation provided specifically for the establishment of agricultural and mechanical arts colleges, we probably will appreciate the chain of circumstances which had such a marked influence on the founding of our institution early in the 1880's. There is no need here to go into the provisions and the operations of the Morrill Bill. What has great significance for us is that it had such a dominating influence on the establishment and development of such schools as ours.

"Concurrently with Turner's fight to establish the so-called land grant colleges, the entire world became interested in technical progress and education. The International Exposition at the Crystal Palace in London took place in 1851. New York held a similar one in 1853, Paris in 1855, and London again in 1862. Subsequently at very frequent intervals world fairs and exhibits were held and in every one of them engineering and the sciences took a prominent part. In our time we can recall the New York World Fair of 1939, the Century of Progress in Chicago, and the Golden Gate Exposition in California. Most of us are aware of the strong emphasis placed on technology and engineering at these exhibitions.

"Reference must be made to these Fairs throughout history as having had a marked influence on the establishment and development of engineering institutions. Rensselaer was founded as long ago as 1824 but most of the engineering schools in this country came as an aftermath of the Morrill Act of 1862. Brooklyn Polytechnic Institute was founded in 1854 while there was considerable agitation for the passage of the Morrill Act, while M. I. T. was founded in 1861, Worcester Polytechnic Institute came into being in 1867, Rose Polytechnic Institute in 1874, Case in 1880, and our own institution here in Newark in 1881.

"Other factors contributed much to technical educational development in Newark. Not only was Newark happy in its many thriving industrial concerns but she was also fortunate in her men of inventive and organizational ability. Prominent among the latter was Edward Weston who arrived in the United States IN THE MONTH OF MAY IN 1873. Once established, he became an outstanding advocate of technical education. He was in the forefront of the fight to obtain funds by subscription for the founding of the school and the early success it had was due in a large measure to his personal and public efforts in its behalf. It was indeed fitting that he became a member of the first Board of Trustees of the institution.

"One cannot help feeling that the institution would have come into being some years before 1881 except that the Civil War took so many young men into service. Potential students in great numbers never returned from the fighting areas. Nevertheless, the Civil War, as did those wars that followed even in our times, gave much impetus to technical development. During those terrible years naval construction was entirely changed. The first ironclads came into being. Military necessity developed new methods of construction; weapons, ammunition, and heavy artillery were all improved during the conflict and certainly military expediency taught the nation how to do a great many things that were unthought of previously. For instance, the year 1864 saw an unparalleled feat of engineering accomplishment by 3,000 United States soldiers under Lt. Col. Bailey of the Army Corps of Engineers. The fighting ships of the Mississippi Squadron were unfortunately caught in low water on the Red River above the falls north of Alexandria, Louisiana. Naval ships worth millions of dollars were immobilised and would have been abandoned of necessity to the South if they could not be moved, but Col. Bailey conceived and carried out the construction of a dam 600 feet long in an incredibly short time against great obstacles. With the additional water depth thus created the fleet was floated to safety one ship at a time and the official report to the War Department in Washington by the Commanding General and the Admiral of the Fleet called this accomplishment "the best engineering feat ever performed.' This accomplishment was for many years considered a classic example of construction of dams under very difficult and seemingly impossible circumstances.

"Every war our country has had to fight, provided many changes and improvements in our way of getting things done. The Spanish-American War in 1898, World War I in 1917-19, and World War II all brought to our country new methods, new products, and new ways of doing things. Each war took its toll of our youth, and educational institutions were affected numerically downward by the loss of young men in battle. Here at the old Newark Technical School and the newer Newark College of Engineering we have felt the impact of two great wars; but as nations rise again after trials and tribulations, so has our school and college nursed its wounds, recovered its strength, and gone on to attain greater heights than ever in the educational world."

Some attempt should certainly be made to trace the development of technical education and a parallel development of the industrial history of the city of Newark and its contiguous territory. The

Newark College of Engineering and its parent institution, the Newark Technical School, of course followed very closely the development of the industrial changes in this locality, and there is introduced here some material gathered by Professor Robert E. Kiehl which bears upon the development of the community extending from approximately the year 1885, which marked the beginning of the actual work of the Technical School, to 1919, when the Technical School as a separate entity ceased to exist, its work merging and becoming a part of the work embraced by the old Technical School and the new College of Engineering.

The industrial developments in this area prior to 1885 have been outlined earlier; and considering this particular area, we might say that it had been somewhat neglected in comparison with the earlier history of Newark which was so rich in advances in many lines of work which were instituted perhaps in a prior period. Particular attention, of course, should be drawn to the work of Boyden, Edison, and Weston, with many lesser lights appearing in the picture.

"Generally speaking this era was one of Newark's more than holding its own as a major manufacturing center in the United States, and therefore in the world. By 1880 Newark ranked 11th in the cites of the United States insofar as the value of its products was concerned. By the end of the era it ranked 9th. During this time its population tripled and the dollar value of its products increased eightfold. The number of manufacturing establishments increased at a slower rate. Apparently the trend was toward larger companies.

"The development of the different industries in Newark did not proceed uniformly. During the period being studied the leather industry increased 3 1/2 times and the boot and shoe industry 2 3/4 times. Malt liquors increased 5 1/2 times. It would be unfortunate if this were interpreted to mean that the citizens of Newark walked less and drank more! Jewelry and machine shops and foundries increased 7 times, while drugs and chemicals became 12 times as large as before.

"In 1891 the Mercantile Publishing Company published a volume entitled _Newark and Its Leading Business Men._ This book includes an interesting section called 'Newark of Today' with a section on pages 29-31 devoted to manufacturing industries. This will be quoted below. Incidentally, the book contains four good photos of High Street at that time:

> 'Newark is frequently called the Birmingham of America, and it well deserves the title. For within its limits are over 1200 firms engaged in manufacturing, turning out millions of dollars worth of goods annually, giving employment to tens of thousands of working people, and having a capital of over $40,000,000 invested in its manufacturing. Newark is the third city in the union in the extent and variety of its manufactures and one of its establishments alone does a business of over $10,000,000 a year. Another gives employment fully to 4,000 hands, and its works cover acres of ground on both sides of the river. In several branches of manufacturing Newark is acknowledged to lead all other cities in the country and any article that bears the stamp of a Newark manufacturer finds a ready sale in any market, for the reason that Newark artisans turn out only the best of goods.'

"Newark's earlier history showed that cider was the first product for which the city became famous. This was followed by shoemaking (1676) which started as a winter occupation. Leather tanning and carriage building followed and were the forerunners of the many industries to follow, although progress towards industrialization was not steady.

"The Civil War was a stimulus to the manufacturing business and by 1891 an historian in Newark and Its Leading Business Men described the industrial life of the community and noted the following: 'The manufacture of jewelry is an important item in the growth of the city....there have grown up amongst us 72 establishments, with a capital of $2,501,899, employing 2,535 hands, paying in wages $1,094,016..' This same historian pointed out that New York City transacted 25% of the total United States jewelry trade and that Newark's proximity to that market was a big asset. 'In the matter of rents the advantages enjoyed by the Newark manufacturers over those of New York are readily seen, not to mention that of labor, which averages less in this city (owing to cost of living.)'

"'The leather business, that is, tanning and currying of hides and skins, has a history similar to jewelry, and is now the largest single interest that is carried on in Newark.'"

"Continuing, he listed other industries of 1891:

'The manufacturing of hats is one of the industries that started at an early period in Newark, and one that has maintained its position in the foremost ranks of our profitable industries.

'The manufacturing of boots and shoes, that was the first and leading industry of Newark at which two-thirds of the inhabitants were employed in the beginning of the present century, has not kept pace with, nor has it held its position, with some of the branches started.

'The manufacturing of trunks...is now among the leading industries of Newark...

'Saddlery hardware is another important and large interest in this city.

'The manufacture of malt liquors is a large and growing interest in Newark...there are at present 26 breweries and one malt house in this city...'"

Insert attached

Professor Charles A. Colton's work in raising the money and developing the Newark Technical School to the point where it was recognized as one of the most important factors in the industrial work of metropolitan New Jersey was in every way an outstanding contribution to American education. From the time Professor Colton came

It is not just clear as to what circumstances led up to the appointment of Professor Charles A. Colton of Rose Polytechnic Institute for the headship of the newly founded Newark Technical School. There was, as has been mentioned, a great deal of interest throughout America in the formation of such schools for artisans, probably stimulated by the Morrill Act which reached its height of popularity in the years from 1865 to 1875.

It's very possible in the discussion of such matters among those who were primarily interested in Newark concerning the possibility of attracting the right sort of man to head the school there was a very close link between some of the professors at Columbia University and other collegiate institutions and several lectures were given by these men before influential Newark groups. It is highly probably that as Professor Colton was a former student and graduate of the Columbia School of Mines that he was chosen as a likely candidate. The choice, as will be seen later, was a very happy one and Professor Colton not only possessed high technical competency but his experience and his very high moral ideals made him a man almost unique in the educational field.

to the school in 1884 to the date when he gave up active participation in the affairs of the school as Director, many changes had come over the picture of technical education in the United States and in fact, in the whole world.

At the time of the foundation of the school the accepted method of training engineers was through the medium of part-time education. It was perhaps a projection of the old apprentice system; and in 1881 when the first talk came of organizing the school, engineering education, while not unknown, had not assumed any of the proportions which it had assumed when Professor Colton withdrew in 1918. During the last years of his regime efforts were made to start two-year courses, giving certificates in various technical branches; and while they could hardly be called engineering, they would serve as an intermediate step between the work of the technical school and the possible or projected work of a college.

The Newark Technical School was founded in 1881. Its doors were opened on Monday, the ninth of February, 1885. As to what went before its opening, what deliberations, what conferences, what canvassing among state and city officials, boards of education, manufacturers, bankers, and nearby schools and colleges, one can only guess. A news item stated simply on February 10, 1885: "The Technical School on West Park Street was opened last night and, notwithstanding the terrible storm, there was a large attendance. Eighty-eight students appeared and were assigned to classes." It was observed also that there was no speechmaking or other formalities. "The students were simply introduced to Professor Colton and the various instructors and assigned to their classes."

It was a day in which electricity was new and a marvel. It was noted especially that the building was illuminated by ten incandescent electric lamps of 125 candle power and sixteen lights of 16 candle power; that the instructor could turn them off and on with a switch, all of them or part of them as he pleased; and that the lights and the power to run them were furnished free by the United States Electric Light Company with a factory at Orange and Plane Streets.

The period which we are now in is so interestingly described in David O. Woodbury's book, "A Measure for Greatness," a biography of Dr. Edward Weston, that we have borrowed very freely from it. Quotes have been inserted where the use of Woodbury's book has been considerable, but sometimes it has been necessary to purloin words, phrases, and sentences which fit so nicely into the picture and which make it very much better adapted to the purpose of this little history.

Many interesting things were going on in those days bearing on the development of the electric light and its use in public and private organizations. In the midst of it, and contributing a major part to the development of the electric arc lamp and the incandescent lamp to follow was Dr. Edward Weston who, with Mr. Phillips, took the first steps to found the Newark Technical School; so that at this point the school very definitely was coupled with some of the very important and interesting scientific and engineering discoveries which characterized that period.

In Mr. Woodbury's book, which was distributed by the Newark

College of Engineering, these quotations appear which are interesting to show not only that the school was directly connected with the development of these pioneer efforts in the field of electricity, but because they are in themselves so interesting. Mr. Woodbury points out that Weston considered it desirable "to install a battery of arc lamps on the roof of his synagogue-factory."

During the period just before the period of the Technical School the display of arc lighting stimulated a tremendous amount of public interest. In 1878 Weston put up an arc lamp in Military Park in Newark. "It drew vast public attention--and millions of bugs and moths. It was believed to have been the first light ever supplied on contract to a municipality. In 1879 Weston made installations in Boston and in other places."

In Weston's Plane Street plant we note that it was lighted from end to end with Weston arc lamps and it was very probably the gift of these arc lamps and incandescents that were furnished free by the United States Electric Company.

While the arc lamp was at the height of its popularity there were many interesting stories told about it; and as Woodbury says, "It is amusing to imagine a crowd gathering today, say in Times Square, to stare at an arc light. Only a group of aborigines visiting New York would do that. Such is the change in the level of human experience in a few decades!"

To quote again from Woodbury, "Some months before Brush succeeded in lighting Wanamaker's store in 1878 Weston persuaded the city fathers of Newark to let him put up an arc at the very center of town. The Fire Department's watch tower was a cast-iron affair. It was perhaps six to eight stories in height. The tower had a glass enclosure at the top and a large bell hanging about half way up. In the glass enclosure firemen were constantly on watch for any unusual smoke seen during the day time or a bright light at night. It was in full view of this commanding point of vantage that Weston installed his first arc-light display."

"Whenever the lamps were turned on on the roof of the factory it was sure to be visited during the next few days by curious and helpful sea captains who had observed the light from Newark Bay or New York Harbor, had traced its location, and had come to learn and suggest the desirability of having such lights in lighthouses."

"One of the first important contracts which the company received was the lighting of the new Brooklyn Bridge with two rows of Weston arc lamps on ornamental poles. The Weston dynamo to run them, with all subsidiary equipment, was housed in a small building on the Brooklyn side. 'At eight o'clock,' says D. B. Steinman, in his biography of Roebling, 'the first fuse was touched off, releasing fifty giant rockets, and a few seconds later the two cities lay under a sparkling shower of gold, blue, red, and emerald fire.' Countless thousands witnessed the unforgettable spectacle. They saw the span flooded with the miracle light of eighty powerful electric lamps strung along the arching roadway."

The school on West Park Street, rented at $1100 a year, was a narrow brick structure of some pretensions architecturally, crowded in between buildings of similar type. It had probably begun life as the home of some person of consideration "convenient to the main thoroughfare of the city and the shops." It was spacious enough to accommodate a nightly attendance of about two hundred, distributed over its three floors. The first floor, which was probably the street floor, had two rooms for the classes in mathematics. The second floor was fitted up as a lecture room. "Here," it was said, "Professor Colton lectures on chemistry and physics." On the third floor, furnished with Kensington tables, the pupils studied free-hand drawing. It is hard to understand why free-hand drawing was so highly thought of at that time, but it seemed a subject of great importance, or at least of great interest, and it was continued in the school with vigor to a time well beyond Professor Colton's directorship. Perhaps its favored position may be explained by saying that it could, after all, be considered a subject of some technical interest and at the same time serve as satisfying the student's artistic and creative spirit.

It is not completely clear who assisted at the birth of the school besides Professor Colton. Certain names are repeatedly mentioned in the newspaper notices as the commencements rolled around. City and state officials always accepted invitations to be present and, indeed, often came. Superintendents of schools, members of the boards of education, mayors, and governors passed in and out. Sometimes they said a few words at commencement exercises. Professor Colton seemed to know a lot of "the people who count" and had influence enough to get them to sit on the stage with him on the important days. Certain names appear repeatedly in the history of these convocations and festivals; William Barringer, George Phillips, Moses Bigelow, E. O. Chapman, Colonel Joy, Edward Goeller. Some were officials of the educational system of the city or state; some were merchants or manufacturers with an interest in education. These men, especially the politicians of the scene, might come and go; but there was always one to worry about the money, to plan for the future, to say a few inspiring words to the graduating class after the main bout of oratory, and to go off in the summer to visit chemical plants. That was Professor Colton.

Professor Colton—the student of today who gets to the Newark College of Engineering in the morning with a half hour to spare and who may spend it gossiping in the entrance hall, or his classmate with a half minute to spare, will probably both pass a painting on the stairway. It is one of those things that in the consciousness of the crowds flowing up and down the stairs has blended into the background. At some time one may have asked, "Who was Professor Colton?" and then forgotten the answer.

But to the student of forty years ago and to the alumnus of the 1920's Professor Colton was a person of great importance and consideration. He had been the Director of the Newark Technical School for over thirty years. He had at last retired to a farm in Dutchess County, New York, and left behind him in the minds of his former students a feeling of respect and admiration which amounted to a minor Cult. William Lynn Phelps at Yale, Copeland at Harvard, had reacted on their more articulate students (they had been teachers of English) in a similar way.

One of Professor Colton's particular points of pride was that he knew personally almost every student that came into the school and the loyalty of the whole student body was something to marvel at. Professor Colton was no particularly easy taskmaster. His idea about technical education was very definite and had a good deal of austerity mixed with enough interest to rather induce a kind of worship on the part of the students. The story goes that he sat in his office during the opening of school each year with a big book in which were inscribed the names of the students. Then certain questions were asked about preparation, objectives, philosophy, etc. One of the questions, however, was, "How do you spend your evenings?" It was very interesting to read over that book and in the light of the present occupations of some of the graduates of the Newark Technical School see how they answered this question.

Another thing which characterized Professor Colton and which seemed always very helpful to the students was the little mottoes which he had painted over all the doors of the classrooms and laboratories. They were extremely well chosen and the writer was much impressed and much helped by them. One in particular was striking which occurred over the door of the electrical laboratory and which still is remembered: "I will be true for there are those who trust me." It seemed a particularly good motto for anybody, but for engineers in particular.

I spoke of Professor Colton's austerity. Concerning questions of scholastic standing and questions of absence and tardiness, he might have appeared a martinet; but the school in its early days did inculcate very definitely some of those basic virtues which seem to STILL CHARACTERIZE IT ~~some extent lacking~~ in the modern day.

Professor Colton, as has been mentioned, acquired a farm in Pleasant Valley, New York, and there with his wife he spent the summer. He was not a stern man, but a very kindly and patient individual with fixed ideas as to the training of young technicians. It was startling when the writer first came to Newark to find the number of men in executive positions and men of standing in various industries who had graduated under Professor Colton or who had at least come to school for a time. It seemed as if almost everybody of any consequence at one time had gone to the Newark Technical School, some of them to stay and graduate and others just to find out that they were not particularly fitted for this calling. I remember once, in talking to the late editor of the NEWARK EVENING NEWS, Mr. Arthur Sinnott, being surprised to find he had been a student at the Technical School for a time.

A very good example of the type of men which the school produced was Fred L. Eberhardt, for a considerable time President of the Board of Trustees. He must have been a man very much after Professor Colton's own heart. Brought up in the best traditions of what a Swiss technician should be, he was in one of the first classes of the Newark Technical School and he later, of course, became President of the Board of Trustees. His position as President of the Gould & Eberhardt Company, who manufactured machine tools, placed him in a very strategic position so far as rendering service to the institution was concerned, and it was through his help and under his leadership that the Newark College of Engineering developed. Nothing was ever too much work for Fred Eberhardt and in the meetings of the Board and in the meantimes as Chairman of the Building Committee he was busy directing his energies toward the development of the school.

It is very interesting to note in this connection that his Chief Engineer, Mr. William Zimmerman, was a graduate of the Newark Technical School and next in line, Mr. Granger Davenport, was a graduate of the Newark College of Engineering.

The situation in many concerns was typical, particularly true in the Singer Manufacturing Company. I remember Mr. Nydegger, Mr. Von Lehm, and Mr. Hoer.

The first graduate of the school was Mr. Cephus I. Shirley who was for many years the Business Manager of the Newark Board of Education.

Not only in manufacturing but in business the graduates of the school had risen rapidly and in the banking field we can only mention Mr. Brenn of the Franklin, Mr. MacEvoy, President of the Washington Trust Company, and Mr. Rieber of the National State Bank. There were many more in the Public Service, quite a few in the Prudential. Some of our students and teachers came from the Mutual Benefit Life Insurance Company, which goes to prove the important thing--that the Newark Technical School was and did integrate itself very closely with the community life of Newark.

Not long since in a conference in Pennsylvania I learned that Mr. MacNiece, the Chairman of the Division of Management of the American Society of Mechanical Engineers, was a former evening student with us.

While in many of these cases the education of the school did not proceed very far under present-day technological standards, it did give to a very considerable number of young men who never even graduated a bird's eye view of the technical field and served to stimulate them to greater development. It is interesting to note that not so much importance was placed on graduation in those days; and while certificates and diplomas were given, it was quite evident that the thing desired was a knowledge of the subject and nothing else. This the Technical School gave and with all of its austerity and with all of its sternness it did make a tremendous contribution to the overall economic and financial life of Newark during the years of its existence. Too much credit cannot be given to Professor Colton for furthering these ideals. To the very end he stood staunchly for what he considered to be the best in the building not only of young technicians but young manhood.

There are very few stories persisting about Professor Colton. While he was very much interested in the lives of young men who were students in the school, he was not one with whom liberties could be taken. The only stories that seem to persist are concerning his choice of models for life classes in freehand drawing and those, strangely enough, are rather objective than personal.

One thing that is not generally appreciated is the tremendous influence Professor Colton had in his community and the benefit which was derived in later years from this influence. His philosophies and thoughts were naturally reflected in his students and when the occasion arose to develop more advanced courses in the college, these students of his, holding as they did advanced places in industry, were of the utmost help. It should be said over and over again and stressed that the growth of the institution in its later years was very much dependent on the sound foundation which was laid by Professor Colton and his teachers.

Most of the professors of that day have passed on but it is safe to say that they reflected the philosophy of Professor Colton in a very marked degree. They were men, while serving the school in a part-time capacity, who still took to heart its problems and were in every way in sympathy with the student body collectively and individually. Most of them were men of some considerable substance either in the production or consulting engineering field.

As I look back, some men particularly were important in the development of the institution. Such men as Mr. Archibald Kidd, Mr. David R. Weir, and Mr. Edward A. Conroy and others were towers of strength always in connection with the evening school.

Often in the spring Colton's boys, some of them already elderly, made pilgrimages to Dutchess County, spent the day with their former teacher, and had a group picture taken with the old gentleman seated in the midst of them. Scholarships were given in his name.

The atmosphere at the time of the founding of the Newark Technical School was unbelievably different from that in which we now live. Russia, Korea, and Indo China were little-known areas a great distance away and not of any conceivable immediate interest. They were not our next-door neighbors, or perhaps our next-town neighbors, as they are now, thanks to the technicians of the world. Bombs in those days did not exist. The explosives were comparatively benign. Armies traveled slowly on foot or on horse, after the first quick lift by railroad, and in any case they did not go far. From Paris to Moscow is only about 1500 miles; from New York to Tokyo about 6800. That universal concern of contemporary mankind which was the atom bomb in 1945, the hydrogen bomb today, and something else tomorrow, had not been imagined. It was, in fact, unimaginable. It was quite clear to all competent chemists that the atom was the lowest limit of all things and that it said, "Thus far shalt thou go and no farther." There was no cataclysm in sight.

Men's consciences did not bother them greatly, unless in purely personal matters. There was no feeling of mass guilt. There were no storm wornings of a wave of intellectual and moral nihilism which was threatening us. It would have been impossible in those days for a professor of psychiatry at a leading school of medicine to suspect that there is developing "a new psychosocial ailment among scientists," and that emotional stresses in the scientist's career have so increased that "only men of exceptional maturity and stability can stand up to them for long and remain clear-headed and generous-hearted under such psychologically unhygienic conditions."

Broad social and humanitarian problems did not in the year of the founding of the Newark Technical School trouble the minds of too many. It was a period of laisses faire. If you were not among the underprivileged it was not too difficult to reconcile someone else's hard lot with the will of Providence. It was a time when children of ten, and even younger, were in the mills and the factories and the canneries; and a few citizens, alarmed at this, were looking for some way to protect them. But there was still a long road to travel before the average week of work was cut down from six days of nine hours each to one of thirty-five or forty hours.

In relation to the Newark Technical School these matters were not all of academic interest only. The students were, or hoped to be, technicians. And a technician is one type of scientist, perhaps the only type of scientist, in industry in those days. The scientists were concentrated chiefly in Germany. If a man wished to study chemistry at any time before the first world war, he went to Germany. In this country, in 1885, if a boy went to college the chances were that he spent a great deal of his time studying Latin and Greek. Compared with its status at the present time, scientific studies had hardly begun in America.

They were beginning at Newark in a fundamental way. The education was in basic science. No high school diploma was required for admission. The entrance examinations were tests in simple arithmetic, history, geography, and grammar; and when the student entered the school his study of algebra, geometry, chemistry, and physics stressed the practical side. Professor Colton, indeed, defined the kind of education which he was directing as technical education, "the application of science to understood pursuits." He looked on technical schools as "the outgrowth of the demands of an advanced civilization, valuable in proportion to the degree to which the graduates are able to apply their instruction to useful ends." These were the ideas he set forth in his few remarks at the formal celebration of the opening of

Insert attached

the school on April 8, 1885, ~~and~~ He ended his talk by defining the object of the technical school, which was to teach the application of science to the industrial arts in the shop and the factory. It, the technical school in general, was "not a school of general culture, not a school of abstract science." The Newark Technical School was to have for its principal purpose the training of the pupil to accurate habits of thought and work, the endowing of its young men with a clear understanding of the work they do.

Much of the talk at the commencement exercises had to do with the work the students were doing in their daily occupations, the work

The following dates indicate the events that took place in connection with the opening of the Newark Technical School. The source of this information is copies of newspaper reports under the dates shown:

Jan. 23, 1885. The Technical School will be in readiness to receive nearly 100 pupils by February 9. (A Monday according to 1955 World Almanac.)

Jan. 26, 1885. The Essex Art Association Building, on West Park Street, that is being put in shape for the Technical School will be ready for occupancy in a few days, and the school will probably open early in February.

Feb. 7, 1885. Page 85 & 86 Opening the Technical School - The Event a Source of Congratulations to All Interested.

Note: Above item is a headline of an article on the school. This item showed that the building on West Park Street was in active use on February 6, 1885, and probably earlier.

Apr. 6, 1885. Page 89 Opening of the Technical School

The formal opening of the Technical School will take place on Wednesday evening and the exercises will be held in the Association Hall, Clinton Street.

Apr. 7, 1885. Page 90 Opening of the Technical School

The public exercises connected with the opening of Newark Technical School will take place at 8 o'clock Wednesday evening, April 8, at Association Hall, Clinton, Street.

Page 96 Note: The formal opening exercises of the Technical School were therefore held April 8, 1885.

Note: The 1955 World Almanac shows 4/8/85 to be a Wednesday. It is believed that classes started on 2/9/85 and that the formal opening exercises were held on 4/8/85.

which it was hoped would become more productive and skilled as a result of their training at the evening classes at the Newark Technical School, five nights a week, from 7:20 to 9:20 P. M. But this work should also have its reward in a material way; and sometimes, though not often, this phase of the matter was taken up.

This question of the improvement of the condition of the laboring man would naturally be expected to be of some interest to those who were associated with the Newark Technical School. Most of its students were engaged in local industries. They may not have been considered laborers, although some of them probably were. At any rate, they must have been very much alive to the condition of the laborers whom, no doubt, they knew very well. Although, as we learn from the entrance examinations set by Professor Colton, living was cheap, labor was also cheap. A house might have been bought, according to Professor Colton, for $3200, a ton of coal for $3.50; but the workman may have been earning $15 a week.

Concern with the worker's economic condition actually did once receive major attention in a commencement address. This was on

May 12, 1890. The speaker of the evening was the Reverend Doctor William Prall who had formerly been an assemblyman. He referred to a "great restlessness on the part of the people" and said that he felt that the first step to combat this would be the restriction of the hours of labor. He hoped that he would offend none of the manufacturers if he said that he believed eight hours a day was long enough for any man to labor. He went even further. He said that he believed that the man who created and cared for the machine which had increased production and profit by application of power, "that man has a right to say to his brother who controls capital, 'let me have a share of these profits.'"

This must have sounded strongly like socialism or communism to some of the men who sat on the platform at the commencement in the hall of the Young Men's Christian Association. When the other side of the argument was advanced it might not have been handled in language as moderate as that used by the Reverend Doctor Prall. He was, in fact, followed by State Superintendent E. O. Chapman who may have had in mind

Dr. Prall's remarks when he declared himself "in favor of Yankee Doodle and the Star Spangled Banner."

It must not be thought that there was any controversy on the rights of labor at these school commencements. Then, as now, a speaker would naturally turn to a subject which was close to his heart or which was receiving wide attention or which might be pertinent to the lives of his audience. On the other side, it might be called the anti-socialistic side, had already been heard. Words had been spoken by Governor Abbett himself and in a tone which today would seem offensive.

In those days, however, men were much more firmly fixed in their convictions, whether religious, political, or economic. Their thoughts ran in well-worn channels. Their associations and outlook were parochial. Today, before we speak publicly, and often before we speak privately, we give some thought to the possibility that our words may offend. Politicians of today, particularly, have to keep in mind the fact that words may offend a group and that this group may be able to retaliate.

It was not so in 1885. Governor Abbett of New Jersey had spoken at the formal opening of the Newark Technical School on April 8, 1885. In the following year at the closing exercises his impromptu speech (vigorously applauded, according to the papers) might be described as a mixture of inspirational oratory and carefree vituperation. "This school," he said, "does more than give a boy a mere education. It trains his mind, his hand, his heart. It teaches him obedience to authority, obedience to law. It is time that we should learn to stand by the institutions of the country. The boys in this school learn that. They will learn that it is only the spawn and offscouring of another country that ever attempted to engraft upon our land the ideas of anarchy, revolution, and communism."

This must have been hard for citizens of foreign birth to take. There were many of these. The Germans alone were numerous enough to support three German language newspapers, all of which were overgenerous in carrying news of the school; columns more lengthy, more to the point, and better presented than those in the English language newspapers. It would be expected that the Germans would be interested in technical education which had begun in Germany, but the Governor's words must have annoyed many. The New Jersey Deutsche Zeitung carried the story of the commencement but toned down Governor Abbett's words. In the German version he was made to say merely that anarchists and communists had no hold on the educated worker.

The education of the worker at the Newark Technical School was, as has been said, basic in its simplicity. It was frankly utilitarian. The founding of the school was intended to benefit not only the worker, but the manufacturer; perhaps primarily the manufacturer, by supplying him with more versatile and intelligent help. It was conceived in the deliberations of the Newark Board of Trade. We learn this through a philosophising letter on "Workingmen and Machine Labor; Some Thoughtful Suggestions Concerning the Technical Schools." The letter appeared in the Newark Daily Journal on September 25, 1886, and was signed simply with the letter "C." Could this have been Professor Colton's letter? After a preliminary discussion of the need of training for the workingman, especially training in orderly thought, the writer pointed out that "if the individual can be trained in proper methods of thought, the stability of the government, which seems threatened at times by the masses, will be more secure by reason of the individual thought."

Whether or not these worries about the threat of the masses were in the collective mind of the Newark Board of Trade, the story continues with an observation that the Board created sufficient public sentiment to establish a Technical School for the benefit of the masses---a school which would not graduate superintendents, engineers, or experts, but better workmen.

What were these "workmen" like when they came to the school? In general they were young, sixteen to twenty-eight years of age; on the average under twenty-one. A few were in their thirties. Some were married and had families.

Most of the students were working in plants in and around Newark--in the Domestic Sewing Machine Works, the Weston Electric Light Works, Hewes and Phillips, Watts and Campbell, and Celluloid, and so on. It was often said that they were workmen who were trying to improve themselves. Only after they graduated was it possible to get an idea of their actual occupations. This can be learned from the "Book of Information" which was equivalent to the usual school catalog or bulletin and which was published yearly. From this we can learn what the students were doing after graduation. Elaborate lists were published giving the occupations of graduates of the years past. In the 1917-1918 "Book of Information," for instance, the graduates of the classes of 1888 to 1917 inclusive were accounted for. One finds that the graduate might have been a moulder, toolmaker, draughtsman, foreman, machinist, die maker, jeweler, electrician, electroplater, designer, clerk, inspector, armature winder. Some had wandered far afield and become brewers, florists, insurance men, and counsellors-at-law. A few had become presidents of companies. But it was still the policy of the school in 1917 to advise the public through the medium of the "Book of Information" that its aim was "to prepare students for entrance into manual vocations either as learners, apprentices, journeymen, or to give supplemental instruction to those already in a trade or other manual vocation." It always stated emphatically that the school "did not prepare students for college or professional schools."

The opening of the school was informal, as already noted. There was no celebration until the night two months later when Governor Abbett, Colonel Joy, and certain other solid citizens spoke briefly. There was usually, in later years, a formal convocation or meeting to celebrate the end of the school year. At these meetings there were speakers to give words of praise and appreciation to the pupils who went to school for two hours at night after having worked perhaps from seven to twelve, and one to five. The speakers generally stressed the value of manual training and the kind of education that would make the boys self-helpful and progressive. At the end of the speech-making the audience was usually invited to inspect the classrooms and laboratories of the school. These yearly exercises were usually held in the auditorium of the Young Men's Christian Association on Clinton Street.

At the closing exercises of the second year which were held on May 16, 1887, a large audience was present, "among whom were many ladies."

Governor Green spoke briefly and mentioned the fact that a bill had been passed by the state legislature providing that the state should give to each school district an amount equal to the sum "raised by the people," provided that it did not exceed $5,000. This was to be used for technical education, and the Governor said that he looked to the Newark Technical School for instruction as to the best manner of carrying out the system of technical education. This was the first notice of the financial relationship of the school and the state which was to be a permanent one and which will be told as a story by itself.

The chief speaker at this exercise, however, was not the governor, but a professor from Professor Colton's alma mater, the Columbia School of Mines, Thomas Egleston. His talk was strongly in favor of American technical education as compared with the European--American technical education of the type established by Peter Cooper. "Cooper Institute, during the war," he said, "furnished nearly all of the engineers to run such vessels as the Monitor. They were not taken from West Point and the colleges." Professor Egleston concluded by an appreciative discussion of two of the important studies of the Newark Technical School, mathematics and drawing, "the two most important languages, languages which all can understand, which need no translation, which will be just as easily understood in Afghanistan as in the shops of Newark."

The meeting at which Professor Egleston spoke was the last one which might be considered a mere "end-of-the-year meeting." After that the yearly celebrations became known as "commencements," that strange word used to describe the ending of a school course, and explained rather doubtfully by noting that school is ending but life is beginning.

The school's first commencement took place on May 14, 1888, and the speaker on that evening was a man who later became one of America's most eminent educators and the President of Columbia University. Nicholas Murray Butler was at that time President of the New York College for the Training of Teachers which is now known as Teachers' College. Unaccountably, Professor Butler appeared in all the newspaper accounts of this commencement as the President of "The Industrial

College of the City of New York." The commencement received very numerous and extensive notices in both the English and German languages.

Nicholas Murray Butler's speech, even in those days, had the flavor and quality that later generations learned to look for—dignified, parliamentary, sonorous, leaning heavily on the classics and on European history, early and late. In his talk, on this event, at least, the academic education of the universities ran second best to the technical training of Newark. "In the great manufacturing cities," he said, "we find all sorts and conditions of men, and the knowledge which they evince in the production of articles by applied mechanics is power in its fullest meaning. The teachings of history are that great cities are dangerous. Athens, when in the fullness of her power, made the fatal mistake of ostracizing Aristides; Paris had to suffer its reign of terror; London its diurnal riots, and even New York and Chicago have not escaped the fury of the ignorant masses." The old civilization, Mr. Butler pointed out, was a martial aristocracy—the modern, an industrial democracy. He looked for the pupils of the industrial schools to supply the stamina of the country and the real backbone of civilization. He believed that there was sufficient patriotism, intelligence, and enterprise in Newark to make its Technical School one of the greatest in the Union because it was already founded on the soundest business and philosophic basis. "The address of the able gentleman," said the notice in the Press-Register, "was listened to throughout with rapt attention, and he was thanked by a tumultuous applause." Even the restrained New Jersey Freie Zeitung concluded its story of Dr. Butler's address with the parenthetical (Lauter Beifall).

But while the fine speeches were being made, Professor Colton and a good many others were considering the annoying matter of money. The Sunday Call, on November 13, 1887, had run a column on the school's finances under the ominous heading, "Shall It Be Closed?" In this there was a rather complete history of the initial financial arrangements of the school and their contemporary unhealthy state.

The support of the school had originally depended on a peculiar and unreliable piece of teamwork between the citizens of Newark and the state of New Jersey, by which it was agreed that $5,000 was to be raised annually by the citizens and that this was to be matched by the state; but the act of the state legislature actually said that the amount to be raised by popular subscription was to be at least $3,000 and that the state would give an amount equal to that raised by the people, but not more than $5,000. This seemed to indicate that the education of 200 boys a year (about the usual enrollment) would be carried on at a cost of from $6,000 to $10,000 a year.

In the first enthusiasm amounts were subscribed by some of the more affluent citizens of Newark, amounts ranging from $200 down to $25. The entire $5,000 was promised by these contributors; but of the 250 who agreed to pay, fewer than 200 actually did pay. It was felt necessary sometimes to nudge the elbows of these men, and the newspapers were often interested enough to do this. The _Sunday Call_ on December 19, 1886, expressed its alarm that less than $3,000 of the $5,000 promised for the school's third year had not been paid and reminded the citizens that, under these conditions, the $5,000 appropriated annually by the state would not be available. It was pointed out also that the school was badly in need of a library and reading room. This need for a library became an important demand in the early months of 1887 and thereafter. There was also an occasional reference to a possible "museum of industries" in which would be collected samples of the products of the local industries and which would be of vast benefit to the public. The newspapers were co-operative in this matter and gave much space to Professor Colton's philosophizing and planning. The Daily Journal, the New York World, the Evening News, the New Jersey Freie Zeitung, and the Sunday Call were all of help. "President Colton, of the Newark Technical School, chatted freely again," and the reporter relayed the news of the school's plans, hopes, and needs.

The school's file of technical magazines was to be the nucleus of a valuable reference library for the city; but the combined library and business office of these days was understandably inefficient and, during the summer, was open only one night a week. "The city," said

Professor Colton, "was sorely in need of a reading room which should be free to everyone and open at all times." "I am satisfied," he commented, "from observation, that many young men, and older ones as well, go to the saloons to spend their evenings because there is no other place to go where they have the same freedom." Professor Colton was, perhaps naively, sympathetic to the young man. Years later he was to include in his "Book of Information" the following adjuration to employeers: "Every employer who has an employee attending these classes will do that young man a kindly act by speaking a word of encouragement to him now and then. Sacrificing social pleasures, as the student must if he attends evening classes and keeps up his standing, shows that he possesses grit and determination to succeed, and a little praise is frequently an incentive to him."

Encouragement was sorely needed. In the early days of the Technical School the student mortality was amazingly high. This was mentioned on the occasion of the second commencement at which six men were graduated. The class had originally numbered fifty-seven. Absences were severely restricted and penalized. More than five absences in a term caused the student to be dropped. Once dropped, it took the Board of Trustees to get him back into the school. In spite of this withering away of the student body, Professor Colton insisted regularly at commencements and in newspaper interviews that the school's capacity was severely taxed. It was true also that the lease on the West Park Street building would expire on May 1, 1891. This made it necessary "that other and more commodious quarters should be procured."

This meant money, but money was now a little easier since the city of Newark, through its Common Council, voted an appropriation which was to equal that of the state. This had become available to the school for the year 1888-1889. "Had it not been for the city's assistance," said Professor Colton, "the expenditures would have far exceeded receipts." The good news about the city's donation was first announced to the Alumni Association at its annual meeting on February 13, 1890. The Association was then in its second year. Professor Colton further told his graduates that a bill would soon be passed making the Board of Trustees an incorporated body "under the name and style of The

Board of Trustees of Schools for Industrial Education, with the right of perpetual succession, to sue and be sued,---and with power to accept donations and bequests of money and property---." Beyond this Professor Colton said that his board had enough money saved up to buy land for the erection of a new building. Money for the building itself they did not have but they hoped to look for it in the direction of the citizens of Newark, especially those who were at the head of the numerous industries of the city and of the surrounding towns.

In less than a month after this announcement the land had been bought, the "Hedges Place," at the corner of High Street and Summit Place, a plot about 138 by 175 feet. The price was $14,000--no mean sum; but it was property on a very desirable street in a large city. There were mansions on High Street in those days. Several of them are still standing in the stretch between Market Street and Clinton Avenue. It should be remembered also that the lot was a large one. On the "square foot basis" the cost was only about fifty-eight cents.

This was the lowest price per square foot of any of the real estate transfers reported on April 26, 1890. In his announcement of this purchase Professor Colton optimistically stated that it was desirable that a new school building should be ready for occupancy by May 1, 1891, when the lease on the West Park Street property ran out. The trustees did not have the money but they hoped and believed "that wealthy men would open their purses." The price of the land could have come out of the money saved during the preceding years. It was possible, apparently, for an institution to save money in those days. Indeed it was done. The Evening News, on April 26, 1890, made the almost incredible statement that the Newark Technical School's receipts for the year preceding were $21, 295.13 and the disbursements were $8,049.44; but, while this savings, which was over $13,000, would nearly buy the land, the larger item of the buildings would have to be considered also. Professor Colton expected that thirty or forty thousand dollars would cover it, at least initially. There was to be one building to begin with, while others would be added later. At the commencement exercises on May 12, 1890, there was but little talk of the new building. Professor Colton said merely that no money had yet been contributed, but that he felt confident that it would be forthcoming later.

Aside from matters of money, there were other things of interest for the fall opening in 1890. A circular was published giving information about the school and stating its aims. These were said to be primarily the advancement of the manufacturing interests of the city. The courses were arranged "with special references to the intellectual wants and improvement of the working classes." These courses were, naturally, the old group, including mathematics, physics, chemistry, English, and drawing; but there were new ones.

A two-year postgraduate course in English was added, as well as a two-year course in architectural drawing. The English course, founded "at the earnest solicitation of graduates of the school," was, for the first year at least, to be available only to the alumni. Of the twenty-nine graduates of the school, eleven took the course.

There were only two meetings a week, but considerable outside work was expected of the students in the matter of writing and reading. It was hoped that in later years this course, remodeled somewhat, might be opened to the general public at a modest tuition. Ten dollars a year was the amount mentioned.

The course in architectural drawing was so popular that it was necessary in the following year to extend its classes to include one on Saturday night. This subject retained its popularity for many years, even into the 1930's, and would probably be going still if it had not become one of the victims of the accrediting boards. Its popularity was understandable. It satisfied the creative urge of the student. It made him familiar with the architecture of the past. It gave him an appreciation of the controversial architecture of his own day. It supplied him with an understanding of possible relationships between the engineering and the esthetic aspects of design. Even the textbooks it used were treasuries of the art of architecture from Egypt to Chicago.

There was another matter of interest which was quite strongly in the engineering field. Among the three new men added to the faculty was one William Kent who was to give a series of ten lectures on steam engineering on Friday evenings from 7:30 to 8:30. These lectures were designed for fourth year students, but graduates had the privilege of attending them. Professor Kent was to be celebrated before long as the compiler of the famed "Mechanical Engineers' Pocket Book" which appeared first in 1895. It was, and still is, published by John Wiley and Sons, New York, although its title is now "Kent's Mechanical Engineers' Handbook." The work on this book had been started by Kent before 1875 on the advice of Nystrom; "Every engineer should make his own pocket book as he proceeds in study and practice to suit his particular business." In the first edition the author assumed the role of a compiler, not an "authority," and gave credit to the original workers, when possible, by naming them and the publications from which the information was drawn.

The work has gone through twelve editions—first under the editorship of William Kent, and later that of his son, Robert Kent, It is now a compilation of authoritative monographs and is published under the general editorship of Colin Carmichael and J. Kenneth Salisbury. In addition to his teaching at the Newark Technical School, William Kent lectured at many other institutions: Purdue, the Polytechnic Institute of Brooklyn, the Franklin Institute, Cornell, Stevens, Worcester, etc. His special interests were steam engineering, water-tube boilers, weighing machinery, and smokeless furnaces. Later he turned to industrial cost accounting. He appears to have been a sharp businessman. The copyright on the handbook is still held by the Passaic National Bank and Trust Company as trustee of his estate.

On November 30, 1890, the _Sunday Call_, in a generous spread, notified the public that the new building for the Newark Technical School was somewhat more than a dream, and printed the architect's drawing of what is now Weston Hall. "It is hoped," said the _Call_, with innocent optimism, "that every effort will be made to have the new school in readiness for use by the opening of the term next fall." There followed a detailed description of the proposed physical structure of the building.

In the following May the trustees were hoping "to see their way clear to break ground by fall," and on May 12, 1891, at the fourth commencement, money matters were taken up. After the speaker of the evening, Professor Felix Adler of the Workingmen's School of New York City, had addressed the gathering on the subject of technical education, Professor Colton came forward. Referring to the proposed new building, he said that there were three stages in the erection of a school building—contemplation, agitation, and realization. "We are now in the agitative stage," he said, "and it takes a great deal to agitate Newark." (Applause). He was referring, as one learns later, to "the conservatism" expressed by the average citizen when it comes to giving money. He was, however, able to announce a few plums from the brewers: John H. Ballantine, $5,000; Robert F. Ballantine, $5,000; Gottfried Krueger, $1,000. But the men of those days were reluctant to give outright. These subscriptions were to be paid only when the rest of the needed $40,000 was subscribed.

From that time forward there was a succession of alarums and excursions on the part of the newspapers actuated, no doubt, by Professor Colton and his board. There was considerable finger-pointing. Philadelphia was complimented on having a Drexel to give it a Drexel Institute and a Childs to supply it with treasures of literature and art. Newark had its wealthy citizens, but they did not show the same public spirit. Mr. Anthony Drexel had given to date a million and a half dollars--Newark needed only forty thousand. Peter Cooper was mentioned with reverence, as were Andrew Carnegie, Isaiah Williamson, and Charles Pratt, all contributors to education and benefactors of their country. Such were the words of the _Daily Journal_ in December, 1891.

In May of the following year William Clark of the Clark Thread Company promised another $5,000, but that left $24,000 still to collect, and the _Journal_ began to talk about small subscriptions, $5 to $100, from hundreds of citizens, while the _Newark Times_ began to hint that the state ought to foot the bill, and the _Daily Advertiser_ said that the Board of Trade should pitch in and help. About this time another contributor appeared with the annoying promise that he would give $500 when the subscriptions totaled $20,000. This made a total, on May 29, 1892, of $16,500 in promises. At their annual dinner the Alumni Association, perhaps by way of changing the subject, voted to place a wreath on Seth Boyden's statue in Washington Park on Memorial Day. But the Daily Journal, in a parting shot for the year, observed that the Grant Monument Fund, which General Porter had undertaken to complete only two months previously, had all been subscribed which, the Journal said, "only goes to show what can be done by vigorous hustling."

During the summer of 1892 the subscriptions continued to come in and they kept on through the fall and the winter so that by the middle of March they amounted to $22,840, which left $7,160 to be collected before the actual building could be started. During these months the newspapers had kept up their low pressure campaigns and reported all gifts, no matter how small. Although no mention is made of it, there is a likelihood that Professor Colton carried on his own campaign, possibly by letter or even by personal visit, since the listings seem to show only companies and individuals from the Newark area. In the vacation months Professor Colton had, as usual, made his trips to the industrial plants. This time he visited several dyeing establishments and "made valuable additions to the Industrial Museum." He also prepared an exhibit for the World's Fair illustrating the bleaching, dyeing, and printing of calico. This was "put up in a handsome oak case, made especially by Kirk and Jacobus, with a metal tablet reading: "Technical Chemistry from the Newark Technical School." This was the World's Fair of 1893 which was held in Chicago.

The trickle of subscriptions died out, however, in the following months. The year had been a bad one in the business world, the building fund had not increased; and in November, 1894, Professor Colton reported a total of $23,218 of subscriptions which was an increase of a mere $378 for a year and a half. Clearly something had to be done and the Professor did it by the aid of a quaint and interesting publicity campaign. This was carried out through the Sunday Call which was always very helpful. It involved the printing of a series of letters from graduates of the Newark Technical School who told in "simple unvarnished language" what the school had done for them.

In a kindly introduction to the letters which appeared in May and June, 1895, the Call commented on the fact that it seemed strange that it was so difficult to raise the last $7,000 of the building fund, since the school was not only a good institution of its kind, but the embodiment of the spirit which had made Newark great. At the same time the Call printed the circular letter which Professor Colton had sent to all the graduates under the date of February 15, 1895. The letter included three questions which the graduate was requested to answer as fully as he wished. They were:

1. What is your present occupation?
2. Has the instruction you received at school been of any benefit to you?
3. What suggestions can you make for improving the course of instruction as at present carried out?

Some of the answering letters were brief and to the point; others were of the nature of a minor autobiography. Almost all were dated from Newark or its neighborhood. The most distant letter writer had sent his answer from Birmingham, Alabama, where he was acting as draftsman and bookkeeper for the Birmingham Engine Works. The positions of the graduates were of the kind that would be expected: civil engineer, draftsman, toolmaker, sheet metal worker, machinist, chief engineer, salesman. One man, however, had become a medical student in Philadelphia. They all agreed, loyally, that the school had been of benefit to them in their life and in their work. As to the suggestions for improvement of the curriculum, there were a few of those. It was thought, for instance, that individual experimental work in chemistry and physics would be preferable to the customary lecture experiments which were all the school had to offer. A number of the writers had this thought. Other suggestions were: a course in business, the lengthening of the school year, the handling and use of surveying instruments, a course in Latin (this from the medical student). But in general the writers did not have many suggestions for the improvement of the school.

This little campaign served to keep the school and its problems before the public for the summer. In the fall the financial worries were still as big as ever, even bigger. It was thought that the new building might cost $40,000 rather than $30,000. Further troubles appeared. As a result of the raising of standards in the entrance examination in arithmetic there was a notable falling off of the eligibles and in place of a "waiting list" which had sometimes been the case, there were not more than fifty who could pass the examinations and enter the preparatory class.

At this time the building fund had been growing in a more healthy manner by contributions ranging from $10 to $500 until, at the end of 1895, there was only about $4,000 needed to make up the total of the building fund which had again settled down to a more comfortable $30,000. Then came the happy news, on January 5, 1896, that the Newark City Council, finding that the city's balance showed a surplus of $65,000 at the end of the year, voted $5,000 of it to the Newark Technical School, thus bringing to reality a suggestion that the _Newark Sunday Call_ had made a short time before. It had been a long struggle, so long that four of the early subscribers had died, but Professor Colton anticipated no trouble, "that is, practically none," in collecting the actual money, even from the estates of the dead subscribers. The Sunday Call published a "Roll of Honor," including all subscribers except the Newark City Council, and brought out the embarrassing fact that if only $30,000 had been needed the City Council might have kept its money, since the subscriptions totaled $30,973. The amounts ranged from $5,000 down to $3.

After a few unpleasant episodes relating to the letting of contracts were smoothed over, the cornerstone of the new building was laid on May 11, 1896. This ceremony was held in the afternoon, the annual commencement in the evening. The cornerstone box contained copies of several of the local newspapers, the school's "Handbook of Information," and certain other documents. The Sunday Call at this time came out with a lengthy history of the school from its very beginning and even certain happenings which preceded its beginning, such as the Board of Trade meeting on March 8, 1879, when an essay on technical education was read by Professor Alfred Colin. The troubles of the home builder were not absent. The school was to open in October, as usual, but there was delay in the construction of the roof. The date of opening was postponed to November, then to January. The first classes were held in the new building on January 4, 1897.

In March of this year the school attempted to have its annual appropriation increased by the state from $5,000 to $10,000 but this bill was defeated in the Senate. The city of Newark, however, was more compliant. It raised its annual appropriation in May, 1899, from $5,000 to $10,000.

This was the way in which the Newark Technical School took a firmer hold on life. Its new home in those days was on a quiet street of cobblestones and was surrounded by buildings of some pretensions. The high school had not yet been built. In its place there was a pleasant lawn surrounded by a well-kept hedge and an iron picket fence. The Laboratory Building was added to the institution in 1912.

With the opening of the new building there came the start of day classes. These were first announced in an advertisement on December 13, 1896. The courses listed were: mathematics, chemistry, physics, mechanical engineering, free-hand drawing, architectural drawing, mechanical drawing, English composition, rhetoric.

But the school was changing in other ways. In 1893 the title page of its annual circular listed it as a Free Evening School for Young Men. By 1897 this restriction had been dropped. Women were admitted although their numbers have always been minute. The courses of study became more elaborate. Most of these courses must have been well thought out and in continuous demand since they persisted to the period following Dr. Colton's directorship. They were, in accordance with the policy of the school, based on the requirements of industry and, to a certain extent, geared to the industries in and around Newark. The fact that the manufacture of jewelry has been an important business was reflected in the course in jewelry and silverware design which was popular for a certain period. The nature of the curriculum can be realised from a consideration of the following course list which appeared in the Book of Information for 1916-17:

General Technical
Decorative Design
Building Construction
Theoretical and Applied Electricity
Electroplating
Course for Plumbers
Course for Machinists
Course in Foundry Practice
Assaying
Surveying
Toolmaking

The first three were five-year courses, the others were completed in two years. Residents of Newark were admitted to some tuition-free. For the other courses there were fees ranging from ten to twenty dollars a year. Newark Technical School, even with its tuition rates, was practically a free school.

Compared with institutions of the present day the numbers of the school's students were small. In the early days it could count about 200 students in its average year. By 1916 it had 516 students, of which 306 were residents of Newark. Professor Colton remained as Director through the academic year 1917-1918. Then, with a thorough reorganisation of faculty and curricula, the directorship was assumed by Dr. Daniel R. Hodgdon.

The history of the Newark Technical School and the Newark College of Engineering would be certainly incomplete without indicating the integration and supplementary work given not only in the early years, but in the later years, by the Essex County Board of Vocational Education and particularly its Director, Mr. Ronald W. Kent. It has been indicated that when the Newark Technical School was opened, and even as far up as perhaps 1925, a great many of the courses were what are considered now strictly vocational in nature, that is, they trained for certain skilled and semi-skilled positions. In the early days, of course, the Newark Technical School had no academic status as a college or even as a junior college.

The development of the school was predicated primarily upon the proposition that when the system of free public education offered a vocational course and offered it satisfactorily, the Newark Technical School would cease to offer that course. Gradually then, over the years, many of the courses, particularly first those in the skilled and semi-skilled trades, were taken over by vocational schools. Perhaps the first of these courses was a course in plumbing. Gradually the vocational schools took over all the courses, leaving some courses which are today offered by mechanics' institutes, technical institutes, and community or junior colleges.

The semi-skilled trades went first, training in the skilled trades next, and for quite a time the Newark Technical school in the evening gave courses frankly of junior college grade. But again, under the administration and control of a forward-looking county vocational board and a very able, competent, and aggressive director, the vocational schools supplemented, or it might be even said that the Newark Technical School supplemented, a very extensive program of training in Essex County. This close tie-up or correlation between the work of these two bodies was, it would seem, very much in the public interest. There was never any competitive spirit, never any friction. Just as soon as the public schools, either local, city, or county, took up certain work, the Technical School moved on to other fields.

To say that this work of the vocational school was of lower grade is perhaps a misnomer. As the educational work touches more and more students, the work definitely becomes more and more important and it would seem even today that a highly developed and efficient secondary school system, backed by the same sort of a primary system, is the groundwork on which all education in America is built.

It was possible, because of the very pleasant connections and contacts with the vocational school, for the institution to suggest, if not actually assist in, some of the developments which touched overall technical education in Essex County and in New Jersey. The then Assistant Commissioner of Vocational Education, Dr. Wesley A. O'Leary, had followed with interest the development of the Newark Technical School. He had seen it attempt to develop its evening courses into day courses of two or three years duration. He had helped in that development; and when it came to the problems which involved the development of the college, he envisioned it, and the authorities in Trenton envisioned it because of his influence, as a capstone, as an overall program which could handle everything from the semi-skilled trades to engineers of professional stature. It was through his influence very largely that the institution was able to transfer its emphasis from the vocational to the professional. That transition was difficult and took a long time and many questions of importance rose which the authorities of the school could not have solved unaided; but as long as Dr. O'Leary lived he was always interested in, always sensitive to, and helpfully inclined toward any developments in the Newark Technical School which led to the founding of the Newark College of Engineering. When the College was founded, and in its early days where the situation was perhaps precarious, his help and his influence in Trenton and throughout the state can hardly be overestimated. He left an indelible imprint in New Jersey, not only in his personal field of vocational education, but in its touching fields of the public schools, the high schools, and the colleges.

There never seemed to be any desire on the part of the vocational schools to overreach their proper objectives. In so many cases the history of the schools has been that they first want to move from trade schools to vocational schools, then from vocational schools to technical institutes, from technical institutes to junior colleges, and from junior colleges to degree-granting institutions; and it was a source not only of great gratification to the technical school and college administration, but a source of great benefit to Essex County that there was a recognition between these two necessary branches of technical training of the proper sphere of activity of each and a desire to co-operate for the benefit of all concerned within their sphere, rather than to compete, with a consequent inefficiency from the taxpayers standpoint in matters which had to do with technological training at any level. This particular co-operation went so far that in 1930 or 1934 there was some interchange between the vocational school and the professors in the technical school.

The Newark College of Engineering, a little later, made arrangements so exceptional students in the vocational schools might go on to an engineering education provided their work was outstanding in the vocational school and provided they did take certain supplementary work during the summer or summers before entering the college. This work properly never involved a considerable number of students, but only the exceptional cases which were well warranted by the ability of the students.

The vocational school was careful that it should not in any way assume a college preparatory status; and while the co-operation between the college and the vocational schools in Essex County was extremely helpful, the co-operation between the vocational schools and the college preparatory schools such as the local city high schools, was almost unique in American education.

There was and still remains a modicum of individuals who look on vocational school work as of low grade and having no basic or cultural value. Such people, it would seem, neglect the fundamental facts of history in the development not only of our modern science, but our modern art, and the interchange between the two. While there is certainly no reason to suppose that the type of work given in the vocational schools is any less important than the type of work given in colleges or in college preparatory school, it is essentially different in its nature; but this difference does not indicate in any sense a lowering of standards. In fact, all indications point to the fact that a man intellectually able is also manually able and that there is no distinct type which places the intellectually able on a plane above the manually able. This is of great importance, particularly in a democracy, and an appreciation of it would not only help the colleges of arts and the colleges of engineering, but college preparatory and vocational schools as well.

There is no definite line of distinction between an artist and an artisan and there is no reason to believe that a man who builds a cathedral is any less a benefactor of mankind than a man who plays the violin. There is no reason to think that manual dexterity is necessarily lower than physical dexterity and we only have to call to mind a few instances to realise how important correlation and integration of the physical and intellectual are. The brain of a Paderewski without his nimble fingers could hardly be an artistic performance. The chisel of

Michelangelo and the conception of some of his great works of art went hand in hand. In the modern day the expert surgeon is one of considerable manual dexterity and many of us might even prefer an extremely dexterous surgeon with a high degree of manual dexterity to a very clumsy surgeon who happened to have written a great many books on the science of surgery.

The great thing, it seems, to be remembered in this whole educational picture, and particularly as it applies to a highly industrialized area such as Newark, is that culture, that is, a way of life, springs from many sources and is not confined alone to those who talk with their mouths. Those who work with their hands have an equally important duty to perform.

It was a source of great gratification and even inspiration to the college to have associated philosophically as well as geographically with the segment of technical education which was so competent and forward looking as was the Essex County Board for Vocational Education and its executives operating in the county. This is not to imply that other counties in the state or in the nation, or other groups, were not as farseeing; but the inter-relation between these two phases of education was certainly a fortunate circumstance.

A word should be said about the executives of the Board of Trustees of Vocational Education in Essex County. Early in the history of the school the relationship between this public body and the Newark Technical School was of the closest. When it appeared that there might be some overlapping in the fields covered by the two groups, any differences were resolved with comparative ease and to the benefit over the long pull of both parties. Gradually, of course, as the Newark Technical School merged into the Newark College of Engineering, and gradually as some of the vocational work gave way to some of engineering grade, the Essex County Board for Vocational Education took over much of the work of the old technical school. Such courses as plumbing and electroplating were the first to go.

It should be said that the Essex County Board was a fine group of citizens who operated in a very efficient manner and who were fully conversant with the general industrial and commercial needs of the county.

Mr. Beebe at first, and afterwards Mr. Kent, were always greatly helpful and in many cases the co-operation was even greater than could reasonably be expected between a college and a vocational school. This served to color very thoroughly the whole industrial, commercial, and production needs of the locality and it cannot be too strongly stressed that this Board and these men had a very definite part in the development of the Newark Technical School, particularly when it was taking on college stature.

The first authentic mention of the possibility of instituting a college course as a part of Newark Technical School was noted as early as November, 1916, when the Secretary was instructed by the Board of Trustees to call a special meeting, before the next regular session, for the discussion of the proposed engineering course. In December of that year Mr. Halsey M. Larter moved to refer the question of higher education along engineering lines to a committee of three members.

In the minutes of February 21, 1917, Dr. Colton reported that he had had an interview with State Commissioner of Education Kendall with reference to the proper body to whom application should be made to give the trustees power to grant degrees for properly organized engineering courses. Dr. Colton further reported that the State Commissioner had informed him that the application must be made to the State Board of Education.

As early as 1915 a movement was started, very probably upon the instigation of Dr. Colton, to find an Assistant Director who could lighten the load of the Director; and reading between the lines, it would seem to be true that Professor Colton desired to have someone available to take his place who knew and had some contact with the institution and some appreciation of the philosophy and point of view of its Director and its Board of Trustees. From 1916 through 1917 a search went on for a new Assistant Director.

In the academic year of 1916-1917 we find that there were two courses of instruction in the day, each of two years in duration--one in toolmaking and the other in electricity. These courses were vocational in nature but of slightly higher grade than high school work. For instance, the course in toolmaking required that applicants must be at least 16 years of age, be of good moral character, and have graduated from grammar school, or passed an equivalent examination.

The course in electricity was still a little more advanced and required that a student be at least 16 years of age, be of good moral character, and have had at least one year instruction in high school or its equivalent. So we have for one of the day courses grammar school graduation required, and for the other one one year of high school.

It is very interesting to note that even in those early days in the department of English, English literature was required in both courses and it is also interesting to note that the text books were "Business English," "The Biography of Benjamin Franklin," Webster's "Bunker Hill Oration," Washington's, "Farewell Address," Gray's "Elegy," Goldsmith's "Deserted Village," Longfellow's #Evangeline," etc. This was, of course, in addition to work in mathematics and the sciences, and certain practical applications in laboratory courses.

The requirements of the courses were rather rigid and it is interesting that in connection with the course in electricity this statement is made in the current catalog:

> "Students are required to be present promptly at their classes and a record is kept of all time lost from the laboratories either by absence or tardiness. Time lost in this way must be made up before a student will receive his certificate of graduation."

It is also interesting that the certificates were given only to those students who properly completed studies in the course they were pursuing and who passed the examinations required. There seem to be no exceptions to this rule. In 1916 these day courses registered only 17 students.

In the field of evening instruction eleven courses were given. Three of them--the General Technical, the course in Decorative Design, and the course in Building Construction--were five years in length. The other courses in Theoretical and Applied Electricity, Electroplating, Plumbing, for Machinists, in Foundry Practice, Assaying, Surveying, and

Toolmaking courses were two years in length. The sessions were held five evenings a week from 7:30 to 9:30, except for certain special classes which began at 6:30. The fee for non-resident students varied from $15 a year to $3. The number of students in 1916 in these courses totaled 516, of which 306 were residents of Newark and 210 were non-resident students.

In 1917, which perhaps marks the beginning of consideration of the foundation of a college, a day course in Industrial Chemistry of two years was added. The courses in the evening remained the same. The day courses at that time enrolled a total of 25. The evening courses enrolled a total of 573—381 being residents and 192 non-residents.

In connection with these day courses perhaps a word of explanation should be inserted. Since the foundation of the land grant colleges stressing the work then called Mechanic Arts and Agriculture, there had been a continuing and increasing emphasis on college courses in the so-called engineering group. The development of these courses and the development of the whole movement is interesting but there would be no particular point in introducing and discussing this subject in detail here. Suffice it to say that in many cases engineering was entirely new to the colleges which wanted to share under the largess of the Morill Act and courses in some cases were thrown together rather helter-skelter, with the idea of qualifying as engineering.

Nevertheless, these courses proved increasingly popular as time went on and the development which has now resulted in modern engineering education was well on its way in 1916 and 1917. The result of the establishment of these four-year engineering courses was to cast a shadow on the shorter more vocational courses; and as far as the Newark Technical School was concerned, they never took hold. With Professor Colton's retirement impending, it seemed wise to the Board to consider something in the light of the new day in technical or engineering education.

There had been then, and there still is, a considerable amount of talk about courses for technicians, courses in so-called technical institutes, granting no degrees, and of short duration. While these might be theoretically very desirable, and while it is undoubtedly true that the number of technicians required to supplement the work of one top-flight engineer is perhaps in the ratio of ten to one, nevertheless it isn't in the spirit of America to consign one's children to a second-rate pursuit when a first-rate pursuit is available.

The American Society for Engineering Education has long advocated, without any conspicuous success, the foundation and stimulation of technical institutes; but although economically they might theoretically be desirable, socially it is impossible to implement them with the proper student body.

Of course there are exceptions to this and we note the Lowell Institute in Boston; certain technical institutes under the jurisdiction of Purdue University in Indiana; also a project of the Pennsylvania State College; and in the middlewest, the Ohio Mechanics' Institute; but still and nevertheless, the picture is somewhat the same all over the country. This very briefly was the situation which faced the Newark Technical School.

While it seemed impossible to give day courses of less than college grade, if they were not given the whole plant and physical facilities went idle during the day and were only used a few hours in the evening. This seemed primarily wasteful, and secondarily not at all in the spirit of the time.

There seems to have been considerable discussion in the Board during the latter years of Professor Colton's incumbency concerning this matter. A considerable number of the Board members took the position that the school's function was to develop Lieutenants in industry rather than Captains; that the stress should be on techniques rather than strategy; and they hesitated to depart definitely from a philosophy which had been so successful in the training of technical personnel and staff at the operational level. When Dr. Hodgdon came to the institution directly from the headship of the Science Department of the Newark State Normal School—having taught in the University of Maine and in the Maine State Normal School—he found a very definite difference of opinion which divided the Board for some considerable time. Perhaps the evident impossibility of persistence in the technological work had its ultimate effect.

The Newark Technical School was not alone in this dilemma. Witness: Pratt Institute in Brooklyn and the Drexel Institute in Philadelphia, and perhaps the Armour Institute in Chicago. Emphasis was changing. Technological research, design, and construction were expanding very rapidly and it became necessary, if students were expected to show any sort of leadership, that their theoretical instruction in mathematics and basic sciences should be tremendously expanded; and while there was a great call for routine technicians, no one cared to consign himself to this field if the opportunities in the upper and more favorable field were open.

So that in the last part of Professor Colton's administration, through the administration of Dr. Hodgdon, and extending into the administration of Mr. Cullimore, this question has to be resolved as one of the major problems of this state in the development of the institution.

It might be wise just at this point to indicate something of the nature and characteristics of the men who found themselves confronted with this major question of changing the Technical School, or perhaps emphasizing the more advanced work of the new College of Engineering. There was, of course, first Professor Colton, to whose lot perhaps fell the hardest job of all, that is, getting something really started. Many of us who have gone through the actual pioneer work of instituting an institution or an organization realize the tremendous apathy and sometimes reactive objection of many forces that we thought might help, that is we thought might be willing to help. It almost seems that a place like Newark, located as it is, with a type of industry in the hands of master craftsman, with the background of Seth Boyden, Edison, and Weston, to mention only a few, would be fertile field where technical education would take root. Theoretically this was probably true. The location was superb and from every angle students should have flocked to the doors of an institution such as the Newark Technical School proved to be. However, when we read of the tremendous efforts of Professor Colton, how he was forced to beg, cajole, and even threaten in order to take the first step in forming an organization of this kind, we can appreciate some of the difficulties which he went through.

It took a tremendous amount of enthusiasm, of hard work, and of boundless energy to bring the school into being and almost as much to secure the first buildings of its own; and afterwards, of course, the laboratory building on Summit Street. It all seems rather far away now but in reading over the accounts and talking with Professor Colton about it we must recognize it as a very valuable and a very difficult job. Today, perhaps, it might have been done differently; but in his day, and without means at hand, Professor Colton certainly is deserving of the greatest amount of praise as the actual means through which the institution came into being and gradually came to be a power and a help to the community.

And so while a tremendous part of his work was done in his earlier years, it fell to his lot again to consider the developing of a college of engineering; and in talking with him about this problem at some length, it was very striking to note that his ideas and his ideals were not so very far removed from those of the man who faced for a very considerable period the development of the college work in the undergraduate and graduate fields. It was a happy thing that Professor Colton could feel some interest and pleasure in seeing his work carried on and his sound consultation and advice were very helpful in the first years of Mr. Cullimore's headship of the institution.

As is true in most cases, perhaps, Professor Colton had some reservations with respect to the way things were done but it would be perfectly true and fair to say that these reservations in Professor Colton's mind occupied their proper place and were never made an impediment in the further development of the institution. Mr. Cullimore's ideas as to the development of a college of engineering were probably very largely colored by his experience as a student and a teacher at the Massachusetts Institute of Technology in Boston; and while his time spent teaching there was rather short, he did through almost all of his active career in the institution keep closely in touch with the institution and its ideals and secured a tremendous amount of stimulation and enthusiasm from that contact.

The main problem which he found in the development of the institution, of course, was to shift the emphasis from evening work to day work plus evening work; and as has been mentioned elsewhere, the great material problem had to do with the furnishing of adequate laboratories. The problems of recognition and accreditation were difficult, as they normally would be in the development phase of an institution. The financial problems had to be put on some kind of a satisfactory basis and this took very long and continuous work but some steady progress was made during the almost thirty years that Mr. Cullimore was associated with the institution.

So the problem of establishing the institution as an institution was the function of Professor Colton; emphasizing the graduate technical work and developing facilities to meet it, both material and financial, was the problem which confronted Mr. Cullimore; and the man to succeed him found as his great problem the development of the institution to meet the growing needs of the community and the tremendous advance in education and instruction made absolutely necessary by the tremendous development in science and in technology.

It is a little difficult and quite beside the point to compare the ideals or the practices of any of these men, yet it could probably truly and fortunately be said that Professor Colton, Mr. Cullimore, and Mr. Van Houten each successfully and sequentially successfully handled the somewhat different type of problems that were presented to them. As something has been said about Professor Colton and Mr. Cullimore, certainly something should be said about Mr. Cullimore's successor.

Mr. Van Houten's (later President Van Houten) work in and for the institution had been such as to amply warrant his choice as its President. He came to the College a graduate of the Newark State Normal School, having taught and supervised in the field of industrial arts, and he entered the Newark College of Engineering in the first class in the new department of Civil Engineering. While it perhaps may be somewhat difficult to properly appraise the abilities of a man who presently heads the institution, it certainly should be done and any history of the institution would not be complete without mention of his work and some mention of his characteristics.

First, it should be said that this institution, like all other institutions, must have a President whose function is at least three-fold.

He must have a knowledge and sensitivity to good teaching practice and be not only interested but entirely competent in matters of internal administration. With this must go a fairness and a sense of justice which is on all occasions beyond criticism. It's true that not all college presidents possess this quality in a very high degree; but if a school is to succeed ultimately in the highest and proper sense of the word, its relations with its students must be always on the highest plane and there must be always, too, a consciousness of the innate justice and sincerity of the leader. If this is not true, the institution tends finally to disintegrate and the power tends to flow to other minor officials who have not perhaps the breadth or the experience, certainly are not nominally the head. This situation tends to overemphasize the difference between various departments and very often the actual head of the department assumes a position of responsibility which is not at all fair to the heads of the other departments. The real object, then, is to keep the whole institution in balance with respect to its various activities internally and that is, of course, a tremendous job in itself. Mr. Van Houten seemed admirably suited to do this particular thing in an effective way.

In the first place, he came to us with a sound and balanced experience in teaching; and in teaching in a world where teaching itself was considered of the greatest importance, he was familiar with methods of instruction and methods of operation within his field which is one of the great lacks of the average college executive. While knowledge of subject matter is considered to be primarily important in engineering teaching, there is room, particularly in the administrative staff, for men who know good teaching, what it is, and how to get it; and it seems that methods of instruction in the early days and, as a matter of fact, in the present day, are matters which could be stressed by engineering institutions to a much greater extent than they are.

The virtues of sincerity and justice and honesty, however, to be really valuable, must be coupled with some other attributes---primarily courage, primarily the capacity to do the thing which the mind tells us, and the heart tells us, are the proper things to do. Men of sincerity without courage are very soon deteriorated into mere puppets; and with his sincerity Mr. Van Houten possessed native courage.

Courage alone perhaps is a dangerous thing, because when used alone it brings the man into extreme difficulties; but when coupled with sincerity, it forms the primary basis of all leadership.

This we were fortunate in securing at the Newark College of Engineering and yet with these two basic attributes of sincerity and courage perhaps should go a third which tends to smooth the way and iron out the bumps and bring into proper focus those more basic values of courage and sincerity. We might properly call it likeability. For some strange reason in this world we either like a man or we don't like him. Some people who seem to possess other attributes do not seem to be likeable. For some strange reason perhaps we want them to go before they had intended to go and for some strange reason we didn't quite see why they had come in at all. Sitting in the office with an opaque door the shape of the head sometimes gives the prospective caller away and there is a tendency in some cases to leave by the back door or to jump out through the window. Mr. Van Houten had a likeability which it was extremely difficult to withstand. Because he wanted a thing and liked it was perhaps a very good reason for doing it. Certainly because he liked a thing was a great argument leading toward your co-operation in his endeavor.

Likeability, of course, extends further and from the standpoint of the older man and the younger man consists in part, at least, of a desire or an attempt to think in terms of the other fellow, perhaps to think in terms of the older man and his experience, into which picture comes courtesy, sympathetic understanding, and many of those subjective virtues which have been attributes of all men who have had any degree of greatness. This whole personality of which we give a rough sketch here was pleasing internally in the institution, not only to the faculty members, but to the students in general; and when you couple this with a presence which was in every way positive, you have from the human side a very effective combination of characteristics and somebody has perhaps properly said that "he not only was a gentleman, but looked it." So that in a word, the man seemed admirably qualified for the work of administration which had to do with the internal functioning and operation of the institution.

The second great field, of course, is the field of finance where a President must be very careful not to lean too far toward the financial and away from the human elements. He must have, at first hand, a pretty good idea of the overall financial situation facing the institution. If he has this, and can keep up with it through the varying developments and changes of emphasis in a college program, and can have at hand a financial expert whom he trusts, it is possible to turn in a balanced performance in the field of finance. Perhaps it would be easiest to say that a President must know what he is doing and where he is going financially, and he must know how to get there. This breeds a great deal of respect and admiration from among his faculty and secures appreciation on the outside of his handling of his institutional affairs from a financial point of view.

It is particularly valuable when budget hearings come in the city and the state to have a man who knows what he is doing and a man who believes in it entirely and further, a man who gives the impression (and he can only give it over a long period if he possesses it) of absolute straightforward honesty with a degree of simplicity which is becoming and not subservient. Appropriation committees and the budget commissioners like to do their own thinking, it is true, but they do like to have facts and figures presented in a way in which they can be readily understood, so that the budget, as it were, is transparent rather than opaque.

The College had tried hard always to establish this relationship with its primary sources of income, the city and the state, and no more able man could have been chosen to carry on and develop this primary theme.

The State Board of Education and other groups in power have to be dealt with—accrediting agencies and literally 1,001 contacts in which a man's integrity and his presence, his courtesy and his gentlemanliness, were always in evidence. As we have said, he must be a gentleman all the time.

In talking the matter over with President Van Houten, particularly his impressions which had to do with his first contacts with the institution, there were some very interesting phases of the work which have to do with his personality and with his development through the various stages of responsibility from instructorship to the Presidency of the college. He recalls that in the latter part of his junior year Professor Cummings, who was then head of the Department of Civil Engineering, talked to him about the possibility of teaching in the College. First, as with a great many teachers, there was not too much interest; but later he joined the Department of Mathematics with the understanding that he would be transferred to the Civil Department when the opening arose. Cummings probably saw an extremely good man and wanted to retain him at all costs and this seemed to be the proper way to do it.

President Van Houten speaks of teaching his first class when he confided to Professor Entwisle that he was a little fearful about his first assignment, and Professor Entwisle reminded him that in all probability the students in the class were more frightened of him than he was of the students. So far as the record shows there was no particular difficulty with respect to discipline because always there was the presence, there was the sincerity, and there was a desire to help.

Mr. Van Houten says that a few years after he came into the Civil Department he became interested in the "puzzle" of schedule making which perhaps was the first indication that he was interested in the administrative side of engineering education. At least he succeeded in taking away from Professor Cummings the Chairmanship of the Schedule Committee; and from this beginning, from one administrative job, as he grew out of it, to another, he prepared himself for higher things which led conclusively to the Presidency.

I have not touched on the third attribute of a good chief executive, which is perhaps the most important one and most difficult to deal with. That is the field of public relations. It is undoubtedly true that no institution of any consequence or any size can long exist in a community which does not actively support it in thought and in spirit as well as in matters of finance. This calls upon the President to not only run internal affairs and get the money, but to attend innumerable banquets, serve on innumerable commissions and boards, weave the institution, through himself, into the fabric of the community. This requires the capacity to deal with "all kinds and conditions of men and women." The results of these contacts are extremely hard to appreciate; except if they are not properly done, there does after a little time come to pass certain conditions which are not explainable on any other basis. That the present head of the institution has been singularly successful in this field would perhaps, to prove it, require a long list and recital of many activities in which he has participated in college and professional associations, in associations devoted to engineering teaching, on committees and assignments which had to do primarily with the broader responsibilities which a leading citizen of the community must assume.

This of course does not blossom suddenly but can only be built up through a course of trial and error over the years. It seems that forever and ever the public is trying to find out what kind of a man this is; and if you're the right kind, things come along as surely as water runs downhill; but if you're weighed in the balance and found even a little wanting, things seem to stop. They don't develop. Your primary assignments are never followed up by successive ones. In this field the President has been singularly successful; and using one interesting and outstanding example would be to cite his record in the service clubs of Newark. Here, dealing with a great many men of a great many views and colors of opinion, of a great many types of business and professional leadership, he not only secured the good will of the group, but was elected President of the club in due course; and not satisfied with that, the club has made him one of their most valued advisors. Whether or not you are carried away, as the writer is, by the function of service clubs as a crystallisation of community opinion, it must be acknowledged that in a situation like this true and sound leadership is needed and is properly awarded to a real leader rather independently of many extraneous circumstances.

His work with the State Department of Education, his work with the hospitals in Newark, his Presidency of the National Association of Urban

Universities, and many many other things attest to his success in this broader field.

It is only hoped that as he grows older his digestion will allow him to participate in the requisite number of banquets and parties where food seems to be the nature of the contribution.

And perhaps a personal note would be not amiss. The former President was given the responsibility, not to name his successor, but the responsibility of looking through the field for possible candidates for the Presidency of the Newark College of Engineering. The understanding between Mr. Cullimore and his Board was very clear and very much of a business nature. His only job was to get the best man available within certain age limits, of course; but from an institutional standpoint, he was first to suggest the man who in his opinion and finally in the opinion of the Board could do the best job.

A careful survey was made throughout the United States and several candidates were considered. At first Mr. Van Houten did not wish to have his name presented. At a later date the pressure was such that he allowed it and the simple truth was that he seemed to the Board, and to the President, the man in the country who had the greatest capabilities, and one which was very much more important, the greatest potential promise. That this potential promise finally became dynamic in the Presidency is a matter of record--not a matter of opinion.

It should be mentioned parenthetically that the Alumni were interested in this too. They, of course, liked to see the institution retain its prestige in the field in which they were trained and they feared that that field might be abandoned in favor of another one which perhaps was a little more popular and a little more advanced. There were a great many men in the Alumni who had risen to positions of considerable prominence and they, directly and indirectly, brought to bear upon the Board their point of view which was to resist change, particularly change to a phase which was somewhat contrary to their own philosophy, and which seemed to them like abandoning the philosophy of the Technical School as laid down by Professor Colton and embracing a new and somewhat fantastic philosophy of higher education.

These graduates of the Newark Technical School were extremely helpful in developing the co-operative work in the Newark College of Engineering. In fact, it would be, I think, entirely true to say that without them the work might not have been started at all. There has been some mention of some of the concerns who helped us in this work, but there should also be mentioned the fact that many of our instructing and administering staff were drawn from members of the alumni of the school, or perhaps in greater numbers from those men who had taught in the school at night and whose records were such as to indicate that they might be extremely valuable in the development. At least they were tried and true and the administration knew their faults as well as their strong points.

Of these men who came to us perhaps the most outstanding was Charles J. Kiernan who graduated from the Newark Technical School in the class of 1926. Mr. Kiernan was at first connected with the Department of Civil Engineering when that was instituted in the evening and he brought to the work not only a sound training, but quite a rich experience, particularly in the surveying field in this locality. It became evident as time progressed that Mr. Kiernan's contribution to the institution was not primarily in the teaching field—not that he lacked anything as a teacher, but he had certain other qualifications which were extremely valuable and comparatively rare.

In the first place, he had an uncanny knack of handling students and many of the problems in the Technical School were settled by him without fuss or flurry, fairly, definitely, and finally. He soon came to take over all the work having to do with scholarship grants, help to the needy students, deferred tuition, and other important student contacts. It was the policy of the institution from the very first to help finance any needy students and I think it can be said with absolute truth that never did a student find it necessary, unless he wished, to withdraw from the school on account of financial considerations. This seemed rather a hard road to follow but it was followed nevertheless. It required a great deal of personal contribution, a great deal of work in budgeting a student's expenses, and uncovered any sources of income which were available to him; but the scholarships were sufficient, the loan funds and the extraneous funds available were enough to furnish all the help needed. As a matter of fact, if the work was carefully done, as it was done by Mr. Kiernan, the amounts involved were pitifully small.

As an example, if we considered the Frank Liveright Fund, in the first twenty years of its operation it made possible the attendance for one year of 159 men, and at the end of the twenty years it showed a balance of $3500. It would be interesting to note that the original amount of the fund as donated by Frank J. Liveright, then Treasurer of Bamberger's Department Store, was only $2000. This required, of course, the treatment of these loans as business loans. They were made on short term, made to the individual student himself, not his parents. It was explained that the loans were moral but not legal obligations, that there would be no attempt through law to collect the loans, but occasionally a man might expect to be reminded of the loan. They carried interest at the rate of 2%. The loan seemed a little more democratic in some ways than the granting of scholarships and touched a rather wider band of individuals than we could have touched if the money had been given on the basis of achievement purely.

In engineering, as in many other professions or fields of endeavor, there are a great many people who are not in the top 10%, people who at the same time are not in the low 25%, but are average or above average students; and the policy of the school indicated that they made very good citizens and contributed much to the community as a group. The College very frankly was not above trying to help those people. It was thought that an institution might develop with a student body whose parents were not independently wealthy--that in America brains were where you found them and our job was to ferret them out and see that they got an opportunity.

Mr. Kiernan was a past master in doing this and a very great many individuals in the area owe their education to his sympathetic understanding and his willingness to recommend that help be given. During the period of depression the number of students with deferred tuition or with loans was very considerable. As things grew better the problem was not a vital one, but Mr. Kiernan helped when the helping was necessary.

In another way Charlie, as he was generally called by the students and the faculty alike, had a perfectly astounding facility with the English language. Perhaps it would be fair to say that he could write about in the same way that Mr. Cullimore thought so that as the years went on he was leaned on rather heavily to revise, suggest, and write some articles reflecting the attitude of the College and its administrative officers. It was a rare gift and one which was extremely helpful to everyone concerned.

It is probably true that in his present position as Assistant to the President, Mr. Van Houten, he is giving the same valuable type of service.

Insert attached

Following is a letter from one of the most prominent and influential members of the Newark Technical School Alumni Association. This was printed in the Newark Evening News under the date of December 11, 1918:

Mr. Kiernan's contributions were typical of the contributions of the Alumni of the Newark Technical School and it can be said, I think, with the greatest truth that the development of the College would have been impossible without them, or at least it would be beyond criticism to say that they smoothed the way and brought the College to its greatest usefulness in a much shorter time.

The alumni were very much interested in the development of the Newark Technical School and of course in the further development of the Newark College of Engineering and frequently were heard in the Board and sometimes made themselves known in the public press as to their ideas about the type, the character, and the extent of the work to be given not only in the Technical School, but in the College of Engineering.

Sir:

In the forceful editorial of last week upon technical education, because of the industrial character of Newark which has been made successful, prosperous, and renowned, you say: 'The need of a night school of this class to accommodate apprentices employed in the daytime, and continuation school facilities, form additional arguments for such a school.'

There is a really and truly great, well-equipped, and highly efficient technical school now here, furnished with all the laboratories, equipment, and machinery, with a competent and capable faculty, comprehending nearly all the wide range of technical training and industrial engineering in a considerable number of well-balanced courses, the Newark Technical School on High Street, with which Newark has been singularly blessed for more than thirty years and still flourishing, expanding in leaps and bounds, growing in size, usefulness, and capabilities year by year, graduating students who take, by force of thorough training and merit, important places in the technical, industrial, and engineering world.

It is feared that many people do not know, or perhaps it would be better to say have overlooked this wonderful educational Aladdin's lamp which takes the crude, shy, boyish industrial worker within the warm glow of its bright rays, and lo! within a few short years converts him into a finished, capable, technical worker, a skillful artisan, well-poised, certain, and confident, endowed with intellectual training, an indispensable complement to the training of the hand gained in the job during the day, fitting him for extraordinary tasks through the unusual training of hand and head, simultaneously; so that when technical schools are mentioned, the people of Newark may proudly point to this remarkably successful institution which is second to none of its kind in the country.

To present an adequate idea of the Newark Technical School would require more space than it is fair to ask and for that reason only a brief epitome of the school and a briefer set of statistics will be presented.

The school aims to educate practical men, a system developed by the justly revered head of the school for more than thirty-five years, Professor Charles A. Colton, who is now Director Emeritus, and continued by the present Director, Dr. Daniel R. Hodgdon. This cooperative plan of industrial education brings forth striking fruit, for it is unusual that men are trained practically as well as theoretically. The theoretically-trained man is generally the graduate of the large technical college such as Massachusetts Institute of Technology, Sheffield Scientific School at Yale, Stevens Institute, Lehigh University, Rutgers, Troy Polytechnic, and similar schools; while the practical man is essentially the product of the job and it is very seldom that the two branches are thoroughly combined in one person, but the Newark Technical School has made even this rarity possible.

There are at present 800 students in the Technical School, all employed during the day and studying at night the subject at which they earn their livelihood. There are nearly forty teachers instructing in the evening on the subject at which they are employed during the daytime, practical men of everyday life who know and practice the subject they teach.

The subjects taught cover a wide range of technical knowledge, such as mathematics, physics, electroplating and electrochemistry, metallurgy, applied mechanics, machine design, toolmaking, theoretical and applied electricity, wireless telegraphy, building construction and reinforced concrete, mechanical drawing, foundry practice, molding, architectural drawing, decorative design, surveying and civil engineering, and a fine course in free-hand drawing. Besides these there is a preparatory class which prepares students for the different courses when they are unable to pass the general entrance examinations, so that facilities are provided to accommodate all young men who wish to better themselves; and incidentally, better their craft. If every man now in industry in this vicinity would realize the certain distinct advantage which would follow from technical training, the school would have ten times as many students as it could possibly take care of.

The new term begins in January and anyone interested can readily obtain a handbook, giving outlines of the various courses, by addressing the Director.

Some years ago the then Director, Professor Colton, compiled a set of statistics of the graduates which, placed in the form of a chart, indicated that the average income of all the graduates of the school was three times that of the untrained worker, showing beyond question that the system was successful; for not only was the compensation increased, but nearly every graduate was in an advanced higher position such as foreman, department head, works manager, superintendent, and head of concerns, and some of these men are renowned in the industrial world.

Philip C. Walsh, Jr.

With these two points of view the administration of the College had to deal and this background is necessary to understand perhaps the seeming tardiness with which the new College work was introduced and developed.

In 1917 evening courses were thirteen in number: the General Course, a Special Drawing Course, a course in Electricity, courses for Machinists, in Toolmaking, Plumbing, Building Construction, Surveying, Decorative Design, Foundry Practice, Assaying, a Preparatory Class, and a Radio Course for the U. S. Army.

At this point, which marks the termination of Professor Colton's connection with the school, the Members of the Board of Trustees were: Governor Walter E. Edge, President; Mayor Charles P. Gillen of Newark, Ex-Officio; Messrs, Peter Campbell, John B. Stobaeus, Samuel E. Robertson, M. D., Abram Rothschild, Frederick L. Eberhardt, Herbert P. Gleason, John A. Furman, Halsey M. Larter, Charles A. Colton, Secretary.

The group was properly representative of the best in Newark. Mr. Campbell was President of the Nairn Linoleum Company; Mr. Stobaeus was Secretary of the Charles Cooper Chemical Company; Mr. Rothschild was a leather manufacturer; Mr. Eberhardt a manufacturer of machine tools; Mr. Gleason a manufacturer of shoes; Mr. Furman was with the Celluloid Company; and Mr. Larter was a jeweler. Some attention should be paid to this particular group of men for they were primarily responsible for the development of the Newark College of Engineering and certainly were representative of the industries of Newark. Shortly after the resignation of Professor Colton, Mr. William L. Morgan, who was afterwards to be President of the Board, was added to the group.

The legislation at that time provided that the Governor should be Ex-Officio President of the Board, as was thé Mayor of Newark; and the Vice-President, who was actually the head, was chosen by the Board. In this connection Mr. Peter Campbell was the actual head of the operating institution. His background fitted him most peculiarly for this situation. He had been born in Scotland and had not possessed some of the advantages offormal education which boys of better circumstances might even then have enjoyed in Scotland. He was a self-made man and perhaps more to the point, he was a self-made gentleman.

To be with Peter Campbell and to discuss any question with him within the range of his experience was an extremely stimulating thing and it is hard to realize just how broad his contribution to the development of the Newark Technical School was. He was a man who commanded the respect of everyone with whom he came in contact and he commanded the affection of those who were closest to him and who could appreciate the sterling worth and strength of his character.

He gave freely of his time and his talents to the work of the institution. It was rather exceptional to see a man who was so ready to give freely of himself out of a full and very busy life. He had the peculiar quality not to interfere at all with the routine operation of the plant and this spirit was reflected not only in the original Board but in all of the other Boards that followed. He stuck pretty closely to matters of policy and matters of philosophy; and while he too had a good deal of austerity in his make-up and was considered by some to be a hard taskmaster, this was not in reality so because he required only absolute honesty and absolute straightforwardness in those who worked with him and this was a matter which certainly should qualify a man for the Presidency of the Board of Trustees of the Institution. He was a man, like many Scotchmen, who was generally and deeply religious; and it was very fitting that when he passed on his son, Mr. Robert Campbell, became a member of the Board of Trustess.

Like Professor Colton, Peter Campbell was a man who commanded unbounded admiration and respect but one with whom no liberties were taken. Only one story comes to mind, or perhaps better, one incident. In those days when he presided at the commencement exercises of the College and of the School—and they were in those days given upon separate occasions—it was always his policy to take liberties with the program. You never could tell whether the Number One thing was going to be Number One as it appeared on the program or whether he was going to fit that in some place else. It caused a great deal of worry at first to the head of the school but Mr. Campbell was a past-master at improvising and he carried those meetings on with a sense which was nothing less than artistic. It was a rare opportunity for the acting head of the institution to have such a man in the background upon whom he could put absolute reliance and who was always willing to give generously of his time and efforts. Particularly in the development of the work among the wounded soldiers and with the work of vocational education Mr. Campbell was able to accomplish results which would have been impossible without him.

The faculty at that time number 32 with the Librarian, a clerk, and a secretary to the Director.

In a special meeting of the Board of Trustees held in May, 1917, the question of calling a new man to be Director, following Professor Colton's resignation, came up, and it was thought that the present Director should be continued in his office until May, 1918, after which he would have the title of Director Emeritus. A committee of three was appointed to obtain names of men to be recommended for the position of Director of the school.

So the matter seems clear that during Professor Colton's time the matter of changing the status and objectives of the school, or perhaps better, expanding them, was considered and the preliminary steps were taken and that the matter had been carried far enough to have a conference with the Superintendent of Schools and the Commissioner of Education Kendall.

On May 1, 1918, Mr. Larter, Chairman of the Special Committee to recommend a new Director, recommended Dr. Daniel Russell Hodgdon for that position and it was indicated that his work should date from May 1, 1918; and Professor Colton, following the previous plans, was made Director Emeritus. In due course Dr. Hodgdon took up his work as Director.

A word should be said in appreciation of the services of Mr. Larter. He represented a very active organization, the jewelry trade, and one which had contributed much to the industrial development of Newark. Mr. Larter was not only an able man as a manufacturer, but brought to the Board certain ideas which were of tremendous value, particularly with respect to technical and technological training and its place in the engineering picture.

Mr. Larter was a very kindly man and very seldom spoke either too directly or too harshly but fitted into the Board perfectly and was of tremendous help at all points, particularly in connection with committee assignments.

The first mention of Dr. Hodgdon in his official capacity before the Board was on May 8, 1918. One of the first actions of Dr. Hodgdon's administration had to do with the vocational training of soldiers under the Federal Board for Vocational Education. Immediately there was a motion set in foot to certify the teachers in the school. A considerable amount of the time in the first months of Dr. Hodgdon's incumbency had to do with the development of these Government courses for disabled men which finally eventuated into the number in training at about 500. The following is copy of an article printed in the Newark Sunday Call on February 19, 1919:

TECHNICAL SCHOOL TO TRAIN SOLDIERS AND CIVILIANS ALSO

> The time has come when a great many wealthy people are interesting themselves in the re-education of maimed soldiers, sailors, and workingmen. There is a certain type of philanthrophy which gives a great deal for the benefit of humanity, but the philanthrophy which assists the building up of an institution for the benefit of educating the unfortunate maimed workingmen, returned soldiers, or civilians, is bound to pay a big rate of interest.
>
> The Newark Technical School has decided to give courses to soldiers, sailors, and marines who are wounded or disabled, also the individuals injured and disabled while in industries

and mercantile operations in such a manner as to prevent such individuals from following their regular vocations.

The United States Government has introduced a bill into Congress which will provide $1,000,000. This amount, if utilized by the states, is to be matched with state money to provide a fund of $2,000,000 for vocational training and placement at remunerative labor. For all cripples, in whatever way they may have suffered disability, special schools will be provided in every state to give this training, and it must be done in schools where the adult can feel that he is getting the training from an adult standpoint. He cannot be mixed with young people and obtain the training which is so necessary for an adult.

The movement of the Newark Technical School to undertake to give training to disabled persons is opening up the opportunity for wide use of the institution as a means of serving the community, and not only the community, but the entire state, as schools of this character must be so conducted as to provide education to students of any part of the state. If there are several schools of this character, then each school can specialize in certain branches of education which are adaptable to the locality in which it is situated, and an injured person may select any one of the schools, with the permission of the State Board of Education or State Department of Labor, in which he will get the training most useful to him because of the peculiar injury he may have received.

Dr. Hodgdon also recommended that a five-year course in industrial technology be started with a Freshman class, to which only high school graduates would be eligible.

In 1918 Dr. Hodgdon visited Cincinnati, Cleveland, and Pittsburgh to study the co-operative plan of education as practiced at the University of Cincinnati. At that time he outlined a Freshman college course and presented a budget for this course as well as for the evening and regular day courses. It was not at that time envisioned that the courses in the Newark Technical School at night and the shorter courses as given in the daytime be discontinued, but that the degree courses be added to them as a complement.

In the Fall of 1918 a committee was instructed to report on a co-operative plan of study for second-year students; on a four-year day course to be offered to grammar school graduates; on a four-year day course to be offered to high school graduates; in addition to a special course to be offered in co-operation with the Foundrymen's Association. It would appear that the co-operative plan at that time was outlined for the second-year students of the day course; that there was a four-year course covering the present vocational school curriculum to be offered; and in addition, a four-year day course to high school graduates. It would seem that the four-year day course was the one in which the second-year students were expected to do co-operative work.

The co-operative work was ~~first~~ LATER arranged so that the student had two full years in college with supervised work in industry in the Summer. After the sophomore year the Summer work was carried on under much the same philosophy as in the first two years but there was an alternation period with industry of two weeks duration which was the same type of work in successful operation at the University of Cincinnati.

Some time in September Director Hodgdon presented his resignation and it is recorded in the minutes of September 22, 1919, that Dr. Hodgdon's resignation had been accepted and that he was leaving as early as possible to accept another position. At the same time a committee was appointed to secure a new Director. The following is copy of an article which appeared in the NEWARK CALL on September 28, 1919:

> Dr. Daniel R. Hodgdon, Dean of the Newark College of Technology will resign as school head of that institution within a few days to become president of the Chicago Memorial Foundation University of Science at a salary of $7,000 a year.
>
> He has taught in the Department of Technology, University of Maine; was Principal of Corinna Union Academy, Maine; Vice-Principal of the State Normal School, Maine; and head of the Science Department of the Newark State Normal School.
>
> Placed in direct charge of the Vocational Training School for Wounded Soldiers established at the Technical School since May by the Federal Government, Dr. Hodgdon's work with the discharged servicemen has been highly commended by Government

authorities who state that in this work the Newark center for vocational training has far exceeded the work carried on in the federal vocational training centers of any other city in the United States.

Under Dr. Hodgdon's leadership the Newark College of Technology, known before he took charge as the Newark Technical School, made rapid strides. Resigning his position as head of the Science Department of the State Normal School two years ago, Dr. Hodgdon was appointed school head for the Technical School.

One of his first steps was to hold consultation with the Board of Trustees of the Technical School in order to present the plan of including industrial courses in the program of work. On his suggestion the evolution of the Newark Technical School into the Newark Industrial College of Technology was assured, and college courses were offered students the following September.

As arranged by Dr. Hodgdon, they provided that a college boy spend part of his time in industry learning management, and how to govern men, being shown how to analyze situations, and in every way fitting him for the great industrial expansion which Dr. Hodgdon predicted would take place in the reconstruction era immediately after the war. It was his slogan at that time that if preparedness was such an essential watchword in meeting the needs of the war, the same terms should be borne in mind in meeting the needs of reconstruction.

In an effort to make the Newark College of Technology the "hub of the technical and industrial life of the city," Dr. Hodgdon invited engineers of the city—mechanical, electrical, and others—to create an organization making the college building its headquarters. Alumni and fraternal societies were encouraged and every plan made to bring the men involved in these industries as close to one another as possible.

One of the plans Dr. Hodgdon was working on and which he earnestly hopes his successor will work on is making provision in the college for women students. The plan was suggested by Dr. Hodgdon one year ago before the Board of Trustees and was one of the phases awaiting definite action. Dr. Hodgdon states that Newark had always been the leader in things and that it would be taking a great advance step if it opened such an institution to women students.

The original entering class of ~~38~~ 25 men had dwindled by 1922, when they entered co-operative work, to a group of 12 men and they were the first students actually co-operating in the Newark College of Engineering work.

The Board of Trustees in 1919 began to cast about for a successor to Dr. Hodgdon. A special committee composed of Mr. Frederick L. Eberhardt, Mr. Halsey M. Larter, and Mr. William L. Morgan, as Chairman, was appointed to secure a new Director. Correspondence was carried on with some of the leading institutions, M. I. T. and others, and finally the committee waited on Mr. Allan R. Cullimore, Dean of Engineering at Delaware College; and after a very pleasant interview, the memory of which is still clear in the mind of the writer, he was asked to visit Newark in connection with the position of Director.

Mr. Cullimore well remembers, and perhaps always will remember, the visit of this committee to him at the University of Delaware. The committee waited on him and then proceeded to thoroughly go over the situation with respect to his reputation in the University of Delaware. Whether through the desire of the University to rid itself of Mr. Cullimore, or because of his generally good reputation, the committee seemed satisfied. In Mr. Cullimore's mind the job was secured largely through a very delicious luncheon of scalloped oysters which was served on the college commons.

The visit to Newark was made and after a very pleasant and mutually agreeable experience on the part of all concerned, Mr. Cullimore accepted the position of Director of the Newark Technical School, and as Dean of the newly-formed College of approximately 25 students.

It seemed at that time that a college undergraduate body of 25 hardly warranted the title of President, so that after consultation with the President of the Board, Mr. Peter Campbell, it was decided to apply the title of Dean to the position at the head of the College. Mr. Cullimore was then known as Dean and Director. Eventually, when the College had an undergraduate enrollment of 400, his title was changed to President and James A. Bradley of Harvard was appointed as the first Dean.

There were some very interesting sidelights on this Deanship which persisted all through Mr. Cullimore's connection with the institution. Because he was first, and properly, called Dean, the title persisted and some of the younger men, who became friends later, hearing him alluded to as Dean, perpetuated the title, sometimes to his embarrassment and the embarrassment of others. The relation of the Deanship to the Presidency is perhaps best expressed by that old saying that a Dean is a mouse in training for a rat.

Mr. Cullimore took over the headship of the institution in January of 1920 and on that evening was introduced to the students of the Technical School, as well as the College, and thereafter found himself faced with the problems which are outlined in the following pages.

A word should be said concerning the complexion of the Board of Trustees upon the opening of Mr. Cullimore's administration.

At the head of the Board was Peter Campbell, the President of the Nairn Linoleum Company, a Scotchman of great ability, of whom mention has been made previously.

The Treasurer of the Board was Mr. Herbert P. Gleason, President of the Johnson & Murphy Shoe Company. Mr. Gleason was a businessman of exceptional competency and perspicacity. It is fair to say that he could see through anything and not only was he able as a businessman, but like Mr. Campbell, he gave very freely of his time and his effort.

Mr. Halsey M. Larter, a jewelry manufacturer, represented a considerable segment of the industry in Newark.

Mr. Abraham M. Rothschild represented a second major segment as the head of a large organisation in the leather industry.

Mr. John A. Furman, one of the executives of the Celluloid Company, represented another segment of industry in Newark, one which had long been associated with the city and the locality.

Mr. Frederick L. Eberhardt, afterwards President of the Board, represented the great machine tool industry, being President of the Gould & Eberhardt Company.

Mr. William L. Morgan, also afterwards a President of the Board, represented the legal side of the picture and as the first years went by was particularly helpful in matters having to do with legislation and appropriation.

Dr. Samuel E. Robertson, Chairman of the Educational Committee, was perhaps more closely integrated with the actual operation of the school than any of the other men and his work there was of particular value in the first years of the development of the new College.

The Governor of the state appointed the Board and was an ex officio member, as was also the Mayor of Newark. The original legislation provided that the Governor of the state would be President of the Board but, of course, this did not work out organizationally and by amendment to the original legislation the election of the President from the active members of the Board was provided for. It was with this group that the College was instituted in 1920.

Since that time the rolls of the Board have included some of the most forward-looking men in Newark and some of its ablest citizens. They included such names as Felix Fuld, Thomas N. McCarter, George W. McRae, ~~Robert G. Cowan, and~~ Justice William J. Brennan, and Dr. Frederick O. Runyon

Insert Attached

The Board at this writing is composed of Edward F. Weston, President; Robert Campbell, Vice-President, Robert G. Cowan, Treasurer; Edward F. Bataille, Assistant Treasurer; Frederick W. Birkenhauer, Joseph M. Byrne, Jr.; ~~Frederick O. Runyon;~~ Donald C. Luce John H. Yauch, Jr.

These men, together with those who are at present active, were extremely helpful in the development of the institution and were helpful not only with respect to the internal problems and the financial problems of the institution but lost no opportunity to speak of it whenever the occasion offered. As an example it is interesting to note that at the Centennial Celebration of the Adoption of the Newark City Charter on April 15, 1936, Mr. Thomas N. McCarter, then a member of the Board, and President of the Public Service Electric & Gas Company, has this to say:

> "Situated within our midst, doing a far reaching but little observed work, is the combined institution known as the Newark Technical School and the Newark College of Engineering. I happen to know something of the detail of these two features of our educational life because I am a Trustee thereof. And I have no hesitation in proclaiming that Newark has as fine facilities of this character as exist anywhere in the country. They are, I think, taken together, the largest institutions of their kind in the metropolitan district; and the Newark College of Engineering, under the guidance of its distinguished President—Allan R. Cullimore—is the peer of the Massachusetts Institute of Technology, of Stevens Institute of Technology, or any similar organizations in this country. So highly regarded is it, that even in these times its graduates find ready opportunities for employment."

The functioning of the institute was made comparatively easy and very pleasant by the complexion and the personalities of the Board members, being men all on a high and policy-making level. They were extremely careful not to interfere with the details of the administration of the institution, but were very friendly and frank in questions which determined its policies. This made the administration of the institution not only a simple, but a distinctly pleasant task. The size of the Board not only permitted friendly discussion, but the friendships of such a small body make for sympathetic understanding of not only policies, but point of view as well; and it should be said that the Governors almost without exception honored the wishes of the Board as to appointment of its new members and its replacements. When such exceptions were made, the appointees in all cases proved to be entirely acceptable and the Board operated for the whole of its life, something over seventy years, with no major disagreement as to policy, which simply indicates that sometimes a competent and well-knit Board is best secured by a limitation of numbers.

Mr. Cullimore was a graduate of M. I. T. of the Class of 1907 and had served, before coming to Newark, as Dean of the College of Industrial Science in the University of Toledo, and Dean of the College of Engineering at the University of Delaware. His teaching work was preceded by work in the construction field and the field of structural design.

Mr. Cullimore had had some experience in the co-operative work at the University of Toledo and also to some extent in the University of Delaware, although there not in the formal sense. The values of the co-operative scheme were very evident and Mr. Cullimore had made a very thorough study of the situation as it operated in Cincinnati; and while there were some features which were perhaps objectionable, the plan as a whole commended itself, particularly to this locality. By a lengthening of the school year and also a lengthening of the school day, the college was enabled to introduce into the curriculum the necessary time to make it comparable with curricula in other institutions.

Mr. Frederick L. Eberhardt, the President of the Gould & Eberhardt Machine Tool Company, was from the first a firm believer in the co-operative method of engineering education. He spoke of it on the very first contact he had with Mr. Cullimore in Delaware, and it was very close to his heart. He had a full and complete knowledge of the work as developed by Dean Herman Schneider at Cincinnati; and as Mr. Cullimore was also very familiar with Dean Schneider's work and its attainments, having worshipped at Schneider's feet while at the University of Toledo, a start was made to establish the co-operative plan. Mr. Eberhardt offered the facilities of his shop as the working part of the project and around it developed a co-operative plan as it was known and understood in the years to follow.

Mr. Eberhardt at first was the Chairman of the Committee on Buildings and Grounds and was rather a consistent visitor at the school during the first years of Mr. Cullimore's occupancy as the operating head of the institution. Fred Eberhardt was one of these men who had fixed ideas, but they were usually good ones. He was a forthright soul and if he liked you, he liked you; if he didn't, you knew it. For some reason he became very close to Mr. Cullimore and was of enormous help in working out the details of the development of the College as it developed in the later years of Mr. Cullimore's administration.

Again in Mr. Eberhardt's case it was very difficult to appraise the actual benefit that his presence on the Board brought to the school but it can be said without fear of contradiction that all the members of the Board were men not only of sterling character, thoroughly sincere, but men who were, fortunately for the administration, on a policy-making level and felt it was not their position to inquire into the operation of the institution so long as that operation was in a broad sense reasonably acceptable. They seemed to have the capacity of coming in where they were needed and where they were wanted and the whole set-up made a very interesting and pleasant picture for those who were given the responsibility of operating the institution.

The Board meetings were, it seemed, a pleasure to all concerned and I am quite sure that the institution representatives and the Board itself looked forward to those meetings with a great deal of anticipation.

It is not recalled that there was ever a fight in the Board. There was discussion which very seldom developed into argument. In fact, it would seem that one of the greatest factors in the development of the College was the type of its Board of Trustees.

Particularly in matters of public policy, as reflected the needs of Newark, the Board members' decisions were always final and always enlightened. Particularly with respect to the development of the co-operative plan, it is safe to say that every member of the Board was in favor of the adoption of this form of education which in those days was not too well known.

A word should be said too concerning the personal advice and stimulation furnished by Herman Schneider, Dean of Engineering at the University of Cincinnati, and also Parke Kolbe who afterwards became President of the Polytechnic Institute of Brooklyn.

While a detailed discussion of the co-operative plan would perhaps be out of place here, it is only proper to indicate that it is much more than a method of giving a poor boy a chance to earn a living, which is perhaps considered a criticism of the plan as a whole. Its greatest value, it seems, arises from its contact with commercial organizations and their philosophies, policies, and practices while the boy is carrying on his theoretical studies. It early seemed to become evident to the authorities of the school that there was a very wide field in which correlation could be made between the personnel and the industrial work or perhaps personnel and management work, and classes within the institution itself.

To correlate actual technical subject matter with the type of practice which the young student was allowed to do had some extreme difficulties; but if the discussion could center around matters of employer-employee relationships, matters having to do with human relations, with public relations, as well, it was perfectly possible to make understanding and meaningful correlation between the two types of work--the theoretical academic and the industrial.

Perhaps the most important single factor was the early maturity which the co-operative students seemed to reach. The introduction into his formal education of actual practical productive work was a very valuable and sobering experience. As the co-operative work developed and as new contacts were made, it became increasingly evident that the work in the first two Summers and alternating in the last two years was a tremendously valuable experience, particularly toward orienting the young man to commercial conditions and the problems of production. As one man--I think it was Dean Hughes--said, "It indicates some of the limitations which practice puts on theory." It is certainly true to say that it saved years of learning and trouble and mistakes in a man's early technical or professional life.

From the standpoint of the school, however, there were other objections, the primary one being that if you let all co-operative students represent you in industry, the mistakes of the lower 20% very definitely outweighed the superior performance of the other 80%, so that some extreme care had to be exercised in the proper placing of young men.

As the work proceeded it became quite evident that the accrediting agencies looked with certain disfavor upon co-operative plans limited to four years and soon after the institution of the program five-year courses were substituted for four-year courses and the College was continually on the defensive with respect to a four-year degree-bearing curriculum. This seemed to be based not altogether on factual evidence, for the Massachusetts Institute of Technology granted after five years not only the Bachelor's Degree but also the Master's, which in effect, it would seem, amounted to a Bachelor's in four years and a Master's in one additional. While this was allowed, still in colleges not giving graduate work there came to be a feeling that five years was the proper span for co-operative education. As accrediting was largely controlled by the non co-operative institutions the situation early developed and pressure increased toward the lengthening of the program.

At that time, and even now, the question of whether, in this highly educationally competitive locality, a five-year course could be sustained, no matter what its content, bearing a Bachelor's Degree, in competition with the four-year course granting the same degree, was problematical.

It was tried by some of our neighbors in the Metropolitan area and was not successful, even on an optional basis.

The general character of the student body, the backgrounds of our students, and many other factors tended to make the Metropolitan area a difficult place to administer a co-operative plan, to retain its academic standing, and to do the work in four years. The boys, particularly in the early days of the Newark College of Engineering, were not necessarily poor, but they were of a class which found it very advantageous to go to college and remain at home. Many of these looked at the co-operative plan as a means of supplementing income and it was necessary to supplement income in many cases. It was felt that the five-year course, from this point of view, could hardly be sustained on account of economic considerations.

Elsewhere in this recital you will see more about the development of the co-operative system, but perhaps this insertion at this point will give a little necessary background and serve to interpret some of the problems which beset the College later and which finally eventuated the adoption of the so-called Honors Option which is considered a very great step in advancing engineering education and one which is a distinguishing characteristic of the Newark College of Engineering.

In 1918 there were 38 students enrolled in the day classes, that is, the part-time two-year courses, and 610 in the evening courses.

The help of Dr. Wesley O'Leary in developing the Newark College of Engineering was very considerable. To his position as Assistant Commissioner in Charge of Vocational Education he brought to New Jersey a very rich experience and added to that was an unquestioned competency and standing in his field, and added to that still was a character and personality which graced his position as well as himself.

Dr. O'Leary was tireless in his interest and help to the institution. In many major areas his influence was felt. Particularly due to his efforts the evening school, which for some time continued to give work of a vocational nature in the twilight zone between vocational education and professional education, Dr. O'Leary recommended and secured funds for the development of our evening courses.

In the work of rehabilitation with the veterans of World War I he was very helpful in a financial way, as well as in a consulting way. It was due to his efforts that in 1923 the school was granted the right to give honorary degrees.

The development of that phase of our work known as Twilight Work, where young men secured a college education after work, but still within the traditional framework of college courses, was helped by Dr. O'Leary immensely; and when, in the course of events, it seemed desirable to give degree work at night, it would have been impossible to develop this type of work and secure its proper accreditation if it had not been for the persistent and continued interest of Dr. O'Leary. We cannot say too much about his help in the early days.

In the fall of 1918 the final plans were approved, with the help of the Employers' Association of Newark and Dr. O'Leary. Upon Dr. O'Leary's passing his work was taken up to a very considerable extent by Dr. Robert Morrison in the field of higher education and by Mr. McCarty in the vocational field. These men were extremely helpful in all ways and their influence with the state legislature, the Appropriations Committee, and afterwards with the State Board of Regents was always positive and always constructive. Through them the whole staff of the Commissioner of Education, including the Commissioner himself, knew of the school, the type of work that it was doing; and the department, to a man, was helpful.

It is interesting to note that Professor Colton was granted the degree of Doctor of Science by the College in the Spring of 1919. At the expiration of Dr. Colton's term as Director Emeritus he was made official Librarian and Curator of the school.

In January the State Board of Education gave the Newark Technical School the right to grant degrees in the fields of chemical engineering, electrical engineering, and mechanical engineering. The date of the communication to Dr. Hodgdon giving that right was January 7, 1919, which, as a matter of fact, is perhaps the actual beginning or right to begin the work which is at present given under the name of Newark College of Engineering and which at that time was envisioned to be given under the name of the Newark College of Technology.

Following is copy of an article which was printed in the NEWARK NEWS in January of 1919:

NEWARK TECHNICAL SCHOOL GETS COLLEGE RECOGNITION

Empowered by State Board of Education to Grant Four Scientific Degrees

Culminating efforts to raise the standard of the co-industrial College of Technology of Newark, formerly the Newark Technical School, the State Board of Education today gave the institution, it was announced by Dr. Daniel R. Hodgdon, the school head, the right to grant degrees of Bachelor of Science, Chemical Engineer, Mechanical Engineer, and Electrical Engineer.

Application has also been made by the College for the right to register wounded soldiers for engineering and other courses; and in anticipation of favorable action, plans are being made for the employment of instructors of university standing.

Definite steps toward the development of the technical school into a college of larger vision with increased opportunities for students were taken at a meeting of the Board of Trustees on May 22 last, when Dr. Hodgdon declared that in view of the fact that Newark is an industrial center, the coming lieutenants of industrial heads should be trained at home.

The plans of Dr. Hodgdon were approved at a meeting of the school's Education Committee on June 21 and preliminary arrangements were made for the opening in September. The Doctor's industrial co-operative feature appealed especially to the committee as this afforded students an opportunity to be employed part of their time and helped solve the financial problem for many of these who desired to take up the studies.

In the Spring of 1919 it was decided to try to offer associate engineering courses in chemical, electrical, and mechanical engineering in the evening, consisting of four years of regular work and two years of pre-freshman work; and that the freshman year of co-operative college courses in chemical, electrical, and mechanical engineering leading to a B. S. degree be given in the day--both day and evening courses to begin in the Fall of 1919.

During the interim between the administrations of Dr. Hodgdon and Mr. Cullimore the College was administered by a committee of three, one of whom remained at the College until his retirement and whose work from an early date, even in the administration of Dr. Hodgdon, proved very effective and whose influence was for the very best. This was James Clinton Peet who, with Mrs. Peet, threw himself into the professional and social life of the young college with great interest and enthusiasm. Professor Peet was the finest type of a Christian gentleman and his contacts not only in college and in his classrooms, but in the outside world, were extremely valuable.

Professor Peet's background was interesting. He had a generally balanced experience in teaching and an extremely valuable practical industrial training with the General Electric Company. This background caused him to insist on practical training for all the teaching members of his department, but Professor Peet's greatest work was that of teaching. He was primarily a teacher and enjoyed his classes and his lectures to the fullest. He liked young people and they seemed to like him for they consistently took him into their confidence and he was able to smooth many incipient misunderstandings before they became serious.

Professor Peet has indicated some of the things which he considered important in the very early days of the College and very properly he puts first a strong and active Board of Directors; the co-operative course, particularly important because it provided in those early days the laboratories which were not possible to secure in any other way. He stresses too the common ground of agreement among the faculty on the general aims of engineering college training.

Two other things became extremely important and certainly in Professor Peet's opinion, and in the opinion of the writer, they were basic in the internal organization of the College. The foundational courses in each department were taught by the head of the department. This brought some of the younger professional men in contact with the most capable teachers. Professor Peet also considered that the autonomy of each department was a matter of extreme importance in the developing of the whole structure of the institution. As he puts it, "the heads of each department were held responsible for the results but the methods were the responsibility of the head of the department." It is, of course, rather difficult to appreciate and particularly difficult to outline the contribution of these men because it went on from day to day year in and year out; and in looking back, it is rather hard to see what really were the individual contributions of the various members of the faculty.

Some indication we have tried to give here but in the main perhaps it should be said without any fear of contradiction that the team was a well-matched unit. Professor Peet's mention of the Board of Directors is a particularly happy one because their high-mindedness and solidarity were an example not only to the ~~acting~~ operating head of the institution, but to the faculty as such, and faculty-board relationships were always of the very best.

While certain things, therefore, may be indicative of personal contributions, the most valuable thing to the writer seems to be the capacity of these men to give their best and at the same time embody any decisions for the benefit of the institution as well.

There was from time to time, of course, as new men came in, a tendency to glorify the department at the expense of the institution; but by making the department autonomous, the glorification had been already done and the departments worked, it seemed, in the very closest harmony. After the first few years, as this became a habit and became traditional, the departments were welded closer than ever into a harmonious team.

The problems which met Mr. Cullimore upon his acceptance of the position had to do primarily with the relationship of the evening school to the industries of Newark, the relationship of the college to the industries through the co-operative plan, and the internal relationship existing between the college and the night school, the latter involving the shift of emphasis, or perhaps balance would be the better word to use, between the college and the evening school. This was somewhat complicated by the fact that the college in 1920 was engaged in training about 500 ex-soldiers, the work varying from strictly vocational in nature to work of college grade.

The physical facilities in the college in the way of laboratory equipment were at that time not very considerable. This was primarily because of the fact that for the students in the evening school, who worked during the day in plants and laboratory facilities were close at hand as a part of their daily work, it was only necessary to supplement these facilities with theoretical instruction.

One of the reasons why the co-operative work seemed to be indicated just at this moment was the lack of physical facilities in the way of laboratory equipment. These facilities could be duplicated to a certain extent by the machines in use by the students in their co-operative work. This proved to be a very vital factor in the development of the college work and did allow quite a spread so far as securing physical facilities was concerned.

Immediately there was started a long-term project to secure necessary laboratory equipment. The cost was considerable, but just at this time the securing of this type of equipment was absolutely necessary. The Chemistry Laboratories were of the sketchiest character and a good deal of money was spent in remodeling the present Laboratory Building so as to provide facilities for a Chemical Laboratory on the third floor.

The Physics Laboratory had to be built from the bottom up and the Electrical Laboratory was urgently in need of small testing equipment which could be operated by the students.

The Chemical Engineering Laboratory had to be started from scratch.

From the standpoint of cost, this was by all odds the greatest problem which the college faced in the first years of its existence; and when you remember that the amount of contribution from the state and the city was entirely geared to theoretical instruction only, it was quite difficult to make the powers that be in Trenton and Newark appreciate the necessity of building up a considerable capital structure in the way of both light and heavy equipment.

Fortunately in the work with the returned soldiers the Government made available certain laboratory equipment which was usable for the college students. At that time, of course, the college was very small and the students were very few in number so that it was possible to integrate the college co-operative work with the veterans' training and a great advantage accrued with respect to physical laboratory equipment and the work of the night school, as has been previously stated. This was very largely theoretical in character and involved comparatively little laboratory work.

In 1919 the number of students enrolled for the year 1919-20 was 23 in the college and 698 in the Newark Technical School and in 1925-26 the enrollment in the Newark Technical School had risen to about 1,000 while in the college there were 175 students enrolled. This indicates very definitely that the Technical School was not being played down at the expense of the college and that the college was not being played up at the expense of the Technical School. Both were developing normally. During that period the number of veteran trainees had dropped to an amount which was not appreciable.

It might be interesting to note also that in the year 1920-21 the faculty and the instructing staff numbered 20 men. The annual tuition then was $125 for the residents of the state and $250 for students outside the state. Training in the fields of chemical engineering, electrical engineering, and mechanical engineering was offered leading to the degree of Bachelor of Science in these fields.

Beginning in 1920 the college work was given under the name of the College of Engineering of the Newark Technical School. It is interesting to note that in the two years that followed scholarships numbering about 12 were granted by individuals and organizations to students taking the college work.

Very early in the development of the institution under Mr. Cullimore it was possible to secure the services of a man who had been very active in connection with the evening school and who quickly assumed a position of Dean in the institution, Professor James A. Bradley. Professor Bradley was in the Department of Chemistry where he kept contact with the teaching continuously for the past thirty years. An excellent teacher, he possesses a certain balance and dignity which was helpful to the young institution in many ways. His perhaps properly conservative New England background was just the thing which the institution needed, particularly in its relationship with the student body. That that relationship was sound is attested to by the fact that there was not, during the period when he was active as Dean, a major disciplinary problem in connection with the institution; and it was very exceptional to find in a man a combination of the qualities and enthusiasms necessary in a good teacher and the patience and balance which are so important in a major executive who has to do with the student body and the alumni.

It is extremely difficult to properly appraise the contribution which a man like this makes to an institution. Perhaps it was enough to say that in addition to being a good teacher, his firmness, his fairness, his calmness, and his coolness were always in evidence throughout all the years when he served as Dean. With Yale and Princeton represented on the faculty, we were very fortunate to get in our Department of Chemistry a man from an institution which has turned out great chemists, two of whom later became Presidents of Harvard—Charles A. Elliott and James B. Conant. At least the feeling in the institution was that the whole standing of the faculty was enhanced by having a man of Professor Bradley's attainments and culture as a part of the organization.

The work went on in this general way with the enrollments as indicated and without any particular major change, except in the falling off of the veteran students, until the year 1924-26. The co-operative work had become well established and some of the industries in which the students were co-operating were: The Chemical Company of America, General Electric Company, Singer Manufacturing Company, Weston Electrical Instrument Company, Gould & Eberhardt Company, Crocker-Wheeler Company, Proctor and Gamble Company, National Lock Washer Company, Public Service Electric Company, and Newark Gear Cutting Machine Company.

Something should be said of the personalities connected with the development of this co-operative work. It might be said that the amount of administrative and supervisory work in connection with the co-operative course is simply stupendous. Of course it can be run simply as a method of a young man's taking a job in order to help pay his way in college; but if real educational values are desired from the commercial experience, it is almost an individual job to discover what they are in certain particular cases and use them for the benefit not only of the student himself, but of others who are to profit by this type of education.

It means very close contact with the various co-operative concerns; it means that they must learn directly the values that you want; and it means that there must be more than one man in the co-operative concern who is interested in the student or students. It means that there must be a rotation of meaningful work, work that tends to develop a professional sensitivity toward engineering as well. Just routine work given to earn money is not sufficient. All this means a high type of administration and supervision, even down to the level of what might be called inspection. All this too required not only men of character, but men of some considerable personality because in the field with the co-operative concerns time is always of the essence of the contract and there is hardly time enough to develop in full the particular philosophy of the co-operative plan so that it is a continuous job throughout the whole year.

The co-operative plan is not sometimes too well understood by the students and sometimes not too well understood by the parents and there is always a cry that "I sent my boy to school to be educated, not to work" and it is a little hard to see, for some parents who have not had experience that work and education have much in common, and the lesson that education without its application is futile is a thing that had to be taught not only to the co-operative concerns, but to the students and parents as well.

To the man who took the responsibility for handling this phase of the work it was a challenging and a very difficult assignment. Early in the experience of the College Mr. Cullimore took over the headship of this particular phase simply because it seemed to be the thing which fitted in most closely with his experience and a thing which was rather difficult to do unless you had had a very considerable experience, so that the first few classes were handled by the head of the College.

The work then was taken over by a Mr. Ernest Bradford, formerly chief engineer of the Gould & Eberhardt Company and a man who, while not an educator, was a man very much experienced in the ways of the commercial production world and the part that engineers had in it.

After Mr. Bradford's withdrawal the work was taken up by Mr. F. W. Lavenburg who came to us after an extended experience in teaching and administering the work of the Federal Board for Vocational Education, the forerunner of the Veterans' Bureau. Mr. Lavenburg was a man who was very familiar with contacting engineering concerns and was a man who did the work conscientiously and efficiently and effectively and under his administration that particular phase of our program grew consistently and soundly.

The Federal Board for Vocational Education or the Veterans' Bureau furnished us two very strong men, one in the person of Mr. Lavenburg, and the other in the person of Professor J. Ansel Brooks. Professor Brooks, our man from Yale, was a very able and competent engineer and had had a considerable amount of experience in the consulting field. Having some practical work in Boston at the outset of his career, he entered Brown as an instructor and after rising to the position of Associate Professor , he entered the Army Air Force in the First World War as a Captain. He was one of the leaders in the study and design of the forerunners of our modern fighting planes. He studied for a while at the Sorbonne in Paris and was an associate of Frank B. Gilbreth, whose Gilbreth Room, founded at the College in the memory of Mr. Gilbreth, was one of Professor Brooks pet projects.

One of Professor Brooks' greatest contributions to the institution was the building up of the Mechanical Engineering laboratory. When he came to the Newark College of Engineering in 1924 the Mechanical Engineering Department had one steam engine, one condenser, one testing machine, and small equipment necessary for testing the engine and the boiler which furnished heat and power to the institution. All in all

Professor Brooks' contribution was very considerable, particularly in the building up of the Mechanical Engineering Department at a time when building was not so easy.

But to go back to the co-operative work, under Mr. Lavenburg, with the some-time assistance of Mr. Cullimore, the work was put finally on a perfectly sound basis and there was a growing understanding of what the College was trying to do on the part of the various organisations about Newark.

When Mr. Lavenburg retired from the position as head of the co-operative work because of illness, the work was taken over by Professor Robert Widdop and there were associated with him a number of young men who gave much of enthusiasm and energy to the work which Professor Widdop supervised.

Professor Widdop, while his connection with this work was of considerable duration, had many other things to do. Beginning as the Superintendent of Plant and Utilities he had his finger on most of the things that went on in the institution. He was particularly interested in the fields of drawing and descriptive geometry and a man of a very considerable amount of intellectual power. His judgment was good and he had the uncanny art of conducting conferences in almost a fabulous manner. He was very instrumental in developing the Engineering Science and Management War Training in the institution and contributed tremendously to the success of this enterprise. He did so many things well that his contribution was sought on many fronts.

Summing up Professor Widdop's work, it was a considerable factor in the development of the thing which had come to be a unique characteristic of the institution and that is the work on engineering personnel. In connection with the co-operative work the fundamental thing which we could tie to and which served to co-ordinate all the work in industry with the work in college was the work in personnel. The human values and the human things which made industry work. Up to this time they had been largely neglected; and while industrial psychology had begun to enter the field, it was not accepted at the time this work was done as a really engineering subject. So Professor Widdop and those who were associated with him in the development of the co-operative work did very much in the development of the work. They served to develop and formalize a philosophy of education which became characteristic of the institution.

While the work of administering in the co-operative field was important, it was singularly exhausting and very often in the early days we felt that the problems were such as to almost baffle an educator. The experience gained thereby, while perhaps not tremendously important, except to a limited number of students, did furnish the basis for a real educational philosophy and for some of the work which immediately and then eventually followed. Such names as Bradford, Lavenburg, and Widdop should be, therefor, coupled with a broader conception than that of simply administering the co-operative work which, after all, was far from a simple operation.

Some of the younger men had for a time a very vital part in this same development. Professor Paul Hoffman might be mentioned as a man who for a considerable time took charge of that part of the co-operative work which sprung from the co-ordination of the co-operative work with the work of the College and which came to be known latterly as "Principles of Engineering and Staff Control." Professor Hoffman gave to the work the benefit of a sterling character and high intelligence.

Perhaps it might be outlined here as to just how the co-operative work developed into the later work of what we call "Principles of Engineering" and "Staff Control." It was early learned in the co-operative work that the in-plant experience was very well worthwhile in developing in the student a sense of maturity and a sense of responsibility. These are two things which it was a little difficult to develop in college; but where a young man was put into an industry in competition with others where the making of money was an objective, responsibility and efficiency were immediately recognized, so that the attempt to co-ordinate the work in the industry with the work in the college--which was a very definite and important part of Dean Schneider's contribution to education--became the most important phase of the co-ordinating procedure; and early in the development of the project these human values in personnel and public relations became of the greatest importance.

Instead, therefore, of calling the work simply "co-ordination," in the first two years we gave it the name "Principles of Engineering" and "Staff Control" in the last two years. "Principles of Engineering" dealt primarily in the first two years with the orientation of the student in the problems and practices which are characteristic of a professional school or a professional college education. Students listened to lectures from the professors. The problems of the younger students were discussed. The functions of the various courses of study were outlined. The place of science and mathematics in the art of adaptation of material things to human needs was outlined and discussed. Professional consciousness, professional discipline, the philosophy of engineering, and kindred subjects were discussed with the class at some length, the objective being to develop in the student an appreciation of the values which characterize the profession that he had chosen.

In the last two years some of the more technical matters having to do primarily with personnel relations were taken up and discussed. The proper recruitment of staff was considered. Its discovery, its development, its upgrading, training for leadership, and all practices which were applicable to engineering staff or to human beings in the plant were discussed and evaluated so that when the Honors Option replaced the co-operative work, this work in the "Principles of Engineering" and "Staff Control" had assumed considerable proportions while the co-operative work strictly as such had disappeared and the industrial experience required was given in a very closely supervised project during the Summer.

In the catalog of the year 1925-26 were listed the factors which the College considered fundamental and it is interesting to note that they were: character, initiative, hard work, understanding of human relations, and a knowledge of fundamentals of applied science. Looking back over the growth of the College it would seem that the insistence upon the first and fourth, that is, character and understanding human relations, were rather unique characteristics to which the college paid particular attention and which persisted as perhaps the most basic qualities which the College endeavored to develop.

The number of students had increased and through the application of loan funds students of ability throughout the state were enabled to secure an education which otherwise would have been impossible.

A word should perhaps be said here about the humanistic social program at the Newark College of Engineering. Attention has been called to the fact that the Newark Technical School, from the very hour of its conception, placed a great deal of emphasis upon things which were not considered strictly technical or vocational and this point of view and philosophy grew and was strengthened as the years went on. Immediately after the founding of the college and enough of the material needs of the institution were met, and after a competent faculty was assembled, the question arose and continued an active one for some time as to the balance between what might be called the technological subjects and the subjects which had humanistic social implication. The question seems to warrant consideration on a rather broad basis.

The old idea of humanities, or at least the one then in vogue, consisted of subjects taught by men with no scientific or technological background or appreciation and consisted largely of the subjects of history and English which were given in a rather formal way and there was no attempt in many places to integrate the work with that of the technological stem. This rose out of a very understandable situation where the development of the humanistic social program in the college of engineering was in the hands of professors who taught it to the arts and science students in the university of which the engineering college was a part. The work with the engineers was considered to be rather second class. The engineers were in the main being trained vocationally so some of the classical scholars resisted as they were not majoring or making their primary goal a study of humanities or the classics. The engineers did not, therefore, secure the best efforts of the departments in question and very often teaching in the engineering branches, that is the teaching of humanities, was little short of hack work and certainly was not in the main integrated at all with the lives or the problems or the aspirations of men who looked forward to a professional engineering career.

There were, of course, notable exceptions to this, particularly in some of the smaller universities where the Dean of Engineering had a somewhat broader conception of the whole problem; but this was the picture as it was observed at this moment. The colleges of technology which operated as separate entities—not connected with universities—were in a somewhat better position. To them humanities meant humanities for engineering. To them humanities meant an important part of the work of the institution—not a sort of by-product where the younger and less able instructors were relegated to the engineering teaching. There came to grow up in the engineering teaching fraternity a great desire for a real exposure to the humanities as integrated with the profession.

It was a question perhaps of an engineer's being a human being and learning something about life, and an abundant life; and it was early recognized that we could not get top-flight engineers unless we had a man sensitive to many of the broader and deeper things which go to make up the best of human life.

The Department of Mathematics was particularly fortunate in securing the services of Professor James H. Fithian who had received his degree at Lafayette in the Department of Philosophy and Education. He was elected to Phi Beta Kappa and naturally enough was very much interested in music both instrumental and vocal. He was president of his college glee club and after graduation spent a year as an instructor at Yale and later as an instructor at Brown. In his first year at Newark College he handled all the Freshmen mathematics and the next year another teacher was added to the Department in the person of Robert W. Van Houten, later to be President of the institution.

Professor Fithian not only brought to the Department of Mathematics a very wide and a very personal interest in the students as well as in the subject, but his interest in music helped very much toward the development of our extracurricular philosophy and policy. He coached the college glee club and one of the things which is clearest in his mind is the first appearance of our college concert orchestra. They, it seems, had learned only one number, "The Wedding of the Winds," but had practiced it to perfection. An interesting thing was that time did not permit the polishing of the French horn completely, but the side toward the audience shone. The President, being on the stage, and seeing the other side, rose, as Professor

Fithian says, with a doubtful, if not foreboding countenance. They went through the number and received tremendous applause. Professor Fithian even records that the President was pleased.

It is also interesting to note that one of the violin players in the first orchestra was John Cataldo, who later became concert master of the Bloomfield Symphony Orchestra. The leader of our orchestra a few years later was Norman Pickering who afterwards played in the Indianapolis Symphony Orchestra. Following his engineering bent, Pickering now has his own factory and is well known for his production of fine high fidelity phonograph equipment.

So that Professor Fithian brought to the college and to his own Department much more than competency within his own field.

This perhaps was a little broader conception than was held by many educators in that day but it grew steadily until the American Association of Engineering Education, then the S. P. E. E., instituted a major project which had for its object the introduction of more humanitarian subjects into the engineering curricula and as a by-product to give a little different view of what the humanities really comprised. This report was published by the American Society for Engineering Education about the year _____.

In the Newark College of Engineering considerable stress was placed on the integration of the humanities with engineering. Many of the subjects were given under names which would hardly be recognized by some of our classic humanitarians as being humanities at all, but an attempt was made, and I think it would be safe to say it was a successful one, to broaden the scope and modify the subject matter of many of the professional courses to introduce humanities as an integral part of the curricula. This was a hard thing to do and seemed to be impossible to do directly, so that certain courses were introduced, known as "Principles of Engineering" and "Staff Control." The course in English was somewhat expanded and a concerted attempt was brought about to interest students in the humanities as an entirely necessary and intricate part of their lives, including their professional life as well. It was at least dreamed that humanities might become a part of the working capital of an engineer—that humanities might affect his life on many fronts and it might become a part of his mental, emotional, and moral equipment.

Of course the first move was to interest the faculty and show them the necessity of this particular point of view. This seemed to be as successful as it could be with most engineering school faculties; and while there was some difficulty at first, the general principle came to be recognised a little later. This was in counterdistinction to the general conception of humanities as being some material that you read out of a book when you had gotten through the work of the world, gone home, had a bath, and sat down with a cigarette. The trouble with the hmmanities as they were observed then from the standpoint of an engineering college was their importance in the work of the world. This sort of conception of the humanities did not attract many teachers of English and history at the higher levels who frankly were a little more interested perhaps in the subject taught than in the integration of that subject with the life of the student and the practical effect on him. Numerous methods were experimented with and some proved successful. An engineer was given charge of the English. Oral presentation was made a part of the course in English and the subjects were to a very considerable extent subjects which had some connection with the professional life of an engineer. Gradually the "Principles of Engineering" came under the same shadow and the work very largely covered the relation of extracurricular activities to the life of the student.

In connection with the early work of co-ordination, or "Staff Control" as it is now called, Mr. Cullimore associated with himself some of the younger men who had shown a particular promise in the field of education on purely technical levels. One of these was Associate Professor Solomon Fishman. Professor Fishman had a very extraordinary mind and was in appearance perhaps a little like Dr. Einstein in his younger days. He was full of original and sound ideas and it could not be said of him that his sound ideas were not original and his original ideas were not sound. He was a very great help and furnished a tremendous amount of stimulation and interest to the discussions which were then being held concerning the place, character, and extent of the personnel work and its problems in industry.

Very often at this time the conversation turned to the difficulties which were becoming evident and were characteristic of the so-called labor and management disputes. It was then decided that the College should take the position that labor and management had enough in common, if it were developed and stressed, to furnish a foundation broad enough to attack together some of the problems which seemed to involve antagonistic points of view. Perhaps it was the old question of Benjamin Franklin's philosophy--to find a broad base of common interest upon which to stand, and having established that base, and having established the community of the common interest, then we could advance, but only then, to the point of discussing or even arguing the points of difference. We felt that this contribution was important for both labor and management, and particularly important for the engineer who had sometimes to take into account the point of view of both these groups.

So that as a point of philosophy, and it was developed primarily with Mr. Fishman, with any dispute as between the employer and the employee there were three factors to be considered; the factor of the welfare or well-being of the employer; that of the employee; and just as important as either of these, the equity or the interest which the people in general, the consumers, had in the problem, and that no problem in "Staff Control" or employee-employer relations could be studied without a minute examination of not two, but three, points of view. This principle, coupled with the principles that both parties, and in the light of this later statement all three parties, had a definite equity or part in the solution, and that the point of view of all three should be studied, was at that time quite a departure in the field of personnel and human relations. Its truth had colored all the decisions which were made in that field and the soundness of the point of view has been attested to by a long practice and has been of the greatest importance to the philosophy of the College.

Then too Mr. Fishman was a very good example of what the College was trying to do in a rather broader field and in which it has made a considerable contribution in the course of its lifetime.

The course of "Staff Control" and the discussions which were held throughout this course dealt to a very considerable extent with factors which would not be considered technical by engineers and which by the same token perhaps would not be considered humane by teachers in the humanistic social group. The College took quite an interest in this movement on the national scale and in the year 1944 the President was named a member of the Council in the Humanistic Social Division. At that time the amount of material which was considered in the humanistic social field was in the neighborhood of 20%, which was the amount suggested by the report of the American Society of Engineering Education as the desirable proportion.

A book of extracts from classics tending to integrate engineering with the humanities was introduced as a means of stimulating reading in the field of the classics and it proved very effective, the use of the library increasing about 1000% in the first fifteen years of the development of the college.

As has been indicated several places, and will be further indicated later on, the College has held always the philosophy that it was necessary to make a successful human being first and then add on to that the professional qualifications of an engineer. This point of view required that the science and the mathematics in the courses should, of course, be sufficient, but should not exclude matters of a deeper and broader interest. Even in the days of the old technical school it was felt that English and literature, particularly literature, were extremely important; and some of the old examination papers indicate that other subjects such as economics and geography were extremely important.

At least the College was always tremendously sensitive to this need of a broader and more basic education. This naturally colored the choice of the faculty and fortunately a choice could be made from the ground up. One of the first men to come to the College after Mr. Cullimore's acceptance of the position of head was Professor Harold N. Cummings in the Department of Civil Engineering. He was a man who Mr. Cullimore had known for quite a time and who had served under him at the University of Delaware. He was a graduate of Bates College in Maine and later of the Massachusetts Institute of Technology. He and

Mr. Cullimore had much in common. They had worked together and there was a spirit of loyalty and trust between the two which is seldom attained.

Professor Cummings was a consultant and advisor throughout all the first years of the institution and he gradually grew out of his position as head of the Civil Engineering Department and afterwards assumed the title of Vice-President, where he had very much to do with the internal workings and the efficiency and effectiveness of the organization. His characteristics seemer perhaps a little austere, but admirably adapted to the pioneering work which had to be undertaken at the College. The head of the institution felt always free to ask his advice and usually took it and together they considered and developed many of the policies and practices which became typical of the institution.

It is perhaps impossible to explain in words the effect that Professor Cummings and his personality and his philosophy had upon the Technical School and the growing College. His Father, a Methodist minister, had given his son, perhaps directly, of an honesty, a sincerity, and sense of loyalty which have seldom been equaled. His knowledge of educational practices and his thoroughness made him a great power in the institution. Very seldom do we see a man who has such a capacity for detail and it might be said of him that the attention to trifles made a genius but genius is no trifle. His advice and counsel and help were important not only in the educational development of the institution but in the development of the financial policy as well. His influence in the then small faculty was tremendous and by precept and example he was a tower of strength at all points. In his contribution to the institution he was absolutely unselfish and never measured his time or his effort.

In speaking about Professor Cummings perhaps the most interesting and farsighted thing that he did was the discovery of President Van Houten. Cummings was always a very observing man and had the uncanny capacity to pick valuable men and his choice of Mr. Van Houten as a future member of the department, although he had to introduce him through the medium of the Mathematics Department, was a real discovery.

In his work at the College Professor Cummings helped to develop in his own department two young men who came to take an important place in the philosophy and workings of the institution.

Professor William S. LaLonde, who afterwards became head of the Department, was a graduate of the Massachusetts Institute of Technology and a young man who, after a considerable amount of civil engineering work, was desirous of taking a position in teaching. His contribution in the technical sense was tremendous and can hardly be appreciated. Very early in his career he was chosen as the editor of the AMERICAN CIVIL ENGINEERS' HANDBOOK and for a time was Chairman of the Metropolitan Section of the American Society of Civil Engineers, and later became a Director ~~Manager~~ of that Society.

He maintained this department on a very high plane of teaching and gave it the professional status which was necessary for its proper development. The work of this new course was always beyond criticism.

Very soon after the institution of the Civil Department, and perhaps even before that time, the contribution of the professional society work to the philosophy of the institution began to be appreciated. The student chapters of the professional society furnished an excellent forum for the discussion of technical matter; but more particularly the practice which the students got in thinking on their feet and taking part in the sort of discussions that are not only professional but which were altogether characteristic of our democracy.

The students seemed to be extremely interested in this type of work if properly sponsored and developed by the various departments and it took the place of certain other extracurricular activities which it was felt were not nearly as constructive toward the development of our philosophy. Perhaps even professional society meetings sometimes crowded out dances and the story is told that after one professional society meeting where a dance had been arranged, our boys wanted to get out and take a look at the heating and ventilating system rather than go to the dance; and while we were very careful not to crowd out those things which a normal youngster about that age would like to do, we rather felt that if they could get enjoyment out of constructive things there certainly was no objection to that. We were, however, rather sensitive toward cutting out all play; and while it was hard to make the curricula such as to permit very much in the way of fun and play, it was done wherever it could be done; but the great problem of education at that level seemed to be to turn the energy which a boy had put in almost 100% in play into channels which were professional and which were productive. All in all there was a necessity for building up a professional consciousness even in the first two years of college.

We found, or we thought we found, that a very good way to do this was to impress the younger students with the professional attainments and stature of the men in the students' branches of the professional societies and it was very pleasing to note that in the metropolitan area our men began to take a place of leadership in these professional undertakings. This, of course, required that our professors, or at least someone in the department, be very sensitive to the needs of the students in this regard and have close enough contact and stature enough in the national society to take leadership with respect to the student branches.

Professor LaLonde seemed to be particularly sensitive and successful in this field and he, with Professor Robbins, did much to develop the overall professional consciousness in our student body. Professor LaLonde's background had been such as to make him see the great necessity and value of these student branch contacts; and with a wide engineering experience in the coast survey, in municipal work in Los Angeles, and as a construction engineer he had a very definite down-to-earth experience in the professional engineering field.

He had done some work in teaching at the Massachusetts Institute of Technology and did not come to the teaching work at the Newark College of Engineering without some practice and some knowledge of what the profession entailed.

During the Second World War Professor LaLonde was in the Navy as a Lieutenant Commander on the construction of some of our largest works, including the huge dry dock in Bayonne, New Jersey, and had had some considerable experience before coming to Newark, and after, in the office of one of the most prominent consulting engineers in New York. Under the guidance of Professor Cummings he made a tremendous contribution to the institution.

With him must be coupled the name of Professor James M. Robbins who entered the department in its early days. Professor Robbins, like many of the men who came into the college in the early days, was technically sound and in addition had a considerable interest in the student as well as in the subjects taught. He is a graduate of the Massachusetts Institute of Technology where his Father held for years the position of Professor of Topographical Engineering. Professor Robbins had not only a sound academic training, but a rather unique background which stressed all the virtues of a New England ancestry and brought much to the department, not only in the technical way, but in the broader sense.

He was particularly interested and was very helpful with respect to some of the cultural advances envisioned not only in his department but in the college at large. The development of much of the work in non-professional electives was his. His work in the Library Committee was outstanding and this he supplemented by writings and revisions in the engineering field.

In later years he was particularly interested in the matter of discipline and carried on on a very high plane the mark set by Professor Nimms who pioneered in the work of the Committee on Discipline. It is perhaps not the place here to develop particularly the details of Professor Robbins' work in the disciplinary field but both he and Professor Nimms were imbued with the philosophy that a strong internal discipline, call it what you will, was the basis of proper scholastic operation. The whole theory as developed by these two men had to do primarily with the discovering of faults before they had assumed proportions which required suspension or expulsion; and in the development of the College the work was highly successful.

Of course the product of the Civil Engineering Department of which we are all particularly proud is Robert W. Van Houten who, in 1947, was made Acting Head of the Institution, and assumed his Presidency in 1949.

We were altogether fortunate in the newly instituted Civil Department and the staff was beyond question one of the strongest that we could have drawn together. Fortunately too the Civil Department was not completely carried away with the idea of departmental autonomy and worked first, last, and all the time with the institution, as well as the department. As has been mentioned elsewhere, this was a characteristic of all the departments from the start and perhaps explains as clearly as is possible the success of our enterprise.

The influence of the personalities standing behind this movement was considerable and with a faculty that was sensitive to this particular point of view much progress was made. It showed itself even in the student branches where our men, because of their somewhat broader training—training which was applicable in their everyday life—found themselves more at home not only with their fellows, but with speeches and meetings, with oral presentations, and particularly there could be observed that a great deal of the material usually known as classical had shone through. Listening to the oral presentations and reading themes of the students showed quite definitely that much was being achieved.

The development of the course in English was due in the first years to the untiring efforts of Dr. Paul M. Giesy who undertook to step from a distinctly professional and research position into the headship of the English Department. A word should be said about Dr. Giesy and his qualifications. Coming to the institution with a very rich experience and training in the field of chemistry, and having done much original work with more than one commercial organization, he brought to his work not only high scholarship but also a very fertile mind. It's very seldom that one encounters a type of scientific mind and a scientific approach which was as sound as that possessed by Dr. Giesy.

Under him were developed many of the practices which proved so important in the earlier years. In addition to the classical writing of themes or essays based on subjects which were not always closely in touch with engineering, he had an oral period of presentation of material which was valuable in the extreme. The sessions of the English classes partook very much of the nature of a presentation of material before a professional society. Papers were presented formally and discussed, under a student chairman chosen from the meeting. The course was striking, particularly because it stimulated very closely the actual procedure which a young engineer must go through after his graduation. It accustomed him to presenting material in public, to thinking on his feet, and perhaps gave the school more of a repatation than any other single thing which characterized its beginning. It is interesting to note that in the early days the Newark College of Engineering twice received the Charles T. Maine Award for the best paper written by a senior student in an engineering college. This was, at that time, a very signal honor shared, I believe, only by the University of Michigan.

This idea which Dr. Giesy so nobly pioneered was one, of course, which was fundamental in the work of the college, that of considering culture and living a broader life as not a thing apart from one's profession or vocation, but as an integral part of it; and culture, instead of being considered as a thing by itself super-imposed upon an individual at perhaps convenient moments, was considered to be a way of life—a kind of development and growth which was of the professional and something which was a requirement and must be inherent in its leaders.

English became, from this point of view, a meaningful engineering experience which was integral with the profession itself. All due credit to the work in the early days should be given to Professor Graham DuBois who came to the Technical School during the administration of Dr. Hodgdon and made a great contribution, particularly in the training of the returning soldiers, when the work in English was arduous and demanding. Professor DuBois laid the work for those who succeeded him.

The work in the library proceeded satisfactorily and the development of the reading habits of the students was a matter of extreme concern and in 1940 Mr. Ira A. Tumbleson came from the University of Nebraska to serve as librarian of the College. Since that time the library has been in particularly good and particularly sympathetic hands.

It will be noted from what is said about the various personalities involved that some of our early men were from Harvard, and then a little later from Yale, and from Princeton, not to mention the fact that the Massachusetts Institute of Technology contributed a considerable number of individuals to our early staff. This is only natural for the administration of Mr. Cullimore, marking as it did the commencing of the real development of the College, was affected by his conception of a technological education as he had received it at the Massachusetts Institute of Technology. The situation, upon his coming to Newark, was not inherently different. Here was a great metropolitan area which was not directly served by any technological institution. To be sure the Stevens Institute of Technology, with its international reputation, was located not so very far away, but the need was not primarily for education as apart from the community, but education as a part of the community; and those young men who had to live at home for good reasons had no real opportunity to take up an engineering training. The tuition rates at neighboring institutions were high and the problem very soon developed into one of furnishing first class, top flight engineering education at a reasonable figure. For this reason the question of simplicity, or even austerity, became of tremendous moment and perhaps outweighed all other basic considerations. The thing, to be successful, had to be done within the reach of our students; and in those days, say from '20 to '25, the level of earnings was reasonably low. What was needed was an institution where brains and capabilities and aptitudes could be developed at a reasonable cost. The institution early recognised that in America brains come up from the bottom sometimes easier than they come down from the top and at least it was fair to say that in the great democracy of the United States brains are where you find them, so that the basic philosophy of the school developed around the idea of finding brains where they were without the impediment of financial competency on the part of the parents. Whether or not this is a sound point of view depends entirely upon the success of the institution.

About the year 1936 the College underwent a major change in its organisational set-up and instead of a scalar organisation, a planar organisation was developed in which the autonomy of each department was established and maintained irrespective of its size and its technical significance. The President and the Executive Committee, together with the officers of administration, acted as a balance between the various departments of the institution and for the first time the humanistic social group, consisting of the Department of English and the Department of Management and Personnel, were joined under the Department of Humanities. Dr. Pitman, head of the Department, has this to say and it is very significant concerning this particular group:

> The Humanistic-Social Group now consists of the Department of English (which, in fact, is more nearly what is called a Department of Humanities in most colleges) and the Department of Management and Personnel. There has always been close co-operation between these two departments. Every effort is made to avoid duplication of effort, to produce maximum effect in minimum time, and most important, to see that all members of both departments understand and are in sympathy with our mutual aims. There is occasional interchange of instructors between departments, and both are constantly revising material and methods within their courses to take advantage of every possible improvement. Both have tried to avoid freezing the curriculum into an inflexible mechanical system which would prevent experimental approach to new problems.

About the year 1940 the College was very fortunate in securing the services of Dr. James H. Pitman who was in many ways a unique personality. He was not only a good teacher and a good administrator but had, which was unique, a belief in and a conception of the necessity for integrating the work of the engineer and the great contribution which a proper humanistic social program might have if properly applied.

About the year 1932 the College published a little book called "Anent Engineering Culture and the Humanities" in which something of our procedures was laid down for the first time. To put the matter as simply as possible, our problem seemed to be to eradicate the old notion that there was something necessarily different between, or fundamentally antagonistic between, a man's culture and his work. How this should have grown up in this world of ours is rather difficult to say because as far back as the time of Leonardo and Michelangelo the artist and the artisan were fused into one. Perhaps it was the English system of nobility which managed to separate the gentlemen from the workers; but to let it persist in workaday democratic America seemed to be wrong. The College undertook the struggle and it is hoped that some success was gained.

More than usual importance is assigned to this particular phase of our work because it does seem that everything taken into account it was one of the greatest contributions which the college made to engineering education--and that was the understanding that the social studies, humanities, and the classics have a definite active part, and a kinetic part, in the lives of all of us; and if we are to develop, as we should develop, and live lives as abundantly as we can, we must make our classics, our humanities, and our social studies work for us--not perhaps directly in earning money but in creating a sensitivity, a point of view, and an appreciation of some of the broader things of life which characterize a broad man. It is a little hard to see how we could make a broad engineer out of a narrow man.

About this time student life began to be a factor in the College. Intra-mural and varsity basketball were instituted. A great deal of stress was placed upon participation by the students in all extracurricular activities. While from this early date some varsity basketball was played, the great stress and emphasis was always on intra-mural athletics where as many students as possible could participate. Professor Frank N.

Entwisle was the moving spirit in the development of the athletic and the extracurricular activities from the founding of the College up until very recently and his comments on the philosophy and technique of the practices would be of special interest.

But first a word about Professor Entwisle himself. Again he came to the Newark Technical School and the Newark College of Engineering primarily because he was a teacher, a man who was interested in the development of young people and their problems and sensitive to the necessity of solving them early. Like most of our men at first he came from a great university. In his case it was Princeton, where he graduated in 1912, being a Phi Beta Kappa, as well as an engineer. He was for six years with the United States Engineering Corps, then with the Transmarine Corporation on the design of steel and concrete docks, and later had some experience in the teaching of mechanical drawing.

He came to the Newark College of Engineering in 1922 as instructor in the Department of Physics and as was common in those days, spread his activities over a somewhat wider field and taught descriptive geometry and strength of materials.

Early in his work with us he became interested in the counseling of engineering students at all levels and in 1933 entered upon a study to devise a test which would help us determine which sophomore students could profitably be promoted to the professional departments. This work was of extremely great importance at the time of its introduction in the College for the philosophy of the College was, and is, that when a student completed his first two years of college and had acquired some background in science and mathematics, then was he introduced to the professional work of his particular specialty; and while a certain type of student seemed to be able to do the first two years of work which consisted then, as it does now, mainly of examples and problems in physics and mathematics, this was no sure sign that he could profitably take up junior work. While some considerable work was done in that field, and while the philosopy still holds, Professor Entwisle's study showed that quite definitely, with materials then available, such a test was quite beside the question. It indicated other things which were very importamt as well, and that is that certain objective tests failed to take into account those subjective qualities of mind and heart which make for success in the real field of engineering. At least this effort directed Professor Entwisle's attention to the matter of testing and he became actively interested in this field.

It was perhaps natural for him to continue actively for twenty years as director, coach, and advisor to the student athletic program. His work in this field stands as a unique contribution in the field of student life and student activities and our policy of letting the students handle at all levels college athletic organizations, even taking the responsibility for the financial solvency of the program, stands out as one of the few successful amateur athletic organisations in the collegiate world.

Due, it seems, to this close experience with the student, coupled with his background as to the more formal aspects of education, Professor Entwisle, as early as 1924, assisted in the development of the pre-engineering inventory test which had its birth at the Newark College of Engineering under the auspices of the Carnegie Foundation and also the development of a sophomore comprehensive test. In 1945 he was made head of a Testing and Counseling Division to work with veterans referred by the Veterans' Administration. He assembled an organization in the neighborhood of twenty persons and Dr. George Hartmann was engaged as consultant. During the life of this very important service 13,581 veterans were interviewed and tested. Upon the discontinuance of the work with the Veterans' Bureau, similar services to our own students were taken up.

A little later Professor Entwisle assisted Mr. Cullimore in the preparation of "The Most Desirable Personal Characteristics" and the contacts which were then made with many organizations all over the world, and particularly with the Engineers' Council for Professional Development, were very productive. A project, of which the booklet formed a part, is now one of the "points" in the six-point program of E. C. P. D. in the encouragement of the young engineer.

Professor Entwisle's brief comment on his activities here seems to be worth repeating in his own words:

> I must be an emotional chameleon because it seems to me that I'm living now in the most interesting portion of my experience here. And yet there was a time when I thought there was no fun greater than teaching a class in physics. Perhaps you

had best classify my "contributions" as those of a participating spectator, if you can imagine such an individual. I have a feeling of having seen something rather minor in size grow to something sturdy and alive in front of my eyes. It would be nice to think that I had some part in this growth, but I have difficulty in distinguishing it."

The following few pages have been contributed by Professor F. N. Entwisle:

"'Extracurricular' is the title used to designate those activities which are undertaken by students for their own pleasure and on their own time but which, nevertheless, have a definite relation to the institution they attend. The definition covers a great variety of things. Athletics, obviously, would be one example of such activity, as would membership in a social fraternity or in a school club or in the student chapter of a professional society. In most American colleges the variety of these extracurricular affairs is very great and the time consumed by their proponents may be extensive. At certain periods and in certain places the extracurricular seem to dwarf the curricular; or, as Woodrow Wilson once remarked, 'The sideshow is in danger of swallowing the main tent.'

"Engineering schools are protected against this possibility to a degree by the rigor of their curriculum requirements, but are not immune by any means. Out-of-class activities flourish even in this austere engineering environment, although on a somewhat rather reduced scale. These activities do not exist on any 'bootleg' basis. The great majority of engineering college administrations approve of them. Many foster them on the generally announced theory that they furnish opportunities for the development of 'leadership.' The inference is that opportunities for the development of this desirable quality are not present in any of the classroom courses.

"While it seems likely that relatively few individuals among the many engaging in these activities emerge as leaders by virtue of the training thus undergone, there is good reason to believe that general social benefits do accrue to the remainder. Organizing and working for a common good is a healthy and satisfying experience. With this the administration of the new college at Newark from the very beginning was, and at the date of writing still is, strongly in favor of and in complete agreement, with just one mental reservation--it felt that the kind of experience which imparts the greatest measure of good is a 'real' experience, not a simulated one. They believed that extracurricular experience should embody financial responsibility as well as social planning.

"In most colleges funds for these out-of-class activities are provided by means of an imposed fee under one name or another which is extracted from all students along with the tuition. Newark College of Engineering held that this was not a democratic or fair way of providing extracurricular experience. If the experience is to be real, it must be complete. Adhering to this philosophy, a system gradually took form in which the students undertook to raise and were given the responsibility for the spending of all monies thus secured. No college funds or activity fees were imposed, nor grants of any sort whatsoever provided them. This system has now been in effect for 31 years and seems, if anything, to grow in strength and stability as it progresses. It would appear to be not merely rare, but unique.

It was quite natural that the desire to organise athletic teams should have been the first project for which money was needed. Athletic expenses still absorb two-thirds of the money which is raised each year by student subscription. Gradually, however, a more complete program came into being so that at the present time, in addition to nine varsity athletic teams and many intra-mural leagues, the student association recognizes and supports a varied number of clubs, sometimes as many as 15 or 20. It has general oversight of the six publications, ranging all the way from a yearbook to a monthly newspaper. It oversees the activities of seven social fraternities, operates the student services committee, and sundry other things.

"The operation of non-athletic activities in this fashion is probably not an unusual thing, but the maintenance of a satisfactory athletic standing in a geographical area filled with rival colleges which administer their programs on the usual basis of athletic scholarships and professional coaching is really quite an achievement. None of the necessary coaches receives any money for his services in the Newark system, and no student has ever been lured into attendance by that peculiar misnomer, an 'athletic scholarship.' It follows that no special rules of scholastic performance need to be imposed upon anyone who wishes to indulge in a sport. Anyone who is good enough to stay in college is good enough to play in college. Notwithstanding these 'handicaps' the athletic teams in the past 30 years have won an average of 55% of their matches.

"To keep in successful operation so varied a group of activities entails a great amount of time and energy. These chores are handled by members of the duly elected Student Council, advised by eight or ten members of the faculty who volunteer for such services but receive no pay therefor. There is no doubt but that these members of the Student Council qualify as having been trained for leadership before their term of office is over, but the greatest good is believed to have accrued to the rank and file, on teams and in clubs, who have had the experience of responsible participation in that rarity in modern collegiate life—an amateur organization.

"This is not to say that the going is always smooth. Money is perennially scarce and corners have to be cut. From time to time murmurs arise as to the sad lot of a student organization whose administration will not collect the necessary (and, please, more abundant) funds. Always, however, the general opinion emerges that, after all, it is nice to control one's own money."

In all forms of sports it was considered that participation was the objective and that mere spectator interest was something which was not of tremendous and vital importance in the development of an extra-curricular program.

While we have found the athletic activities of the students of great value in the overall development of the human being, there is, of course, something to be said for so-called varsity athletics from the standpoint of morale and esprit de corps and a feeling of something of the community spirit which ought to characterize the college group. At first the participation in athletic affairs was not insisted upon. The college plan of co-operation where students were not gathered together in dormitories did not lend itself to a very highly formalized athletic program at all. Every attempt was made to have the students participate in the athletic activities of their own communities; but to get them together at night from plants so widely separated through the whole metropolitan area seemed to be impossible and no properly representative group could be trained for longer than a two- or four-week period to represent the college. It was felt that competition on this basis was essentially unfair; and while there were some local teams in the earlier days that represented the college, the schedules were very meager and very light and usually we found it fruitless to compete with any hope of winning with colleges with the same number of students, but organized in a different way.

From the very first, however, the students managed their own athletic program. There was no faculty supervision or control and no alumni control and no alumni contributions as such. There have been no athletic scholarships and the athletics were supposed to have the same place and the same function in the life of a younger man as they would have in the life of a mature professional engineer—perhaps a little more so, but not too much more.

The fact that the students managed their own affairs without help from the school or the alumni gave them a sense of values financially which was highly desirable. They retained their own coaches and rendered to the college authorities a report of their activities when they desired to do so. This led to the general principle of the establishment of any extracurricular activities--athletic or otherwise--which were supportable by the student body on their own steam and saved us from many of the mistakes which are made where extracurricular activities are developed far beyond their usefulness. The whole idea was to have the activities recreational in character and not a source of financial income to the institution.

The following comment by Professor Robert F. Swanson, head of our athletic program, seems to be pertinent and wise to introduce here:

> The recent strides made by the athletic program of the college appear to have had their inception during the early days of the war when courses in physical training became a required subject in most institutes of higher learning. This was accomplished with the encouragement and approval of the Federal Government to try to develop the physical side of students for possible service in the Armed Forces. After the war the benefits of the physical training courses were continued and a full-time instructor, Professor Swanson, was engaged to supervise the program.
>
> For the first time a well-regulated program was devised. Students returning from service in Europe, Africa, and the Pacific were enthusiastic at the opportunity to participate in the program, not so much in actual class calisthenics as in extracurricular organized leagues, games, and tournaments. All of the activities are based on producing recreational and beneficial exercises for the greatest number

of students. True, as always, certain varsity sports such as basketball, baseball, fencing, soccer, tennis, and track are encouraged, but all the schedules are very modest; and while some success in various years by teams competing on the varsity level is observed, by and large the intra-mural sports are those most heavily participated in by students and seem to provide a real need for engineering students.

Something in the nature of our athletic program as it has grown up and developed in the past few years might be of interest. Since the very first teams in basketball, fencing, and tennis have persisted through the years. Once in a while baseball is added and other things creep in and sometimes creep out. The intramural sports started with basketball and afterwards softball and bowling came in. The related clubs have been helpful but not, of course, a part of the specific college athletic program.

Something of the scope of the program at the date of writing would be perhaps of general interest and give some idea as to what direction our athletic program has been pointed and it seems reasonable to say that its development over the years has been in keeping with the fundamental philosophy which characterized its inception:

I. Generalized:

a. Athletic Association

Total budget of $2,431.00, supervised by the A. A., and distributed in the following categories.

1. Overhead (awards, cleaning, publicity, miscellaneous)
2. Teams (9): Basketball, baseball, bowling, fencing, rifle, soccer, table tennis, tennis, cross country
3. Intra-murals: Basketball, softball, bowling
4. Related clubs: Cheer Leaders, Yacht Club

II. Some articles of general interest:

a. The fencing team retired the Invitation Tournament Trophy once again (6 years in a row).

b. The bowling team took second place in NJIAC Conference play.

c. The tennis team has won three, lost one, to date.

d. Ten cheer leaders were active at all basketball games. (11 women in day college).

e. 144 students, including 10 cheer leaders, received awards at the Sixth Annual Athletic Association Dinner on Wednesday, May 19, at the Athletic Club.

f. 158 students are participating weekly in a softball league at Branch Brook Park. With the Physical Education classes also meeting at the Park, over 550 men are participating weekly in organized activity at Branch Brook Park through the month of May.

g. Approximately 250 men participated in the Intra-mural Basketball Tournament, with 16 teams selected for the final elimination league. A Junior Mechanical section team won the league.

Here again we have been particularly fortunate in the men who have been interested in the athletic program from the very first—all men of character who were thoroughly imbued with the desire to be of assistance to the boys in developing one vitally important side of the human machine. While sometimes outside coaches have been hired for short periods and for specific emergency projects, the names of Professors Entwisle, Bauder, and Swanson furnished a high type group of men who have caught the philosophy of our athletic program easily and have developed and expanded it in a very exceptional way.

With respect to student publications and also with respect to the Athletic Association, they were entirely managed and financed by the students themselves and there was little in the way of subsidy extended from the college. This had the effect of giving the students the experience not only in athletics, but in the financial management of their own affairs, and the striking result was that the students rose to the occasion and for many years have had the financial control in development of their various activities within their own hands.

By this time it had been possible to very definitely augment the laboratory facilities, particularly in the fields of chemical and electrical engineering. At this particular period electrical engineering seemed to be the most popular, with chemical engineering increasing rather rapidly. The physics laboratory had been built up. There was a testing machine laboratory, and the work of the college seemed to be developing along sound lines, not only from the standpoint of operation, but from a standpoint of overhead as well.

While the classes in the first few years had been extremely small, and while the number of professors and instructors remained practically the same throughout this period, the classes did by 1928 develop to somewhere near normal size. The number of co-operating concerns had been increasing and the co-operative work seemed to be functioning successfully.

About this time it began to be observed that in the correlation of the co-operative training in industry with the theoretical training in school the subject of personnel or employee relationships was one of the most valuable experiences the co-operative type of training gave to the students and particular emphasis was put on this phase of engineering education. This emphasis was increased until the college became known for its work in personnel and its work in human relations.

The history of the Newark Technical School and the Newark College of Engineering reflects the development of a unique relationship between an engineering school and an industrial community. As a general matter the college has, directly and indirectly, made a considerable contribution to the growth of the area industrially; and conversely, the nature of the association with the technical operations of the area has had a definitive bearing on the character and philosophy of the institution.

These interchanges between schools and communities are, of course, inescapable but few engineering schools have been so fortunately situated in a thriving diversified industrial area and have been so willing and proud to serve that activity. Certainly a college isolated geographically finds itself isolated in other respects and could not have the same point of view (for better or for worse) as one conceived and reared in the very center of an important industrial community.

The beginnings of the technical school have been recited. It was organized to meet a real need for technical training in the budding technology of those times. Much of the training was at what is now considered vocational level and most of it was given in the evening. The level or nature of that training is not, at the moment, important. What is important in this theme is that the students worked during the working days and took classes at night.

A large part of the staff was similarly employed in local industry during the day and taught at night. There was, from this circumstance, a fund of real problems from the studentw, and a source of "applied" experience from the instructors.

The evening school has continued throughout the life of the institution, progressing from vocational to sub-professional work, to professional and graduate work and special courses. The depth and breadth of the evening programs have formed one of the most constructive links between the college and the engineering work of northeastern New Jersey. Men currently employed in engineering and production can find training at various levels particularly suited to their immediate needs and to their ambitions. Many members of the day faculty serve on the staff of the evening school and the contacts with the men in the evening classes is both refreshing and educative to the faculty.

It is hard to conceive of a more sensible approach toward meeting the technical needs of the community than the service being rendered in the Graduate School and in the Special Courses Program, and the evening work of the institution should be and is recognized as a very worthwhile educational effort "blessing alike he that gives and he that takes."

The degree work of the college got under way in 1919 on the "co-operative plan," involving alternate periods of employment and instruction in the junior and senior years. This operation necessitated a very close association with the employers of the area, and representatives of the college canvassed the locality for suitable placement of students and "co-ordinated" the working experiences with college instruction.

It is probable that during the operation of this program the college was, through its representatives, in closer touch with the technical operations in Essex and adjoining counties than any other agency at the same level in northern New Jersey. The list of companies, large and small, with whom the college was associated was most imposing--Western Electric, Weston Instrument, Wright Aeronautical, Eastern Steel Foundries, Edison Industries, Proctor & Gamble, Oxweld, International Can, Singer Sewing Company, Diehl Electric, Cook & Dunn--mention any of the leaders and almost always the college was there.

It should be recalled that during the early years of the college the demand for engineering graduates was not as strong and as continuous as it is now and that during the operation of the co-operative plan there were periods when employment opportunities for new engineers were limited.

It followed from this circumstance that placement for undergraduate co-operative students had to be sold to the employers in the area. It was found that men who had gone through the Newark Technical School were most helpful not only in arranging working opportunities but also in the development of the individual students during employment. One of the most pleasant aspects of co-operative work was the real interest shown by the older men among employers in the younger men placed with them, in particular such men as Messrs. Nydegger and von Lehn of the Singer Manufacturing Company, Mr. Zimmerman of Gould & Eberhardt, Mr. Boughton of Westinghouse Elevator, Mr. Robert Abbott of General Electric, Bloomfield, and very many others who had rare patience and an interest which appeared to be altruistic in the young men placed with them. The human helpful attitude of many of the employers of this locality during the school's association with them in the co-operative work merits special mention in this record.

It should be remembered the co-operative program was an educational venture. The proponents of the plan here and elsewhere listed and expounded on the items of advantage in the plan as compared to so-called "regular" courses in engineering. The economic advantage to the employer and to the student was featured and it seems that it may have been over-featured. The real purpose of the co-operational plan was to draw educational value from a working experience. Placement for this purpose was justifiable; for any other purpose it was not; but, where there was a real or implied promise to provide financial assistance to the student through co-operative placement this very often took priority and the real objective was beclouded.

The term co-ordination was used to describe the process of capitalizing, educationally, from the working experiences of the students. It was found to be practically impossible to "co-ordinate" many of the tasks customarily assigned to an engineering novitiate with the technical subject matter of college courses. Counting lard cans was not related to Boyle's law and attempts at specific correlations of this sort were abandoned. However, there was found one area for co-ordination--in the field of human relations.

It is difficult to estimate whether the emphasis on staff control, management, sales and so forth which has characterized the work of the Newark College of Engineering originated in the operation of the co-operative plan or whether it had already germinated on the mind of the administration of the college and was brought to fruition by the experience of that program.

In any event, an extensive systematic attempt to sensitize the students to the problems of human relationship in technical work was started during the years of co-operative work and has continued with what seems to be a great deal of success. It seems then that this particular stem of the school's association with the industrial life of the area broadened and deepened its philosophy enormously and produced the emphasis which has distinguished its work. The co-operative plan was superseded by an Honor Option Program which seems to conserve the principal values and to avoid many of the faults of the older scheme.

This theme has been the unique association between the college and the industrial life of the locality and the values accruing from that association. In addition to the co-operative plan there was another experience, the E. S. M. D. T. which further illustrates the point. Very early in the Second World War it became apparent that the country was deficient in engineering talent and training and the Federal Government provided funds so that the engineering college could give short courses to alleviate that shortage. The objectives of this program differed from the regular work of the college in that it was designed for the benefit of industry rather than for the benefit of the trainees. It was necessary for the college to determine the needs of particular industries so that courses could be designed to meet those needs.

The experience with evening school work and with the co-operative plan gave access to this information and enabled the college to assume leadership in the Federal Program which, in this area, covered short courses ranging from the most elementary work in drafting and design to the most advance work in Ultra High Frequencies.

To illustrate the point of the school's intimate association with and knowledge of the technical needs of northern New Jersey, the fact can be cited that the Engineering School of Princeton University used the facility and guidance of Newark College of Engineering to make their very great contribution to the E. S. M. D. T. Program. The college was very happy to be associated with Princeton in this work and found at least in this circumstance that our associations with industry were invaluable to them.

There might be recalled with satisfaction several particular courses in the E. S. M. D. T. Program. We had one course for engineering secretaries in which we trained them in the jargon of electronics; we had several full-time day courses for female engineering aides, in which the subject matter was chosen in direct conference with such companies as Westinghouse Elevator and Star Electric and in which the young ladies were employed by those companies during and after the training. I believe that it was through this program that Quality Control by Statistical Methods became established in this area.

It was not by accident that Mr. Cullimore was chosen as Regional Advisor for the New Jersey-Delaware-Pennsylvania area in this program. The choice reflected the pre-eminent position of the institution of which he was the head so far as a working knowledge of the direct needs of industry was concerned.

The primary theme is that the Newark College of Engineering had a unique relationship with an industrial community, that the college has given much to that community and has in return profited very much from the association. The foregoing recital of some of the high points of this interchange substantiates the contention.

The institution as a whole and the college in particular is noted for the "solid" nature of its courses, for concentration on the core or fundamentals of subject matter, and it seems entirely probable that this is a reflection of a long experience with evening school students and the close association with those men who have applied the subject matter to actual problems.

Mention should be made at this point with respect to our program of placement. Of course properly the success of any educational venture is measured perhaps most properly by the performance of the graduates in the general field of engineering and for this reason it seems impossible to appraise the work of a school before a considerable part of its graduates have attained an age which warrants a consideration of them as professional engineers. Realizing this the college has, from the very first, paid particular attention to the placement of graduates. Of course under the old co-operative scheme the placement was more or less automatic. There was no particular effort found necessary to place men who had already made their place in one of our co-operative concerns;

and it was found, as would be expected, that if they did not make good there, that they would probably have extreme difficulty in making a place anywhere, so that the placement under the co-operative plan was largely done before actual graduation and in the general course of events which surrounded a student's academic experience. This was one of the advantages of the co-operative plan. The man was sold not on a ten-minute sampling, but on a record extending over weeks, months, and perhaps years. It was a definite advantage.

One of the disadvantages was that in times of depression co-operative students had great difficulty in obtaining positions anywhere near a professional level. This made necessary certain placement procedures not only upon graduation, but during the co-operative experience which were extremely difficult and which at times had almost to be abandoned; for while some of our larger organizations were in a position to make a considerable contribution to the training of their engineers, they could hardly be expected, in times of extreme stress, to lay off their older men in favor of young engineers in training. With the advent of the Honors Option we, of course, found our best men in the main placed long before graduation; and while the placement required a very considerable amount of work, the fact that we followed these fellows pretty closely from the personnel standpoint, from their entrance into the organization, and due to the fact that our officer in charge of placement was also in charge of the division of personnel, gave a uniformity of operation and a definite objective which it is felt was extremely important.

Now with an increased student body, and despite a leveling off in the current year of industrial activity, the scope of this service perhaps would be of interest. The period after the war as far as the placement of engineering graduates is concerned has been characterized by the demand for men. This demand from industries all over the nation brought new companies to the campus. It has been necessary to expand the staff as well as the facilities of the placement office. Two members of the regular staff devote much of their time to the placement service. A full-time secretary has been necessary to carry on the correspondence, schedule the interviews, maintain records and company information files. During this period graduating classes have reached a high of 400 men.

To handle interviews for these large classes the facilities have been arranged to accommodate as many as six different interviewers in private rooms. It has been necessary to arrange schedules for 140 different companies appearing on the campus during the Spring recruiting period. In addition, the senior students have access to listings of some 125 companies who are seeking the services of June graduates but who would prefer to have the interviewing done at their plants by direct referral of interested candidates.

As a result of intensified recruiting N. C. E. men have started their industrial careers in many different locations throughout the country from Maine to Florida and from New York to California.

During this period the alumni has done its part in helping new young engineers start out to the best advantage. Representatives of companies have very often included N. C. E. graduates and this number has been increasing. New companies have appeared on the campus for interviews as a result of the activity and influence of an alumnus. The Industrial Relations Committee of the Alumni Association has also been instrumental in its letters to industry in making the placement activity of the college most effective.

Placement, of course, is not limited to the recruitment of senior students during the Spring. This important college function goes on all year long providing a service to the industries of New Jersey and to the students of the college. Through its Industrial Relations Program it handles part-time student employment, the placement of students in the Honors Option Group for Summer jobs, placement of night school students, and alumni placement.

This is, of course, a far cry from the original activities of this division, but it has developed in the soundest manner imaginable--not handled by three or four discrete departments, but followed through consistently from the start of a man's college experience to its end, and it would not be stretching the point to say that it was highly successful. The following remarks from Professor C. H. Stephans at this point may seem pertinent:

> There were a total of 199 companies seeking the services of 1954 June graduates, of which 141 held interviews at the College.

The Placement Office scheduled 1200 interviews for graduates of the day and evening college, totaling 239 men.

This year 79 interviews were scheduled for night school men alone.

Even though most of the 1954 graduates are subject to military call, 60% of the men have reported that they have already accepted job offerings.

Salary ranges this year were all the way from $285 per month to a top offered one man of $500 per month. The average is approximately $370 per month for this year.

Again the work of the division has been characterised by the contribution of many men. Of late Professor Stephans has brought to the work a rather exceptional point of view. While all of our instructors who have been chosen—assuming on the basis of paper records—have a professional and intellectual competency above question, a primary characteristic which we seek for is character and interest in the development of younger men. Professor Stephans has brought to the work both these characteristics; and the interest in the individuals of our student body, as reflected through his work in his department, has been one of the most valuable contributions which the College has received.

Again it should be stressed that the primary reason for the existence of an educational institution is to help lead and direct young people to a life of professional achievement which is characterized by a breadth and depth which contributes not only to their pleasure and satisfaction, but to the benefit of the community, the state, and the nation. The College has at some times been under criticism with respect to too great a breadth in its ambitions and ideals but as time goes on perhaps we feel more than a little repaid for the criticism and detractions which characterize always any departure, no matter how slight, from the beaten path.

From the very first the college interested itself in the question of orientation and guidance. In fact, one of the greatest contributions made by the College was perhaps in this general field. The different methods of procedure were studied and tried. The College was much interested and took an active part in the developing of the pre-engineering inventory and for a time carried on research with the E. C. P. D. in the field of the prediction of college achievement.

In consultation with A. B. Crawford of the Personnel Division of

Yale, Dr. Bartlett was retained and for two years research went on in this general field of orientation, guidance, and counsel. The result was that under the directorship of Professor F. N. Entwisle who, about 1947, gave his entire time to this phase of our activity, there was a continuous study and rearrangement and change to meet the conditions as they then were developing and have since developed. Professor Entwisle has contributed the next few pages which give some idea of the philosophy which characterizes the Testing and Guidance Program at this writing:

"Counseling service is now commonly held to be a desirable adjunct to the operation of an educational institution, subordinate to the primary responsibility of furnishing instruction and facilities, but necessary to enable as many students as possible to take full advantage of the opportunity offered. Individual differences among students as to ability, background influences, and personality inevitably bring up occasional difficulties of adjustment to the rigors of an engineering education. It would seem to be a part of good management to assist in resolving such troubles where it is possible to do so.

"Such a concept has not always been an accepted part of the administrative policy of institutions of higher learning. It is a flower of recent growth in many and has still to bloom in some. Therefore, significance may be attached to the fact that the first steps toward the establishment of counseling in this college were taken by A. R. Cullimore as far back as 1920 in connection with the placement of those veterans of World War I who were receiving training there under the sponsorship of the Veterans' Administration. Significant too was the employment of a psychologist in 1930 to administer the diagnostic tests which were then comparatively novel tools to be used in counseling.

"Interest in diagnostic or 'forward looking' tests continued to grow among educators, and the college co-operated in the development and validation of several devices from which much was expected in the years between 1933 and 1945. A comprehensive engineering aptitude test to be administered prior to entrance upon the professional studies of the third and fourth years was developed and experimented with;

validation studies were made of the Yale Differential Aptitude Tests which gave much promise as a pre-college selection device at the time; in co-operation with the Carnegie Foundation and the Engineers' Council for Professional Development the Pre-Engineering Inventory was developed by the College for the same purpose; a Sophomore Comprehensive Test for Engineers followed.

"These projects, important in themselves, were adjuncts to the primary desire of the College administration to furnish such counseling to its students as would add to their personal effectiveness. The catalog issue of 1934 makes this significant statement as earnest of this determination: 'The College is particularly interested in study of traits and characteristics...' A control of assignments of co-operative work was maintained which took note of these factors; a personal counselor was added to the staff in 1936 to supplement the activities of certain members of the administration in this direction.

"Individual counseling was not the sole end toward which this philosophy was directed. Mass counseling, in the sense of alerting all students to the personal factors in professional success, was a part of the plan. The catalog for 1939-40 announces the establishment of courses in 'Principles of Engineering' for the first and second years as a prelude to the courses in Staff Control which had been a part of the curriculum in the third and fourth years since the beginning of the College. Principles of Engineering had nothing to do with mathematics or science or drawing or strength of materials. It might have been called 'Principles of Human Behavior' and was dedicated to the idea that 'a successful engineer must first be a successful human being.'

"Pre-college guidance was offered to the high school students of the area in 1941. Groups of high school students were invited to visit so that they might, by personal observation, see what an engineering training actually involved, in this or other colleges, as to type of work, hours, and effort. The impact of the war dulled the appeal of this service at the time. It was later to be revived in a somewhat different form.

"A measure of the significance which was attached to questions of personal characteristics was indicated by the formation of a Department of Personnel Relations in the College in 1942 to which the eminent engineer and psychologist, Dr. Lillian M. Gilbreth, was called as head.

"The pattern of attention to personality traits was now well formed, and it was natural to expect that the College would offer its services to the Veterans' Administration in 1943 as counselors to the returned servicemen.

"A relatively small number (125) were referred during that year and the next and were tested and advised on the basis of a public service. At the beginning of 1945 a formal contract between the College and the Veterans' Administration brought more than 13,000 servicemen to the Guidance Center group which had been assembled and trained to test and counsel them. The contract was relinquished in 1951, but by that time the Center group was engrossed in furnishing a similar service to clients from more diversified sources.

"As far back as 1944 the College catalog makes note of the fact that a corps of advisors appointed from the faculty had been given oversight of the scholastic progress of the students in the College, both day and evening. Since it was evident that scholastic difficulties were frequently the end result of a number of causes, such as home situations, monetary troubles, and personality involvements, the advisors were permitted to refer to the facilities of the Guidance Center for assistance. Later the students were invited to seek its aid on their own initiative, not only when in trouble, but to obtain an appraisal of their abilities and personality traits, looking toward employment in the proper phase of manufacturing activity.

"A second area of usefulness was developed through offering the services of the Center to the public at large. This was developed along several lines: individual counseling; group testing in high schools followed by subsequent consultations with Guidance Directors therein; group testing in Adult Schools accompanied by individual conferences; and finally, testing and appraisals for industrial clients who refer individuals in whom they are interested for employment or advancement.

"Thus the College seeks to discharge what it considers to be its responsibility for assisting in the development of its students to their maximum potential, and for serving the community of which it is proud to be a part. The College has never worked in a vacuum, and this is particularly true of the activities of those individuals of its organization whose sensitivity to the problems of personal adjustment has been most acute. The award of the Lamme Medal to Dr. Cullimore in 1952 by the American Society for Engineering Education for highest achievement in engineering education was a recognition of his leadership in developing the concept that engineers must first of all be truly men. Others associated with him have worked constantly with those national organizations such as the American Personnel and Guidance Association and the Engineers' Council for Professional Development and the Educational Testing Service toward the same end."

While Mr. Cullimore had assumed direct charge of the co-operative placement and the problems of co-operative work at its inception, he had been succeeded by Mr. Ernest C. Bradford as Supervisor of Co-operative work, and Mr. Bradford had been succeeded in 1924 by Mr. F. W. Lavenburg.

The first major modification of the curriculum came in the year 1928 when an option was offered in aeronautical engineering within the Mechanical Engineering Department.

In the year 1928 the courses in the College in the Junior and Senior years in the various professional departments were repeated between 5:15 and 7:15 in the evening. These courses, known as Twilight Courses, met a very considerable need for men who had had two years of college training and who found it necessary to engage in some gainful occupation while still continuing the work in the College. These courses persisted for quite a time under the name of Twilight Courses; but when the evening college work was instituted they naturally were merged with them, and disappeared as a separate phase of the College's activities. A memorandum presented to the Faculty by Prof. H. M. Jennings, Supervisor Evening Sessions, has this to say: ("See attached)

INSERT

In the year 1929-30 the registration in the Newark Technical School had risen to almost 1800 and in the College to 370. The

"You have perhaps noticed in the new Bulletin that a new administrative office has been created—that of Supervisor of Evening Sessions. This comes at a time when we are completing twelve years of development work in the field of evening classes in college work, and it seems wise to explain to the faculty now what has been done and what is the status of this work.

"In 1927 it was decided that repeating some, at least, of the courses given during the conventional college day might provide an opportunity for properly qualified students, that is, students with a considerable amount of college credit, to complete their degree requirements in late afternoon sessions. This would provide such students, while employed locally, with the means of obtaining their B. S. degrees without having to wait until they could arrange to go to college all day every day. An extra section of our Junior and Senior courses was therefore set up, giving these courses between 5 and 7 o'clock in the afternoon. This section ultimately became known as Section 43, to differentiate it from the upper class sections already known as Section 41 and Section 42. A year's experience indicated that this section should start later for the convenience so the hours were changed to run from 5:15 to 7:15. A year later the hours, because of schedule difficulties, ran from 5:15 to 8:15. In 1934, because of continuing difficulties the students had in reaching the college so early, it was decided to set the hours to run from 6:30 to 9:30. These are the hours now in force. Incidentally, I recall that this change was made only after consultation with the State Commissioner of Education, whose consent to the extension of certain parts of the college curriculum into those hours was asked and obtained. This gives you a brief history of the college Evening Sessions.

"I have said that these classes were set up for 'properly qualified students.' This means that such students are, first, qualified for admission to Newark College of Engineering or for that matter to any college, as candidates for a degree, in that they have at least 15 units of high school preparation as specified in the college catalog; and, second, that they have acceptable credits for such parts of the college curriculum as are not obtainable in the courses given in the college Evening Sessions. The first requirement is satisfied upon receipt from the student's highschool of the same certificate form, properly filled out by the Principal, as is required for admission to the day sessions. The second requirement—of so-called advance credits—is met by a record of satisfactory credits grades obtained in other colleges and universities, in Newark College of Engineering, or in Newark Technical School. I might say right here, what I shall say again later—graduation from Newark Technical School does <u>not</u> satisfy this second requirement.

"The above statements on the subject of qualifications apply to <u>all</u> students admitted to the college with advanced standing, whether they complete their degree work in the sections held early in the day or later in the day. The only difference is in the machinery set up to administer their admission and supervision. If they wish to do their work late in Section 43, their cases are handled by the Supervisor of Evening Sessions. Their applications are referred to him, and they are called in for personnel interviews with him. Their records are studied and discussed in detail, and if satisfactory to the Supervisor with respect to the general requirements of the college faculty, they are sent to the professional department heads for approval of for suggestions as to disposition.

"During registration week preceding the opening of the college year each applicant must appear again for a final interview with the Supervisor of Evening Sessions, and if acceptable as a candidate for a degree with advanced standing he must obtain the Supervisor's permission to register as a matriculated student. Except for the Supervisor's signature instead of the Dean's, this is precisely the same routine as is followed out in the case of admission to Sections 41 and 42. After he has registered, such a student is carried on the rolls as a member of the college; but until he has successfully passed through the routine just described, he has absolutely no standing in the college. This is just as true of a Newark Technical School graduate as of any other person.

"You are probably familiar with the routine from this point on. Grades are reported to the Dean, warnings of unsatisfactory work are also reported to him, and all records are filed with those of the other college students. The education of students in Section 43 proceeds under precisely the same faculty control as does that of students in Sections 41 and 42 right up to and including graduation.

"What I have said so far has been for the purpose of showing you the place of the Evening Sessions as an integral part of the college. Reference was made to the obtaining of advanced-standing credits from the Newark

Technical School. This brings up the matter of the relation of the Evening Sessions, that is, Section 43 of the College, to the Technical School. Briefly put, the Technical School has no more connection with the Newark College of Engineering than has Columbia University, or Rutgers, or Stevens Institute, or any other institution from which students may bring records of work offered to the College for advanced standing. The official designation of our Board, as set forth by the legislature, is "The Board of Trustees of Schools for Industrial Education of Newark, N. J." The act simply enables the board to set up schools. (Notice the plural). In accordance with this legislative act the Board has set up two different schools, having no educational interlocking, and no other connection excepting that the Board has seen fit to appoint the same man, Mr. Cullimore, to represent it in the administration of both schools. Naturally the Board finances both schools, but it does so on separate budgets. As to educational policy, the schools differ radically in the matter of control and administration. In the College there is a large and growing amount of faculty control, but absolutely none of this control is or can be exercised with respect to the other school, that is, the Technical School. In the Technical School there is practically no faculty control, the policy and administration being in the hands of the Director and the Supervisor of the Technical School. As to the members of the instructing staff of the Technical School, it is obviously desirable to obtain instructors with experience in engineering fields of education, if possible, to do the teaching of mathematics and science to Technical School students. Therefore, instructors who are serving on the college staff are desirable, if available, for this work. But they serve on the same basis as the other instructors who have no college affiliation. They do <u>not</u> represent the college, and do not bring down any authority from the college while on duty in the Technical School. My own connection with the educational administration of the Technical School was in no wise a connecting link between that school and the college. And my connection with the Technical School is now terminated as the curriculum revision that has been in progress for the past few years is now completed.

"To bring out more emphatically to you the fact that the two schools are not continuous, I ask you to recall my statement that graduation from the Technical School does not satisfy the requirements for admission to Section 43. There is an absolute discontinuity—actually an open gap—between the two curriculums. A graduate of the Technical School is short several credits in the list he must offer to qualify for Section 43. These missing credits he must obtain from some other satisfactory college, or junior college, or by making them up in special classes that we conduct here in the Spring, after the Technical School year is ended. To further make clear to you this discontinuity, I call your attention to the fact that all of the college Sophomores that pass with clear recorders continue automatically in the Junior class—in percentages we find that about 90% (?) of the Sophomores appear in the Fall as Juniors. On the other hand, not even one student that graduates from the Technical School continues automatically in the Junior class work of sections 41, 42, or 43. Each graduate must go through the procedure already outlined to you, if he wishes to enter one of these sections—in percentages, again, we find from 35% to 40% of the Technical School graduates finally appearing in the college classes.

"The words 'Junior College' were used advisably in the preceding paragraph. Although I am no longer connected with the Technical School, I am naturally interested in its future, as many of its graduates are to come to me as candidates for admission to the Evening Sessions of the College. As many of you have noticed the Junior College idea, already well-developed in the West, is getting more and more attention here in the East, and we have clear indications of its growing in strength here in New Jersey. This was foreseen by Mr. Cullimore several years ago, and the changes in the Technical School that have resulted in the present curriculum have given us, some years ahead of everyone else, an institution that, although not called a Junior College, is one in fact, and can be named so at any time with little, if any, change in the present set-up. And this, if I may express an opinion and a hope, is what we can and ultimately should have here, both in the day and in the evening, a Junior College, offering all students a grounding in mathematics and science, with a natural terminal at the end of the curriculum. This Junior College would be under the immediate supervision of a Dean, perhaps, performing duties similar to those of Dean Bradley. For those graduates who show engineering talent, a Senior college with a B. S. degree for its graduates. The Senior College could be under the nominal charge of a Supervisor, as is Section 43 at present, with the professional departments nearly autonomous, each under its department head, as at present. This would, in fact, be almost entirely a change on paper only. The day work of the College is already organized in precisely this way, except for the 'Junior College' graduation, and a Supervisor for Sections 41 and 42.

"The question that is so often asked--will the Technical School ever become a part of the College of Engineering--is pretty definitely to be answered "no." On the contrary, it is more desirable that the organizational changes, if any, shall come in the day sessions of the college. There we might, and I hope in time we can, offer our college students the advantages now available to the students of the Technical School, that is, a Junior course in general science and mathematics, with a stopping-off place, from which some will depart for research or other varied fields and the others go on with us in professional engineering work."

It's interesting to follow the small group who were enrolled in the first Twilight Class; and while a number of them dropped out before graduation, for many good and sufficient reasons, the graduates almost without exception made a name for themselves in their chosen profession of engineering.

The following list makes interesting reading:

NAME	YEAR GRAD.	COURSE	POSITION IN BUSINESS OR INDUSTRY
Anderson, Alfred B.	1930	C. E.	*Chief Engineer - Water & Sewer Div., Pittsburgh Pipe Cleaner Company
Armstrong, Archie H.	1930	C. E.	Manager, Newark Airport New York-New Jersey Port Authority
Bowman, James C.	1930	E. E.	*Engineer - Public Service Electric & Gas Company, Newark, N. J.
Cantlupe, Victor J.	1930	M. E.	Vice-President Le courtney Company, Newark, N. J.
Elias, Michael J.	1930	M. E.	
Fachet, Joseph E.	1931	Ch. E.	*Test Service Engineer Atlas Valve Company, Newark, N. J.
Highfield, Frederick P.	1930	M. E.	*Foreign Trademark Specialist Marks & Clefk, New York, N. Y.
Lamb, Anthony H.	1930	E. E.	Vice-President in Charge of Production Weston Electrical Instrument Corp. Newark, N. J.
Lamb, Francis X.	1930	E. E.	Vice-President & Chief Engineer Weston Electrical Instrument Corp. Newark, N. J.
Lindeman, Ralph W.	1930	Ch. E.	*Chemist & Marine Bulk Oil Surveyor Charles V. Bacon, New York, N. Y.
Newitts, Theodore P.	1930	M. E.	*Supervisor, Sperry Gyroscope Co., Inc.
Osterheld, William	1930	E. E.	*Teacher & Author - Electricity & Radio Jersey City High Schools
Rehn, Armand G.	1930	M. E.	*Administrator - Director of Practical Arts Newark, N. J. Board of Education
Schrope, Edgar B.	1932	C. E.	Engineer, Port of New York Authority
Schumacher, Harold F.	1931	C. E.	*Assistant Engineer - Public Works City of Newark, N. J.
Stuehler, Carl M.	1930	E. E.	Engineer - Engineering Department of Public Service Electric & Gas Company Newark, N. J.
Tully, Thomas J.	1930	Ch. E.	Associate Professor in Chemistry Newark College of Engineering

*Positions recorded in 1948 N. C. E. Alumni Association Directory.

College instructing staff then numbered 24. The work of the College was given ~~four~~ five days a week, Monday to Friday inclusive, and in addition from 9 A. M. to 12 Noon on Saturdays for first-year students.

In the year 1930 two events transpired which were extremely important in the development of the College. The first was the building of the so-called Campbell Hall. Some years previously property adjoining the school to the northwest was acquired by the College and for a time the apartments there were operated by the institution. When the need for room became very pressing, however, the old wooden apartment buildings were torn down and it was decided to erect on their site a recitation building of lighter construction than the Laboratory Building and particularly adapted to classrooms. The first, or ground floor, was to be used for laboratory purposes, but above that there were to be classrooms, with a gymnasium on the top floor.

The construction of the Laboratory Building, so-called, had been extremely heavy and adapted itself very definitely to the housing of heavy equipment and the need seemed to be for a fireproof building which could provide classrooms and such a building was not excessive in cost and certainly worked out and proved to be a very important addition to the College.

A little later the new building was extended so as to abut the older building on High Street and both these units together gave the College some room for expansion. In the first place, they relieved the Laboratory Building of some of the space given over to recitation and in addition provided additional recitation room space.

Also in 1930 there was created by legislation a Board of Regents whose responsibility it was to handle the finances and make suggestions concerning the institutions which were receiving state aid, but which were at that time not known as state institutions. In the field of higher education the two institutions falling into this class were the Newark College of Engineering and its allied Newark Technical School, and Rutgers University.

The Regents made a thorough study of the situation surrounding both institutions and finally decided to contract with both institutions for furnishing services to the state in the field of higher education. The members of the Board of Regents from the very first were individuals of high ideals, of great competency, and held the confidence of everyone. It was through their efforts that the funds of the institution were augmented very considerably from time to time and they were extremely helpful not only from the standpoint of the advice and direction which they gave, but from the standpoint of the presentation of the needs of the institution to the Budget Commissioner, the Appropriations Committee, and the Governor himself.

No allusion to the financial problems of the institution would be complete without mentioning in the highest terms the work of Mr. Henry H. Metzenheim; and while much of his work was primarily in the financial field as Controller of the institution, he made a great contribution in other fields as well. He was educated in the public schools of Germany and received his bachelor's and professional degrees at Cooper Union. Like most of our teachers he possessed experience in the field of his profession. In those days when the Ph. D. was not so common as it is now, and particularly in the technological fields, it was of the greatest importance to have a man who had some engineering background of a practical nature.

It was a little difficult then, and a little difficult even now, to offset the first-hand breadth of experience that was gained by contacts in the commercial world which gave a breadth and depth of experience which could not be gotten from books alone. His professional experience was with the Western Electric Company and the Crocker-Wheeler Company in Ampere, New Jersey. He came to the Newark College of Engineering in 1922 and first taught as an instructor in electrical engineering and in mathematics. For a time he was Assistant to the President and in 1938 was made Controller and for a time Supervisor of the evening school. From 1922 to the date of his retirement in 1950 he brought to the financial problems of the institution a very sound judgment, a very fine sense of values, and a most extraordinary capacity for work which had to do with financial policy, particularly with respect to the budget and analysis of costs. There was no problem too hard for him to solve and there was no limit to his capacity for sound consultation and advice. He had the peculiar capacity of being able to discover and develop some of the questions which were particularly important in preparing an institution budget and was valuable in many financial projects which came up in connection with the development of the institution.

While his work there was of great consequence, he also was a good instructor and teacher, when he took up that work in the early days, and latterly was particularly valuable in matters which had to do with accreditation through the four or five accrediting agencies which passed upon us.

Not the least of his contributions was the keeping of a set of records. In writing a history of this kind or in collecting material for any project, we would usually turn to Mr. Metzenheim for the last word in records and statistics. Such a man may not appear too important in an institution given up to educational work but his value and importance in the growing institution was great. Above all he had a sound sense of justice, of loyalty, and like most of our men in the early days was very sensitive to the point of view and needs of the developing student.

During the existence of the Board of Regents, whose work was finally terminated by legislation in the year 1947, the Board was always extremely sympathetic and helpful in all matters which had to do with the development of the institution and without their aid, I think it would be only fair to say that the development of the College would have been very much slowed and considerably retarded. The College owes much to their collective judgment and much to the interest which their Chairman, Mr. Henry W. Jeffers, and their Vice-Chairman, Mr. Charles A. Heiss, gave to the project.

Special mention should perhaps be made of Mr. George O. Smalley who in 1952 was made President of the State Board of Education. At the termination of the work of the Regents their functions and powers were turned over to the State Board of Education and certain members of the State Board of Regents were transferred to the State Board of

Education so that so far as the College is concerned, the function of the Regents has been projected and carried on by the State Department of Education, particularly under the jurisdiction of Commissioner Bosshart and Commissioner Raubinger. The work of the State Department of Education has gone on in much the same way and in as helpful a way as it did under the Board of Regents.

The laboratory facilities were being gradually but definitely improved and the size of classes had increased so that normal operation with efficient control was possible. At this date the electrical courses seemed to be the most popular and civil and chemical engineering were increasing in popularity.

In the year 1930 there were 32 graduates from the College, compared with 8 in the year 1923. During this period a Department of Civil Engineering had been added to the other departments and a degree of Bachelor of Science in this field was granted.

In the year 1935 we found the number of night school students decreasing very perceptibly from the high point of 1800 in 1929-30 to about 800 in 1935-36. The College registration, however, had almost doubled to 766 by that time, whereas the night school registration had decreased about 50%. By 1935 the faculty and instructing staff had increased to 49.

In that same year the opportunity to enter the College as a Freshman in February was instituted. This not only took care of a good many students who graduated from a local highschool in February, but made it possible, by working all the following Summer, for a Freshman student who failed in the first semester of College, to continue his work and enter the following year's work with his class. This proved to be a very important step in the development of the College and insured a second chance which seemed altogether in line with the policy of the institution.

At this point the tuition had risen to $170 for residents of the state and $340 for non-resident students.

Development of the Department of Civil Engineering was progressing very satisfactorily and it is interesting to note that in charge of the department was Professor H. N. Cummings, afterwards Vice-

President of the College, and as an assistant, Mr. Robert W. Van Houten, who afterwards assumed the Presidency of the College.

In 1936 the College had progressed to the extent where it was accredited by the Middle States Association of Colleges and Secondary Schools and its courses in Civil, Mechanical, and Electrical Engineering had received the approval of the Engineers' Council for Professional Development. At this time it was not deemed wise to make the modifications in the course in Chemical Engineering suggested and required by this latter accrediting agency, and the wisdom of this choice seemed to be borne out by subsequent development following in the years immediately after 1936.

By this time the various professional courses in the College were represented by our respective student branches and this proved to be a very considerable help not only to the morale, but to the maturity, of the student body as a whole. The reflection of these student branches, which were always taken seriously by the College, not only developed professional consciousness in the upper classmen who were leaders in these various branches, but were reflected on the under classmen and the development of this question of professional consciousness had begun to affect the whole institution and be rather typical of its philosophy.

About this time there was instituted an alternate five-year course so that the students who found it difficult to complete the work in four years could cover the same amount of ground in five. A few of the students took this course, but it did not prove particularly popular and was shortly discontinued.

By 1938 an arrangement was completed with the Massachusetts Institute of Technology where the facilities of their Summer camp in East Machias, Maine, were made available to a limited number of students who were selected on their proficiency in surveying and their general excellence in scholarship work. This was a great help and served to add a very considerable incentive to the students in the Civil Engineering course.

In the year 1938-39 the registration in the Newark Technical

School was 1038. The College registration was 887. The College faculty and instructing staff at that time numbered 81.

Although the Newark College of Engineering had for a long time given graduate courses as discrete courses, meeting needs as they arose on the graduate level, these courses were specialized and were not arranged into a formal curriculum until about the year 1940 when a regular program of advanced work was offered. In April of that year, after a series of consultations between Dr. T. S. Taylor of Newark College of Engineering and Dean Frank C. Stockwell of the Stevens Institute of Technology, a joint program of study for graduate students was initiated between the two institutions. The important points of this co-operative program were outlined in a brief and informal statement and agreed to by both institutions.

Courses at the Newark College of Engineering were available for credit to graduate engineers who could satisfy the admission requirements of the Graduate Division at Newark and at Stevens. These courses were to be given by the faculty of the Newark College of

Engineering. Credit for the courses taken at Newark might be applied toward the requirements of the degree of Master of Science at Stevens. Announcements and bulletins included a statement of the co-operative arrangement and a description of the approved courses. The courses given at Newark were approved by Stevens and did not conflict with work given at Stevens.

The courses, both at Newark and at Stevens, were not limited to graduate engineers, but were open to any college graduate with a qualifying background. In general they were necessarily open only to those who had a thorough undergraduate training in mathematics and one of the physical sciences.

From the point of view of the Newark College of Engineering one of the chief difficulties in this arrangement lay in the fact that no course could be offered at Newark which duplicated any given at Stevens. This eliminated from the Newark program certain popular courses such as Advanced Calculus, Advanced Organic Chemistry Lectures, Functions of a Complex Variable, etc.

In planning for the institution of a graduate school at the Newark College of Engineering, endowed by the state of New Jersey, with the power to grant a graduate degree, it seemed that the most pressing problem was that of obtaining professors who held the Doctor's degree and who were also able to give graduate work. The College had at that time a number of men who were well qualified to give graduate courses and who had had some years of successful experience in graduate teaching, but they did not hold Doctors' Degrees. In the opinion of Dr. Robert H. Morrison, Assistant Commissioner of Education in Charge of the Department of Higher Education, it was not advisable to have on the graduate faculty too great a number of these. It was suggested the proportion should be such that a student would be unlikely to take more than 20% of his work under instructors without graduate degrees.

During the whole of Dr. Morrison's incumbency he followed the lead set by Dr. O'Leary and showed a spirit of co-operation and willingness to consider our problems which were of the greatest possible value to the institution. On his part the effort was sustained at a high level throughout the entire history of the institution during his period in office and he still is active and interested in the development of the work of the institution.

It should be said here that although it has been indicated before that the reaction of the State Department of Education, through its Commissioners and Assistant Commissioners, has been of incalculable benefit and one of the greatest factors that was active in the development of the institution. This was a rather unusual circumstance and it should receive more than a passing mention. In the development of institutions of any kind, particularly public institutions, it is necessary to have the good will of not only its clients, the students, but also those who control the pursestrings and who necessarily must give objective judgment upon matters of finance, upon appropriations and grants and subsidies. Our relationships with the State Department of Education, the Commissioners of Education, and the New Jersey State Board of Regents, not to mention the individuals who occupied the Governor's chair, all seemed to be men who properly required an efficient stewardship, and when this was shown, and when the work of the institution was understood, there was never any hesitancy in giving the adequate support.

The same thing should be said with respect to the Mayors of Newark. As the Ex Officio members of the Board they took a definite interest. We could call upon them for help when help was needed and uniformly we felt that we had no antagonistic occupants of either the Governorship of the State or the Mayoralty or Commissioners in Newark. In fact, the budget hearings before both the city and the state, after a few years of preliminary investigation and jockeying--entirely proper--became pleasant meetings rather than inquisitions. Once the fact having been established that our budget was simple and direct, and that we asked for nothing except that which we really needed, the confidence was passed on to succeeding Budget Commissioners and to succeeding Newark Commissioners and the question of proper support of the institution was never difficult of attainment.

It is true within the first few years a fight was necessary occasionally, but only occasionally; and if the fight was hard enough, the memory of it carried over from year to year and the path was made smooth. One year the institution asked for decreased appropriations, that is, decreased from the prior year, and the effect upon the brethren in Trenton was so marked that it is still a matter of discussion and sometimes persiflage. The whole thing was quite different from the experience that some public-supported institutions have had with hostile Governors and hostile legislators.

The only procedure used was to try to impress the power of the purse that the way to make a budget was to put down your expenses on one side and your income on the other, find out which was the greater, subtract the lesser from the greater, and ask for the difference. Never did the institution face the accusation of a padded budget which they came to believe was the price of success.

One observation should probably be made at this point and that is that perhaps the greatest mistake to be made is to assume that municipal and state authorities are not competent in the field of finance; but an experience of 30 years with this institution would disprove that theory absolutely. If we assume competency on the part of the appropriating officials, and if we assume a desire to meet the actual needs of an institution which is rendering a distinctive service to many people, with these two assumptions in mind, it seems evident that no particular difficulty arises.

In order to start the Graduate School it was necessary to first present a petition to the Department of Public Instruction of the State of New Jersey, asking for authority to grant a graduate degree and to have this petition approved. It had to be endorsed by our own Board of Trustees and show the scope of the planned curriculum as well as the proposed requirements for the degree.

By the year 1943-44 the number of courses offered was 18 and the number of courses given was 14. The number of registrations was 138, and the average students per course was 9.9. The tuition collected was $4458 and the payments to instructors was $3750, for a difference of $708. The laboratory fees collected were $670.

As time went on it became increasingly evident that it might be advisable to secure authorisation from the State Board of Education to give graduate courses in the Newark College of Engineering and to break away from the arrangements with Stevens which, while they were satisfactory in an overall sense, presented certain difficulties, particularly financial and operational, which hampered the development of the graduate program.

In the Spring of 1946 the College took the first step in setting up its own graduate program; and after conferences with Dr. Morrison, Assistant Commissioner of Education, a proposed graduate program was set up, the details of which have no particular place in this narrative recital.

It is, however, interesting to note that in June, 1946, a definite formal program was set up to enable the Newark College of Engineering to offer graduate work in the four fields of engineering in which undergraduate curricula were offered in the College, with an addition of a program in aeronautical engineering. The co-operative work with Stevens served as a very important pilot operation in connection with the development of our subsequent graduate program.

The development of the present Graduate Division stemmed from not only the co-operative arrangement with Stevens, but from the integrated five-year courses and the feeling was that rather than superimpose another year on the baccalaureate course, it was perhaps proper to study very thoroughly the possibility of integrating the graduate course with the course for the Bachelor's degree.

The arrangement with Stevens persisted for quite a time after the College had received the right to grant its own graduate degrees and in later years took on the form of an arrangement for the interchange of credits between the two institutions, which arrangement was very beneficial to the College and served to benefit the graduate students in the metropolitan section of northern New Jersey.

By the year 1949-50 the co-operative arrangement with Stevens was still existent on this basis and the catalog of that year has this statement to make:

> By special arrangement, students registered for advanced degrees at Stevens Institute of Technology may receive credit for courses taken at Newark College of Engineering, not to exceed 14 credits. Such students are required to obtain the approval of their advisors at Stevens Institute for such courses and submit this approval at the time they register at Newark College of Engineering.

Students matriculated at Newark College of Engineering may be assigned to courses offered by Stevens Institute of Technology and receive credit for courses not exceeding 14 credits with the approval of the Chairman of the Department in which they are matriculated for an advanced degree. Arrangements for credits and courses involved in the co-operative program may be made through James A. Bradley, Dean, Co-ordinator of the Stevens Co-operative Program.

In the year 1950 the co-operative work with Stevens was terminated and the College operated its own autonomous graduate program under the direction of Dr. Irving F. Orens who followed Dr. Cassier as Chairman. Dr. Orens had assumed the position several years before and had given to the work of the Division both continued and competent support.

So, to recapitulate, in 1946 the State Board of Education authorized the establishment of the Graduate Division. Up until about 1950 this Division was operated to some extent—but to a lessening degree each year—with the Stevens Institute of Technology; and in 1950 the College went on its own, offering degrees in Master of Science in Chemical, Civil, Electrical, and Mechanical Engineering, and since the year 1949, Master of Science with a major in the fields of Chemical, Civil, Electrical, Mechanical, and Management Engineering.

The following comments on the growth of the Graduate Division submitted by Dr. Orens, the present Chairman, will prove of interest at this point:

"With the increased demand by industries for men with specialized training in engineering beyond the Bachelor's Degree level, the College in 1946 entered into an arrangement with Stevens Institute at Hoboken whereby a number of graduate subjects could be taken for credit at Newark for men who were matriculated at Stevens and working for the Master's Degree. This program was carried on through 1947 and 1948. A number of these early students thereby were enabled to earn their Master's Degree from Stevens.

"Starting in the Fall of 1948 the graduate work given here expanded significantly. For that year, 1948-49, we had 298 students registered in our graduate school, 30 instructors, and 4 Master of Science graduates. From that time on the growth of the Division in courses, number of students, and faculty has been phenomenal. For the year just ended, June, 1954, we have had 657 students with 1001 course registrations. The faculty now numbers 59. Among the students were men who obtained their first degree in 112 different colleges.

A breakdown by departments shows the following registrations this year (1953-54):

Chemical Engineering	176
Civil Engineering	46
Electrical Engineering	179
Management Engineering	106
Mechanical Engineering	124

"In our Graduate Division some comparisons with other colleges are interesting. In the entire country a study was made last year, October, 1953, by the United States Office of Education. One hundred and twenty-three institutions of higher learning, providing opportunity for graduate study in engineering were canvassed to obtain figures showing registration for post Bachelor Degrees. All these institutions enjoy accreditation by the Engineers' Council for Professional Development. In this study Newark College of Engineering ranked number 7 in the total of registrations for graduate study in the 123 institutions. The only institutions to have more graduate students than Newark College of Engineering were the Polytechnic Institute of Brooklyn which ranked Number One, and then in order: New York University, Columbia University, Illinois Institute of Technology, Massachusetts

By 1954-55 the institution had risen to 4th place.

Institute of Technology, and University of Pennsylvania. These figures probably illustrate better than any other method the tremendous growth our Graduate Division has enjoyed during the six years it has been functioning:

Consolidated Report on Graduate Division
Newark College of Engineering
1948-1954

	*1948-49	1949-50	1950-51	1951-52	1952-53	1953-54
Student Registrations	298	385	448	540	592	657
Course Registrations	-	578	676	797	913	1001
Graduates (M. S.)	4	26	62	87	99	**113
Courses Offered	-	34	38	40	38	45
Instructors	30	31	32	39	49	59
Departmental (Student Registered):						
Chemical Engineering	-	85	103	133	149	176
Civil Engineering	-	25	39	46	50	46
Electrical Engineering	-	78	103	159	168	179
Management Engineering	-	73	86	96	105	106
Mechanical Engineering	-	69	96	87	104	124
Number of Colleges Represented	-	67	76	88	103	112

*1946-1948: Under the combined NCE and Stevens Program. Little information available in the Division Office and the registration figure is approximate.

**Applications for Candidacy.*

The history of the graduate school was one of continuing expansion and development to meet the very definite needs of engineering school graduates in the New Jersey metropolitan area and its history up to 1950 was one of continuing expansion and development to meet a tremendous and ever-increasing need.

Beginning in the year 1940-41 the co-operative work was modified upon the suggestion and the further insistence of the Engineers' Council for Professional Development. Two full semesters of academic work were given to senior students. The co-operative work for students affected by this arrangement was increased and given during the summers following the Sophomore and Junior years. This work took the place of the alternating schedule which was then in effect for Seniors.

The summer co-operative work had the same purpose as that previously given in the Senior year. It served as an industrial engineering laboratory where the men worked under commercial conditions, commercial standards, and commercial criteria. The work given in industry under the supervision of the college was, however, limited to those men who had shown maturity, accomplishment, and development in the first two years of their college work. It was in the nature of a premium given to those men who were likely to profit from it, along with other premiums in the way of scholarships, exemptions from examinations, etc. This particular group was known as Honors

Option and were recruited from those men who had exceptional scholarship attainments. The development of this Honors Option was perhaps one of the most significant steps in the development of the College.

The choice had to be made between an extended five-year co-operative course and a four-year course with the traditional calendar covering four academic years. A very careful survey of the situation in this metropolitan area led definitely to the conclusion that a five-year course leading to a Bachelor's Degree could not operate in competition with a four-year course leading to the same degree, where geographically the choice was one which could be made.

In adopting the Honors Option it was thought that many of the beneficial factors of the co-operative program could be kept, while some of the more objectionable ones could be dropped. The program, in the first place, was flexible, particularly in times of industrial depression when the placing of a fixed number of co-operative students was difficult. The optional character of the work seemed to be a very considerable advantage, and the work as it developed in the next few years, and even further, seemed to not only justify the change, but to be a step in the right direction.

The difficulty with the co-operative work seemed to be primarily that many students not particularly interested and with a lack of intelligence and maturity failed to appreciate the opportunity which the work gave to round out their theoretical experience. Students were judged mainly by the failures, rather than the successes; and by putting into co-operative employment only our best men we not only created a proper point of view in industry, but gave to the men who would appreciate it the opportunity to have commercial experience.

While there is no intention of in any way disparaging the co-operative course as it primarily existed in the College, it should be said that a choice between a five-year old-line co-operative course and our modern conception of the same philosophy in the Honors Option was not difficult.

While subsequent material has dealt with the development of the Newark College of Engineering, something should be said about the parallel development of the Newark Technical School. The work of the school, after the institution of the college courses in 1919, gradually abandoned the courses of strictly vocational nature as they were taken up and developed by the Vocational Division of the Newark Public Schools and later by the Essex County Vocational Schools.

In 1920 we find a General Technical Course of five years; a course in Technical Electricity, a course in Technical Chemistry, and a Mechanical course, all of which were four years in duration. However, we see that the courses for machinists, toolmakers, and draftsmen, etc. are gradually disappearing. The old General Technical Course which was the stem course of the Newark Technical School led to the diploma and the title of Technical Graduate while the other three courses granted a diploma with the title of Associate Engineer. The work in the last three courses roughly paralleled two years of college work. In the General Technical Course tuition was usually $15 a year and in the other courses, $25 a year.

About 1922 a Civil Engineering course was added to this group of four-year courses, leading to the title of Associate Engineer and a diploma. By that time the strictly vocational courses had dropped to five.

There was instituted about the same time a third division known as the Preparatory Division which gave two years of preparatory work for each of the Associate Engineer courses. This was made absolutely necessary by reason of the fact that it was practically impossible to send older men and women back into high school in association with very much younger students to pick up the necessary credits to enter the more advanced technical work.

The history of the General Technical Course is interesting from the fact that there seemed to be a growing insistence on specialization in the evening and the General Technical Courses as such decreased in enrollment while the other courses consistently increased.

About 1924-25 an attempt was made to ascertain whether or not there was a need for specialized vocational courses at a higher level than the vocational schools and a number of courses were set up with this idea in view, but they did not develop sufficiently to warrant their retention. The course in architecture was successful but the costs of instruction, to give a proper course in architecture, were so high as to prove unacceptable to part-time students and the course was eventually discontinued.

Throughout the period 1920 to 1928 the Mechanical, Electrical, Chemical, and Civil Engineering courses offered in the Newark Technical School had gradually taken on the character of the first two years of academic work given in the College. About ~~1926~~ 1927 students graduating from these evening courses became eligible for entrance in the Junior Class of the Newark College of Engineering after the completion of some supplementary work and many young men of ability found it possible to switch from the part-time evening work to the full-time work in the College, attending classes during the day.

In 1929, with approximately 1800 students, the greater proportion of the students were in the Associate Engineering Courses and the General Technical Course had shrunk very perceptibly, while the courses of vocational content were barely holding their own. At this time those taking the Associate Engineering Courses were charged a tuition of approximately $45 a year and the Preparatory Course students paid a tuition in the neighborhood of $50 a year.

By 1933-34 the Preparatory Courses and the Associate Engineering Courses carried the bulk of the enrollment. The General Technical Course was still retained but the vocational courses had completely faded out of the picture. So from this date on the enrollment can be considered to be enrollment in Preparatory work plus the first two years of college work. It should be noted that the general transition from the vocational work at night to the college work and the college preparatory work was paving the way for the institution of full degree courses at night.

The first step to introduce the full degree-granting evening course came in the year 1934 when the content of the work in the Junior Division classes of the Newark College of Engineering was given under the auspices of the Newark Technical School between the hours of 7:30 P. M. and 9:30 P. M.

In the year 1937 the work of the evening school had covered the four years of day work leading to a degree but still retained the Associate Engineering Courses and granted at the end of four years a diploma, and a degree at the end of eight; and we see the work then included in the various programs alluded to as engineering.

The vocational courses eventually, of course, disappeared and with them the Preparatory courses, so we find by the year 1940 that all the courses given in the evening school, as well as those given in the day school, were of college grade and it certainly is fair, at this point, to indicate that the undergraduate enrollment totaled 1163 in the evening and 1208 in the day, giving a total of 2371 students.

IN 1940-41 there developed Government training in the war industries and the United States Government asked the College to participate in this project. Mr. Cullimore was named "Regional Advisor" for New Jersey, Delaware, and Pennsylvania.

During the ensuing four years the College trained in special classes, both day and evening, a total which reached 2500 students in the highest year. This effort in national defense was extremely strenuous but served to keep fully employed the faculty who were teaching during that time and to fill up any gaps left vacant by the students who went into military service. The records for these years are difficult to compile and interpret because of the fact that special courses were offered; because of the fact that the College handled a considerable number of men under the auspices of the Government ASTP, in addition to the ESMWT; and because of the introduction of so-called accelerated courses. Suffice it to say though that during this war period the College worked to full capacity; and while some of the old traditional curricula were temporarily abandoned, the College survived and came out of the experience very much strengthened.

During the whole of the development of the Technical School and the College a need was felt for certain non-credit courses to be given because of a definite need in this locality—courses of a technological character but courses which were of direct benefit to the industries and their personnel in this immediate locality. Such courses had been given since the very foundation of the evening school—courses, for instance, in plumbing, and in electroplating, and as time went on these courses assumed a character which made them a very valuable part of the work of the institution.

After the experience with this type of course during the war in ESMWT the administration decided to make them a special part of the work of instruction and the Special Courses Division was instituted. Professor Keller served for two years as head of the Division and was succeeded by Professor C. H. Stephans. His interesting comments which follow seem pertinent:

"The program of so-called non-credit courses during the period after the war was an outgrowth of the training given under the Engineering Science and Management War Training offerings which were so effectively taught under the auspices of the Federal Government.

"These post-war developments were in the nature of a step-by-step process which has been a continuing program. The basic philosophy of this newest division of the College reflects the close relationship with industry which marked the origin and progress of the College. The rapid increase in the demand for technically trained personnel in industry emphasizes the service which can be performed for industry by offering courses which will aid in the upgrading of men and women in their work.

"The first step in the process was to establish these courses which would satisfy the requirements of men and women who wanted to return to 'civilian' employment from the so-called 'war industries.' Having developed these courses, the next step was to provide those students with an educational objective which was within their grasp. This was done by arranging a series of twelve certificate programs at a technician level which would be given recognition by industry. These were established by programs in Architectural Aide, Civil Engineering Aide, Mechanical Design, Industrial Supervision, Electrical Engineering Technology, Tool Design, and others.

"With these programs as a nucleus, the enrollment in this department's offerings grew from an original 200 to a registration in the Fall of 1953 of 750.

"At this time new objectives were added to the work of the department. It was necessary to arrange certain specialized subjects, conferences, and seminars for technical people in industry. These resulted from surveys of industries' needs. They were formulated with the co-operation of educational committees in local technical societies. They were developed with the aid of advisory committees whose members came from representative industries in the New Jersey area. In some instances they were devised for a specific company with the training director. Some of these deal with Sales Engineering, Technology for the Finishes Industries, Instrumentation, Safety, Executive Development, and many others. A series of eight lectures on Prestressed Concrete drew an audience of 900 when it was presented in the Spring of 1953. It is in presenting current technical knowledge to a vast audience of industrial people that conferences of this type in which the College can make a valuable contribution to the people of New Jersey."

The period following 1940 presents some difficulties when we attempt to give statistics concerning enrollment because of the various types of courses and curricula. Of course it should be understood that in a proper sense the question on enrollment is hardly indicative of the amount of work done in an institution. A student taking a regular undergraduate course may involve as much as 25 contact hours per week where in some Special Division courses the amount of contact might be as low as two or three hours a week. So any statement of enrollment without a statement of the amount of time the student is enrolled is extremely misleading so far as the actual work of the school is concerned. The only thing the total enrollment really gives is the total number of persons with which the school has had some direct contact in some field for an indeterminate amount of time.

During the war years and under the auspices of the so-called ASTP, Army Specialized Training Program, the College carried on classes for approximately 300 students. The type of work as laid down by the Army was hardly professional engineering in the strictest sense of the word, but there seemed to be a necessity for helping the Government with a program which at the outset bore considerable promise. The institution found extreme difficulty in the housing problem and finally arrangements were made with a former club building in East Park Street where the students were quartered and the local Howard Johnson people furnished the mess facilities. It could hardly be said, perhaps, that the ultimate objective of the program was ever reached. Although we were not perhaps in thorough sympathy with the program, it seemed highly necessary for us to co-operate from the standpoint of trying to help the Army where help was needed. Of course circumstances transpired during the development program robbing it of some of its basic values, but at least we did our best to help in the emergency.

The same general feeling animated our work with respect to the so-called accelerated courses which seemed necessary at the time, but which were strictly an emergency measure and, at least in the opinion of the writer, were of doubtful value.

Another program, ESMWT, that is, Engineering, Science, Management War Training, had rather different objectives and was on the whole helpful, particularly in upgrading personnel in some of the defense and war plants. Mr. Cullimore, the then-President of the College, was Regional Advisor for the states of New Jersey, Delaware, and Pennsylvania, and within that area about 35 colleges co-operated in giving courses of immediate value to the war effort. Classes were set up in various institutions, including the Newark College of Engineering——classes which generally met the specifications of various neighboring war industries——and the work was carried on by our own supervisory staff and our teachers were augmented in considerable numbers from men actually engaged in industrial work. The program offered considerable help to various industries and individuals and in many cases it was felt that these courses were amply warranted.

The contacts with other institutions in the neighborhood were such as to be of broad benefit to the College and at least served to bring the whole group of colleges in this region into a better understanding of the common objectives and induced, it seemed, a spirit of co-operation which was very desirable.

Certain in-plant training was taken up by those institutions with an extension staff, and coupled with the in-plant training program of vocational people, covered a field which was in critical need. The whole organisation, development, and functioning of this program was carried on very satisfactorily under the Department of Education and the Federal Security Agency and at least in this one instance the institution felt that it had contributed much toward the success of the program.

It should be said that the reason why this particular institution could render a very considerable service was because of the direct contact with industry which had characterised our operation from the very first through the co-operative work and the Honors Option. It should be added, parenthetically, that the influence of the older parent institution, the Technical School, was felt distinctly to be helpful in this particular undertaking. Many of the men that we contacted on the operational level were Technical School graduates and they gave unsparingly to the College without any thought of distinction between the two phases of the work of the institution. It should be stated over and over again that the whole development of the Newark College of Engineering was made possible by the fundamental basic contacts of the students of the older Technical School.

The acceptance of the program and the development of the ROTC with its effect on the institution and its educational policies will be treated in another chapter of this report.

It is possible to make some broad divisions which will indicate to some extent the character, or perhaps better, the characteristics of a student body, with respect to their courses or curricula.

Perhaps it would be well to indicate that in the year 1946-47, when the war was over and things had gotten back to a certain extent to normal, we had 1406 students registered in undergraduate work in the College. In the College work in the evening there was a total of 868. In the Newark Technical School, taking courses of less than college grade, we had 63. The Special Courses Division, which consisted of courses adapted to certain technological and specialized fields of endeavor, enrolled 254, and the Graduate Division, 235; giving for this year a total of 2826 individuals who had some contact with the school.

By the year 1948-49 there were no students taking courses of less than college grade in the evening and overall enrollment was 2951.

In the year 1951-52 the picture had not changed perceptibly except that the undergraduate enrollment had fallen off considerably, the evening enrollment had increased to about 1,000, and the Graduate Division showed a marked increase, standing at 568.

In the year 1953-54, which is the last on record, the undergraduate enrollment record stood at 1102 and the evening enrollment at 1155. The Special Courses Division had increased to 818, and the Graduate Division to 700.

A word should be said about the physical facilities which were employed by the institution in its progress and development. The first quarters, as has been indicated, were rented in a building on East Park Street in Newark which were ill-adapted to purposes of instruction. The Technical School operated here for a period of about ten years, up until 1895, when the new building on High Street was built. The difficulties in securing funds for the erection of this building have been indicated in their proper place; but like all pioneer work or first attempts, the difficulties of raising money for the first building were tremendous and involved a great amount of personal solicitation and took a very considerable amount of time. This building housed the institution from 1895 to 1922 and it should be remembered that during this period the great bulk of the work was in the evening; and what was more important so far as basic considerations were concerned was that the great bulk of the work was in classrooms or in recitation, the students in the main being busy during the day in the various industrial plants in Newark, and at that time and with that character of courses, they had little need for laboratory equipment, the work during the day constituting the laboratory or practical experience.

For that day and that time and in that period of the development of the institution its own building was adequate and served to enhance the prestige of the institution which, if it were to develop finally along the lines as envisioned by Dr. Colton, was of fundamental importance. However, this building was soon outgrown and another building called the Laboratory Building was built in the year 1911. This building was of a heavy reinforced concrete factory-type construction. It was a very sound move for it allowed all laboratory equipment to be moved out of the High Street building into the Laboratory Building on the corner of Summit Street and Summit Place; and not only did it provide some additional classrooms at the moment, but it enabled us to construct the next building very reasonably as a classroom building of lighter construction.

Some time around 1924-25 property was acquired on Summit Street contiguous to the Laboratory Building and a recitation hall with a gymnasium was built, ~~fronting on Summit Street,~~ which provided needed classroom space and gave us some degree of facility for physical activity and recreation. The building was of entirely modern fire-proof structure, but as has been indicated was primarily designed for classroom use. It has proved to be very effective, although reasonably built.

A few years after another building was built adjoining the classroom building ~~which was named Campbell Hall.~~ This new building extended from Campbell Hall to ~~the old building on High Street.~~ Summit Street This building was of the same general character and served to expand further our classroom facilities.

The last unit to be added in the year 1947 connected the old Laboratory Building with the older recitation and administration building on

High Street. In building the new unit funds were secured by a direct grant from the state legislature coupled with a bond issue of the city of Newark.

The new addition was entirely modern and up-to-date in every regard and served to considerably extend and expand our Laboratory space, particularly in the departments of Mechanical and Electrical Engineering. This building was so designed that it might in the future properly supplement a building on High Street to take care of the replacement of the first building which was built in 1895.

In 1947-48 the property of the old Newark Orphanage was purchased on High Street between New Street and Bleeker Street. This furnished a possible site for expansion and the existing building was such that it would grace any institution of learning. It was an old landmark of Newark, structurally sound, and adapted to administrative purposes and perhaps it should be remarked here that with respect to administrative purposes, age in itself is no particular detriment to a college building. In all colleges, perhaps, we have something in the way of an ancient structure which is supposed to strike veneration deep into the hearts of the alumni. At least in connection with the development of the orphanage it was possible to use it for administrative offices, financial offices, cafeteria, and the housing of the Guidance Center and other related activities.

In the development of any new plan for the expansion of the institution the vacant ground in the rear of the building, fronting on Summit Street, might possibly furnish the basis for a building of considerable proportions so that the history of the school goes from a rented building on Park Street to a building of older type erected in 1895 on High Street, a building then on the same plot on the corner of Summit Street and Summit Place, then the so-called Campbell Hall facing on Summit Street, with its annex built a little later, and finally in closing the quadrangle, an addition to the Laboratory Building which completed that particular development. A rough sketch is attached. Last of all, we acquired a tract one block removed from the first buildings which serves not only a good current purpose, but is capable of some considerable expansion.

The administration of Mr. Cullimore, extending as it did from January, 1920, to the Spring of 1949, posed some very serious and some very interesting problems to which a considerable amount of thought was devoted and to which also a very considerable amount of energy and activity was necessary. Perhaps the first and a very important problem was how to make a college known in its community, and favorably known. The college had just been founded when Mr. Cullimore came and it had no reputation either good or bad in the community simply because it was not known; and as the financial assistance was derived from the community, including the city and the contiguous state territory, in order to properly reflect the community and in order to properly ask for support, the school had to be known, and favorably known. This problem of public relations had very closely woven with it the problem of financial support and the problem of recruiting a considerable and a high level of student body.

As has been indicated, these things were not separate factors but were directly interrelated and one bore upon the other. If the college had had a reputation and if it had many graduates who were active in the area, the problem would have been much easier; but without any previous academic standing in the baccalaureate field, the problem presented some serious difficulties.

Then too there was nothing in the way of equipment in the laboratories. That is, there was nothing in the way of equipment which could properly be indicated as sufficient for undergraduate teaching for the bachelor's degree. Before the institution could properly train young men and hope to obtain competency in the engineering field for its graduates laboratories had to be established and developed and this was a major problem which, as can be seen, was interrelated very closely with the problems as presented above.

The school had only evening courses, that is, the day courses of a technical institution type were never highly successful and the number of students enrolled was so small as to hardly warrant the continuation of the courses. The men who came at night were men who were working during the day. They usually worked in places where the actual laboratory equipment was close at hand. They received instruction along the line of their vocation and it was not necessary in this supplemental academic instruction; but where it was necessary to build up a background of science, it could not be done unless proper laboratories were developed. There was, of course, a chemical laboratory and some mechanical and electrical equipment had been loaned by the United States Government for the training of veterans but this was a temporary situation and one which might at any time terminate, leaving the college high and dry. Not only was there no equipment in the laboratories, but there was, as a matter of fact, hardly any laboratory space available. Fortunately the so-called Laboratory Building was built to support heavy floor loads and was admirably adapted to the use of laboratory equipment of either a light or heavy type.

Insert Attached

It seemed then that the first thing to do was to build an academic building, so-called, that is a building which was designed for classroom purposes and to move and develop all our laboratories in the laboratory building. This could be done, of course, at much less cost than trying to build another building of heavy construction to house the new equipment when and it if was obtainable.

There were several men in Newark who seemed to take particular joy and delight in helping us with our laboratory equipment. One of these was Mr., later Dr., Frederick O. Runyon, who ultimately came to be a power on our Board of Directors. In the early days when he replaced machinery or instruments of any kind, it was a part of the specifications that the apparatus being replaced be put in first class order and delivered to the Newark College of Engineering.

Other men were very helpful, such as Mr. Arthur Lunn, who has been mentioned.

There is one story has come to us that Mr. Uzal H. McCarter's yacht, the "Josephine," was having some smaller diesel engines removed and replaced by large ones. Professor Robert Rice of the Mechanical Engineering Department was asked to go down to Long Island and look over the old diesels, the hope being that we might acquire them from Mr. Uzal McCarter, who was then President of the Fidelity Union Bank and Trust Company.

I immediately put on my hat and went down to see Mr. McCarter and told him what I heard and he as quickly asked what price I would put on the two engines. I don't remember exactly what the prices were but I do remember that there was a small one and a large one and the price on the small one was, let us say, $300, and on the large one, $900.

Mr. McCarter immediately asked me if I was willing to give him that much for them. I said, "no." He said, "How much will you give me?" I said I had hoped that he would give me one of the engines as a gift and he said, "Which one do you want?" I told him that the small one would be less expensive to move, it would cost less to operate, and it would serve to illustrate the principles just as satisfactorily.

He said, "When will you call for it?" I said, "This afternoon." Then we exchanged some pleasantries and I thanked him, and as I left his office I heard this muttering and growling behind me and managed to catch the word "hat." I looked down at the hat I carried and in it in gold letters was the name "Uzal H. McCarter." It might be mentioned in passing that it was a very good nice new hat. So then I went back into the office and Mr. McCarter said, "I give you an engine and you steal my hat."

I pleaded the mental equipment of an absent minded professor and told him I must have been thinking about something else. Characteristically, he inquired, "What were you thinking about?" For once I seemed to have an inspiration and said, "I was thinking about how foolish I was not to ask for both engines." "Well," he said, "you can have the other one if you want it."

After that he frequently inquired as to the performance of his laboratory equipment and was helpful in securing equipment of all kinds.

To give some idea of the extent of the problem, it might be interesting to note that the amount of the state contribution at that time was in the neighborhood of $10,000 a year. The contribution from the city was about the same amount. The capital expenses necessary were so great as to make it impossible to ask for enough money to make this development possible within any specified time and the problem finally resolved itself into a question of asking from both the state and the city amounts which seemed possible of attainment but which ultimately would give to the college the necessary capital funds. This had to be rather carefully done because on the one hand the taxpayers were to be considered and the possibility of state and city grants had to be considered and on the other the development of an accrediting procedure which would in time necessarily require entirely adequate facilities both from the standpoint of laboratory and classroom space and also from the standpoint of a properly trained and entirely competent faculty.

These problems were common to the establishment of any institution which honestly tried to serve the public and their solution, as has been indicated, was a progressive one but one which was consistently, energetically, and perhaps intelligently carried out.

It might be interesting to note what the thought was with respect to the solving of some of these fundamental factors which presented themselves as a part of the primary development of the institution. In the first place, it seemed that the thing which should be aimed at as perhaps of the most importance was that of a competent faculty simply because they could operate within the spheres of the physical facilities of the institution and what they did would be sound. Very fortunately the evening school offered a very fine source of recruitment for the teaching staff. It was possible to evaluate a man on the basis of his work in the evening and if it was satisfactory, try to secure him for work in the daytime. This involved the choice of men in sometimes secondary school positions; sometimes teachers in neighboring colleges, and sometimes men in industry who could be appealed to on the basis of the satisfactions inherent in an educational career. Some excellent men were secured from these three sources and they were all, I think without exception, men who had a very keen interest in the leadership of young men in the professional field of engineering.

Men were not at first chosen for their advanced degrees, for the ability to carry on independent research, or from the number of publications they had produced, or for their membership in certain learned societies. That had to wait a little; and while it was felt at that time, and I think is still felt now--we think it is still felt now--that the spirit of research was a fundamental necessity in an engineering school, it was also felt that this spirit permeated the whole of the institution rather than be used solely as a source of revenue for the institution and a sop to some of the scientific attainments of individual members of its staff. So that the institution started first with the primary idea of being helpful to the development of young people who had chosen engineering as an approach to life and this spirit of helpfulness on the part of the faculty drew to us in the course of not too many years a great many students who otherwise might not have come.

It should be appreciated that the situation in Newark was almost perfect for a technical school. In the urban center were living then many young people who could not afford to go far afield for an education. In many cases it was not at all a question of poverty but simply a question of the family budgets being able to stand the education of 3, 4, 5, or even more children and to pick and choose among one's own was as difficult then as it is now. It was felt there was a great need in this locality for an institution of this kind where perhaps some of the educational frills and fancies were at least temporarily laid aside and where a sound education could be provided at a reasonable cost. Where sons and daughters of a large family had to be educated, they had to be educated at home and all this meant in a sense that we recognized the fact that in America brains were where we found them and they came up from the bottom perhaps even more easily than they came down from the top and so we began to think of the institution in terms of educational transportation, if you will, where we were building a car or an educational vehicle to get you somewhere but we weren't appealing to the Cadillac class or even the Lincolns but perhaps a small Buick which would get you places effectively and reasonably about as often and about as competently as a larger car. The question was often asked the student when he came in, "What price of educational transportation can your family afford?" We have a very good car and it's very reasonable and after you get to know it you'll be proud of it. If your Father and you think that you want to buy a Cadillac, it's your privilege to do so, but we don't sell them here. So the upshot, perhaps, of it all was that we said, in effect, "All we're after is brains. The mere fact that your Father has $1,000, or $2,000, or $3,000 to spend on your education isn't of any great interest to us. We're anxious to have young people of ability, initiative, and intelligence, irrespective of the size of the family income." This was what we conceived to be a democratic approach to education; but with these philosophies in mind, how did we propose to obtain the students?

This was, of course, a major concern over a number of years and called for the expenditure of a tremendous amount of nervous and even physical energy. We started in by addressing convocations in high schools. Sometimes it is not easy to secure entrance, particularly if you want to; and sometimes you had to use rather indirect methods, although not dishonest ones, to secure a hearing. Then if you were careful to give a constructive, helpful, forward-looking talk within the comprehension of the student body, and if you were careful not to advertise your institution, you were usually invited back once and twice, and along about the second time the principal said to you, "Why don't you tell us something about your own college?" Then, of course, we went the limit.

Perhaps even more effective than addressing the students was a chance to meet the principals and science teachers in the various high schools throughout the state and we ranged within the limits of the state from the north, south, east, and west until we had covered the state as a whole and until we knew and the high school administrations knew of our existence, our philosophy, and in general approved of it.

After the college talk and convocation we usually arranged to talk with the principal or guidance officer where we outlined something of the general philosophy of the institution and indicated that we would be very glad to know of any young man or woman who showed particular interest and ability in science and of course its consequent mathematics. Then we offered to make it possible in some way for that young person to secure an engineering education. Many students came to us through this source and through the source of the suggestions of the science teachers and guidance bureaus in various high schools.

Another very effective way of securing interest in the right places was furnished through the possibility of obtaining high school teachers in science and mathematics in the evening work. I remember that one professor of physics with us in the evening, who taught during the day in one of our high schools, was a tower of strength, and furnished us perhaps the most startling and still the best example of how this plan worked. His interest in the development of the new college and its consequent evening work was so keen that from that particular high school in the earlier years of our growth we enrolled some 17 students in our entering classes. This, multiplied by 20 or 25, gave us a very good start and what was more to the point, gave us a very fine cross section of competent individuals as students.

It is interesting also to note that we did not in the whole 30 years fail to secure funds to finance the education of these young people. I remember very keenly that one day Mr. Frank Liveright, then Treasurer of Bambergers Department Store, hauled the President of the institution by force into the store and finally into his office, secured from his secretary twenty $100 bills, put a rubber band around them, and stuffed them into the educator's coat pocket, and he said, "You know what to do with that. Use that to help boys and girls in the city which has been so good to me." Finally a little scholarship fund was formed which carried a nominal 2% interest. The interesting thing about the fund was that the student himself signed the note and it was considered to be a moral but not a legal obligation. During the time that I was connected with the fund, perhaps a period of 20 years--a little more, a little less--the fund made a year's schooling possible for 161 students; and the amount left at the end of the last current year in which I had any personal handling of the fund had grown to something over $3,500. The secret of its success and of other funds of the same kind, I think, lay in the responsibility which we placed on the individual and the fact that he recognized the obligation as binding although not legal.

I remember one young man who had paid his principal and his interest and who was in the Second World War, Commander of a sizable ship in the South Pacific. He sent in a check for $500 and he said, "Out here we have plenty of time to think; and although I have paid what I am supposed to pay, I can't help but think that my responsibility extends much further and so I am sending $500 for the fund and I wish it could be more." This is not an isolated example but indicates how valuable it is, when giving an education, at the same time to build up a sense of personal responsibility which extends not only to the institution, but through it, to the community. Where these students were helped, it is surprising to see how little they really needed. There were sources of income sometimes within the immediate family. Sometimes a cousin or uncle decided to help and the amount that the school had to remit in the way of services, although it did not in all cases remit money, was inconsequential. Jobs were reasonably plentiful; and while care had to be taken not to use too much of the man's energy with respect to outside work, it was somewhat startling to see how many loans were liquidated prior to graduation.

The only argument which we ever used in case of delinquency was that we notified the students of our knowledge of the delinquency and pointed out that the help which we gave them could not be repeated in any other cases unless they met their obligations. Never did we threaten and never was there a dunning letter, so-called. That the students rose to the occasion is one of the most hopeful things about American youth.

After a period of some eight or ten years it was not necessary to repeat these talks. Students came and came in such numbers as to consistently fill the institution to capacity. No drives had to be made and it was, we think, because of the reputation which the institution holds for its helpfulness and its reputation for developing some of the human traits of leadership as well as some of the more formal types of computation.

Much more could be said along this line--of the trips that were taken sometimes in the very early morning as far south as Atlantic City and Cape May and from Camden to Phillipsburg to Sussex and Dover and almost anywhere where there was a highschool. By covering the state in this way we not only met a great many principals, sometimes in localities where very few students came, but as the principals shifted, many of them still remaining in the state, and a principal in Barnegat had a habit of showing up somewhere else, for instance, at some time. In the course of this whole maneuver, if you could call it such, or the following out of this philosophy, many friends were made. In some cases a year couldn't go by but you were invited and almost ordered to renew this acquaintanceship with the students and with the principals and science professors; and what was first a terrible chore finally developed into a very pleasant contact and in some cases friendships which extended for many years. At least finally I think we got most all of the principals and science teachers and guidance people in the state of New Jersey to know what we were doing and what we would like to do for them and the results have, we think, justified the expenditure.

The contacts with the principals, science teachers, and guidance officers resulted finally in the recruitment of a student body which from the very first was of a high caliber. It became known that the institution stood for the basic educational fundamentals in an engineering training and nothing was sacrificed in order to achieve these fundamentals. With the low tuition costs and the general low cost where students could live at home many young people have been brought in who could not afford it otherwise even with considerable scholarship assistance. The knowledge that an engineering education could be attained at home made it possible for many of the very highest type young people to come in. I remember particularly one year when there came to us the highest ranking student in the graduating class of four of our metropolitan highschools. In setting up a philosophy where brains alone were desirable, coupled of course with good character, and where financial problems were not paramount, we secured a group of people for students where financial conditions were not the governing conditions and where a student with brains could get an education which in some other cases were limited to students with brains and money. As the student body grew great care was used in the selection of students and this of course reacted very definitely upon the secondary schools and the knowledge finally went abroad that the standards of the school were high and gradually the institution established an enviable reputation in its own community and in the state as a whole.

Knowledge on the part of the highschool people that the standards were high percolated down to the State Department of Education at Trenton and from the very earliest day the school had the backing and the increased backing of the State Department of Education.

Many stories might be told of the struggle to establish and maintain a high level of instruction and with that a question of accrediting.

It was quite necessary that the school ultimately meet the approval of the State Department of Education of New Jersey, New Jersey State Board of Regents, the Department of Higher Education of the State of New York, the licensing authorities of the state of New Jersey, and that it be approved by the Association of Colleges and Secondary Schools of the Middle States and Maryland and ultimately by the Engineers' Council for Professional Development. It was necessary also in connection with our graduates to establish somewhat of a reputation with regard to our prospective graduate students but gradually over the years the school managed to surmount these hurdles.

In order to do this it required quite a tremendous amount of energy and sometimes resourcefulness on the part of the administrative officers. One interesting incident happened in the early days when accrediting was sought from the Middle States Association. Among other things, our library was examined and the indication was, before the presentation of the final report, that the library would be declared insufficient. At the meeting in Philadelphia where the final decision was made the question of the library arose and the school authorities held that the mere possession of a certain number of books was not primarily the thing desirable in a library but it was their use and the statement was made that the library had increased in the past five years the use of its books something over 1000%. It was found in the face of this statement that very little information was directly available on the use of libraries and the final decision was to approve the library basically on account of its wide use by students rather than the number of books which were actually on the shelves.

In this first accreditation Dr. Wilson Farrand, then Principal of Newark Academy, and later Secretary of Princeton University, was a tower of strength. Princeton University was, as a matter of fact, very helpful in establishing accreditation to the college. Dean Arthur M. Green knew the school and his reports on it were very favorable. During the war and the ESMWT contacts with Dean Condit and others at Princeton were extremely helpful. President Dodds himself was kind and helpful in many ways and it was not too long before the institution had the respect of its then more influential members.

MIT was, of course, very helpful and frequently professors came down here to advise or to speak to the students. In New York Cooper-Union was particularly helpful and Dr. Burdell's advice and consultation was freely given and as freely followed.

The process nevertheless was a long one and one that required many trips throughout the country and in the Second World War the position of the head of the institution as Regional Advisor for New Jersey, Delaware, and Pennsylvania helped materially to advance the prestige of the college.

Following that Professor Carvin, then head of the Mechanical Engineering Department, visited most of the large schools throughout the United States as the traveling member of a committee of the Federal Security Agency to study schools in connection with the training program of the Federal Security Agency.

Positions on the council and the Vice-presidency of the American Association of Engineering Education helped enhance the prestige of the institution. Its administrators, officers, and professors began to be recognized nationally as competent and gifted engineers and gradually but definitely the problem of public relations came nearer and nearer to an ultimate solution.

One of the happy circumstances connected with this particular phase of the development of the institution came about upon the formation in 1930 of a New Jersey State Board of Regents. Their work was confined very largely to the institutions other than state institutions which received aid and were instrumentalities of the state of New Jersey. The group was an especially gifted one and was particularly sensitive to the needs of the whole state with respect to all types of education. The Regents very early became interested in the development of the Newark College of Engineering and the Newark Technical School and did all in their power, which was much, to see that the school developed along the lines envisioned for it. Not only in budget hearings but in every other conceivable way the Regents were helpful. They were sympathetic and they were farseeing.

Especially should be mentioned Mr. Henry W. Jeffers, the first Chairman of the Board of Regents and Mr. Charles A. Heiss, Vice-Chairman. The power on the Board which helped us more than we can ever appreciate was the effort of Mr. Smalley who later became President of the State Board of Education upon the reorganization which gave the responsibility for these instrumentalities to the State Board of Education.

This indicates only a few of the contacts which were made and the friendships and interest which naturally grew out of these contacts.

So far as securing aid from the city and the state, and it should be remembered that the city and the state both contributed to the operation of the institution, the contacts with the city commission in Newark were of the pleasantest. From the time of Mayor Raymond to Mayor Carlin the offices of the Mayor and the Commissioners were always open to the administration of the college and it could be said without exception that there were no circumstances which indicated that Newark was not ready and willing to maintain an institution which really served its people in an educational way.

The state was a little harder and up until the advent of the Board of Regents, with their backing and their help, the state picture presented some considerable difficulties; but when it became evident that the institution was willing to substantiate and fight for anything it asked for the experiences in Trenton at the hearings before the Appropriations Committee and the Budget Commissioners assumed a definite aspect of freeness. Particularly should we mention Commissioners Steven, Walsh, and Vermuellen who not only carried on the financial negotiations on a high plane, but were extremely sympathetic and helpful to the work at hand.

The Governors too, while not so closely connected with the school, perhaps, as the Mayors of Newark, showed without exception a desire to help in the work insofar as financial conditions enabled them to do so and so the College was able over a period of years to establish a reputation for competency and honesty in its dealings with public officials and with the public in general.

Many honors came to the faculty administrative force all of which helped and while this sort of thing has to be continuously watched, and while public relations are of the utmost consequence not only in the designing and development of an institution, but also in its continuing operation. It is necessary to spend considerable time to keep an institution in touch with its public and its supporters.

The questions of structural additions to the school were serious and were met consecutively, as has been told elsewhere, by the construction of the first building on High Street, the Laboratory Building on the corner of Summit Street and Summit Place, the purchase and ultimate demolition of some apartments on Summit Street next to the Laboratory Building, the building of Campbell Hall and its annex, the rounding out of the buildings by connecting Weston Hall with the Laboratory Building and finally by the acquisition of property now known as Eberhardt Hall.

The Regents were very helpful in the outlining of the plans for these particular developments and the Mutual Benefit Life Insurance Company was very sympathetic toward the type of loan which we needed to supplement the money received from the state, the city, and tuition.

It has been mentioned before that one of the primary problems was securing adequate equipment for the laboratories. This was and properly is a continuing problem. Perhaps no laboratory should be in the broad sense really permanent; so that while our first meager equipment was added to from time to time, sometimes at first by not ideal equipment, by any means, still it was better than that which we had. In time it moved out and more up-to-date equipment came in. Two men were extremely helpful in helping to provide this equipment. One was Dr. Frederick O. Runyon, an engineer of prominence in Newark, afterwards for a considerable time a member of the Board of Trustees and the recipient of one of the few honorary degrees which the institution conferred. The other was Mr. Arthur W. Lunn, Sales Representative of the General Electric Company, without whose help it would have been impossible to properly equip the laboratories, especially in the field of electrical engineering.

As the development of the school proceeded and as its prestige increased, it became easier to secure men of high standing on the faculty and as has been indicated elsewhere these men were chosen, of course, as a necessary condition, for their competency in their chosen field, but as an additional condition, for their character and for their interest in the leadership of young people. It seems almost as if each one of these men should be mentioned by name but in a history like this that is impossible. Only it should be said that in the formative years and continuing into the present day their willingness to work together as a team and to forget some of the jealousies that spring up between departments assured a type of expansion which was of the highest possible order. These were some of the problems which faced the College, as faced all institutions of a like character, in the earlier years of its founding, its development, and its growth. That they were properly solved is perhaps the finest tribute to the administration and the faculty and every member of the organization which took part in this development.

Upon the termination of Mr. Cullimore's presidency there were, of course, many problems which continued to be of great importance whose solution could not necessarily be completed in any time. All the internal matters having to do with the administration of the College remained and were, of course, multiplied as the student body and the faculty grew. The question of public relations, one that is always with us, had to be followed closely and required on the part of the new President a considerable amount of time and the expenditure of much energy. The continuance of the cordial and happy relationships with the power of the purse had to be and were continued in the same spirit and with the same effectiveness and efficiency which had characterised the whole history of the College.

The new President, Mr. Van Houten, having lived with the College and observed many things about its wants and its needs, was, I believe, very sensitive to the fundamental nature of these two particular problems and they were met in the spirit of the new day and were comparable with the best standards in modern technical education.

There were some specific projects which would seem to warrant particular attention as being significant in the first five years of the new administration. First was the establishment of the Air Force ROTC unit. Relations between the College and the military establishment had always been of the best. The College participated in the ASTP as long as it operated and afterwards assisted the Government in many ways, particularly in the case of certain research for the Navy and also some work for the Ordinance Department; and it had been felt that any request on the part of the Government for aid which could be given and which the institution was competent to give should be given without question as a public duty if our abilities were such as to warrant the effort. So that when the ROTC requested that a unit be established at the College the administration felt very strongly that an invitation was a must and that no matter what a private opinion might be our situation should be that we were duty bound to help the Air Force in this regard. So the unit was established and the relations between the ROTC and the College have been extremely pleasant. It was possible to integrate the ROTC program with the College program without too much dislocation and it is felt that the work has been carried on at a very high level and with a considerable amount of efficiency.

Certainly the administration has the feeling that it is discharging a duty, and an important duty, and the work has been carried on on an extremely high professional plane.

The second problem which seemed to require immediate attention was the development of a Special Courses Division which could meet the specialized needs of industry and of students employed in industry in this immediate locality. The old Newark Technical School, of course, was founded primarily on this basis and a series of courses which might be now called vocational were set up in such fields as toolmaking, electroplating, and things of that sort where there was nothing in the way of a diploma or a degree but where certificates of attendance were issued and where the main idea was the acquiring of knowledge which would be of direct benefit to either employee or employer.

While some of these courses were kept up through the development of the College undergraduate work it was felt by the new administration, and properly so, that there should be some considerable development in this field at a very high technological level. Academic degrees were not required for such work and the academic prerequisites were more informal than with other types of classes. It might be said, perhaps, that in connection with these classes the ability to progress, to understand, and to profit by the courses was the primary criterion for entrance.

Courses had been given to some extent throughout the years, notably with respect to courses sponsored by the Paint Manufacturers' Association in the field of protective coverings; but the new concept broadened the field very considerably. Mr. Keller was retained to develop these courses and upon his leaving in 1951 the work was taken over by Professor Clarence Stephans. Professor Stephans brought to the work a very realistic and valuable point of view. His contact with industry in connection with the Honors Option and also in connection with the question of recruitment and placement of our graduates gave him a particularly deep insight into the needs and desirabilities of certain types of courses and conferences.

It would be perhaps impossible to list all these courses but of particular interest were courses and conferences in Sales Engineering, Plastics, Executive Development, and Prestressed Concrete. The history of the development of these courses makes very interesting reading and evidences unquestionably the desire and the ability of the institution to render direct technological aid on a high-level to the industries of this particular neighborhood. These courses have proved so popular that the enrollment in the year 1954 amounted to 1339 students. It would seem that the development of this type of work was one of the most important and forward-looking steps which the institution had taken since its inception.

The third thing which would require specific mention was a continuous and very substantial growth of the Graduate Division. In an urban community such as the institution serves there are a very considerable number of young graduates who wish to carry their formal education further and the need for education on the part of these men is very real and very acute. As has been mentioned earlier in the history, for a time a cooperative arrangement with the Stevens Institute of Technology was set up but which after a while failed to be as advantageous to either institution as might have been desired. While it served a very good purpose so far as the development of graduate courses was concerned, it was not until Professor Orens came as the head of the Division that the work began to assume what might be termed major proportions. Now it has come to be one of the major contributions of the institution and in 1954 its students numbered 657.

The development of this particular phase of the work was very much stimulated by Dr. Robert Morrison, Assistant Commissioner for Higher Education in New Jersey, who was very generous of his time and effort in helping develop this phase of our work.

(Here insert something of the kinds and character of the courses given and some of the fundamental objectives of the Division) to be furnished by Dr. Orens.

In connection with the development of the Graduate Division there came naturally to be some consideration given to problems of research; and while the institution has never particularly attempted to develop this field as a money-making venture, it was felt that the opportunity of research should certainly and without question permeate the work of the Graduate Division and should have an effect upon methods of teaching and the nature and substance of some courses in the undergraduate curricula. With this idea in mind and also with the facts in mind that a publicly-supported institution should be publicly rather than privately supported, certain research projects have been developed and the spirit of research has been kept alive and fostered without, it is believed, too much emphasis on the strictly commercial aspects of research, which may be open to criticism along some lines.

As the Graduate Division develops and as the discoveries and researches in technology and science develop, as they are developing rapidly, it is believed that a greater amount of research must necessarily be done, but must be done primarily for agencies who represent the nation, the state, and the community as well as private research where the results are known only to the individual who pays the bill.

There is another factor in the research proposition which seems to bear on the question and that is that most of the students in the Graduate Division now attend in the evening and very many of them are engaged in research laboratories and most of them, perhaps, have the idea, the philosophy, and the spirit of research predominant in their daily work. Such students are not only a help to the College, but a very considerable inspiration to the teaching force and the development of this particular division would seem to be one of the primary projects which faces the College at the moment. Perhaps the amount of research should be governed by the old adage, "Nothing too much."

While these projects which have been mentioned have been extremely important, of course the most important project that faces any institution is keeping up the physical facilities to a level made necessary by enrollments which have increased and particularly by the steady onward march of science and technology. In the case of this institution laboratory space was sorely needed, particularly space to carry on a reasonable amount of research—advanced in character.

Early in 1948 the College began to make plans for some expansion. In addition to the buildings already described, the property of the Newark Orphanage Asylum was purchased in 1948. The building on it was monumental in character, a landmark standing on a hill overlooking much of the business area of Newark. It was structurally sound and while not particularly adapted for classroom purposes was well adapted to the housing of administrative offices and the development of something which was very much needed at the College, a cafeteria. As a consequence when the building was purchased and adapted at considerable expense to the administrative needs of the institution, it served to relieve the older buildings of the College to a very considerable extent and freed certain space which allowed at that time a considerable expansion in the purely academic and educational facilities of the institution as a whole. It furnished, moreover, in connection with it a tract upon which a new building could be built which might prove absolutely necessary if plans were carried out to replace the oldest building on High Street.

Detailed and definite plans began to take shape in the latter part of 1953 and in 1954 and the general planning was put in the hands of John H. and Wilson Ely, architects, who had designed most of the buildings of a monumental character in Newark. Plans were perfected during 1954 and at that time exploratory measures were taken to determine the best way of financing the building. Numerous consultations were held with the state and city authorities and upon the opening of 1955 the chances seemed bright for the development of a whole program of expansion which would give the institution the most modern educational facilities.

There are other matters which weren't perhaps of such pressing consequence as the development of certain types of education and the development of proper facilities but which should be mentioned as problems which were met and satisfactorily solved by the new administration. One of these projects centered around the development of the Alumni Association. The Association had been, up perhaps until 1948, active sporadically when recognized leadership made itself felt but in the first years of the College development the Alumni were all young men and many of them found that most of their time was properly taken up with matters of professional advancement and pressing responsibilities of their positions. As they grew older and advanced into the management and executive group they found it possible to give more time to the formation of an association and gave to it a maturity in its point of view and judgment which were of course impossible in the first years of the College except on the part of a comparatively few men.

In connection with the development of the Alumni Association the College has helped in the way of furnishing certain services and housing the offices of the Association, but the Alumni have done an outstanding job in the formation and development of and the executing and administering of their plans and the Association has been of great benefit to the institution through their interest and their enthusiasm. They have held regular yearly meetings which have been well attended and their Executive Committee has always been ready and willing to help the school not only through the alumni themselves but directly where they could. They have fostered a number of projects, the least of which is the gift to the college of a portrait of President Cullimore and the presentation of it which served to perhaps again bring the alumni into a little closer contact with a fuller spirit of cooperation and understanding of the philosophy and the needs of the College.

Quite apart from the Alumni Association but in connection perhaps with the overall extracurricular picture should be mentioned some things which were interesting as affecting not only the student body and the Alumni, but our relations with the student body in general. The first of these was the establishment of additional national honor societies. Following is a brief history and outline of the primary function of these societies:

Tau Beta Pi was established October 2, 1941, preceded by the Society of the Trunnion which was established in 1929. The primary function...."is to recognize those men who have shown distinguished scholarship and possess exemplary character...also engaged in... Tutoring Program...to students having difficulty in their academic pursuits. The Third major activity is the Instructor Rating Program under which instructors are evaluated by students in their classes on such qualities as academic proficiency, classroom technique, and personality in general. The results...are reported to the instructor."

Omicron Delta Kappa was established May 6, 1950, having been preceded by Nu Chi Epsilon in the Spring of 1948. It is "... a leadership honor society for men...designed to bring together in one body for the general good of the College all leaders in various forms of activities...Membership limited to upperclassmen who have distinguished themselves in certain major and minor positions or offices while remaining in the upper one-third of their class. The leadership and "gripe" conferences are sponsored by the Circle which extends advisory service to campus organizations. Discussion meetings and convocations are typical ODK projects."

The Arnold Air Society was established in 1951. This .."is a national honorary organization of advanced Air Force ROTC cadets. It has as its explicit purpose the furtherance of the concepts and traditions of the United States Air Force. This liaison with the Air Force is accomplished by means of informal talks and gatherings with specialists from the Air Force and from civilian life on related topics. Field trips to Air Force bases and installations are also made by the members of the society. The national society offers a yearly scholarship of $500 to a deserving junior of the organization. This may be used as the recipient sees fit."

Pi Delta Epsilon was established June 2, 1951, preceded by Tau Epsilon Kappa, 1950-51. It "...is the honorary collegiate journalistic fraternity." Any NCE student who has served two years on the Nucleus, Et Cetera, the Technician, the Cadet, or the Surveyor may be eligible for membership. "In an advisory capacity the society stands ready to assist any organization that requests aid in its publications."

Eta Kappa Nu was established May 23, 1953, preceded by Delta Tau Sigma, March, 1952. This "is the Electrical Engineering honorary society at NCE...to foster scholarship among the student body, to promote and to form a liaison between the staff of the Electrical Engineering Department and the students, and to give recognition to those undergraduates whose character and scholarship merit it."

Phi Eta Sigma was established in 1952, "...to recognize scholastic achievement of the members of the freshman class. One of its main functions is to aid the orientation of incoming freshmen. It also aids in tutoring freshmen who request aid academically."

Pi Tau Sigma was established May 25, 1951. It "...is devoted to the development of high ideals in engineering and to the recognition of distinctive technical ability and leadership of Mechanical Engineering students. In conjunction with the Department of English, Pi Tau Sigma sponsors a technical paper writing contest for sophomores."

Allied to this activity was the establishment of certain projects which seemed to be necessary to properly influence popular opinion and be of some help and stimulation to our student body, our alumni, and the parents of the students. For a considerable time there has been each year in the Spring a Parents' Day or Visiting Day when the College has open house for the parents and friends of the school and of its student body. This has come to be a fixture and is entirely administered and operated by the students of the school with certain faculty advisors.

In addition to this in 1952 was established a Parents' Night for the parents of the freshmen. This was and is felt to be of particular value to explain to the parents something of our method of operation and something of our fundamental philosophy. In many cases, with the parents paying the bills, it is very advisable and very necessary for them to understand as nearly as they can the type of effort and the type of work and the kind of philosophy that we hold dear.

In 1954 there was established the North Jersey Science Fair at the Newark College of Engineering which exhibited certain things and stressed certain values which it was felt would be helpful to our students, our prospective students, and our Alumni.

Also there was instituted the publishing of the folder "NCE Today" and the revival of the student handbook, the publishing of a handbook for the evening faculty, and plans for the publishing of a handbook for the full-time day faculty. These handbooks and these brochures were simply a means of communication which would make for better cooperation and more solidarity in the work of the institution and which it was felt would bring its student body, its faculty, and its administration more closely in contact.

Where competitive intercollegiate athletics are optional, there seems to be a necessity and a real necessity for the development of certain student activities which will furnish a unifying force toward the morale of the institution as a whole. In the first days we had very active chapters of the various student branches of the professional societies, and while they continue today there seemed to be the necessity to initiate something in the lighter vein.

There has been developed a project called the Kampus Kapers which is given each Spring and furnishes a welcome relief in the form of music, dramatics, etc.

Last but not least should be mentioned the addition since 1949 of new scholarship and loan funds. In addition to furnishing needed financial assistance to the student body these loan funds indicate a growing appreciation on the part of the public of the institution and its ideals and indicate quite directly that the College has come to be recognized by its public, that is its constituents, as a part of its community and its state, warranting their moral as well as their financial support.

APPENDIX B

While the amounts appropriated by the Regents for the life of the Board have been listed in Appendix A as an integral part of the activity of the Board of Regents, it seems wise to have a more detailed breakdown of the income for the college extending from 1914-15 to 1954. The record for tuition paid in the early years, 1914-15, is not completely available.

It should be noted that a contract was made with the Federal Board for Vocational Education to train veterans of the First World War, extending from 1919 to 1930. During that time also the school received certain moneys from the Federal Government under the Smith-Hughes Act on account of work which the school was then giving in the general field of vocational education. The high water mark of the Federal payment for vocational education came in 1926 and as the figures show diminished rather rapidly thereafter as the state and county vocational schools took over from the Newark Technical School work of a strictly vocational nature. So that in 1930 the college had its last payment from the Federal Government and its classes thereafter were not in any single instance vocational in character.

It is perhaps nothing more than a coincidence that in 1931 the first payment by the Board of Regents was made. The amount entered opposite the year 1931 was the sum total of the requests covering 1930 and 1931. The legislature in 1930 did not vote the appropriation as suggested by the Board of Regents but added it to the appropriation asked for in 1931.

The totals given represent not only the tuition and appropriations but certain items covering the sale of books, student fees, and so forth. The tabulation follows:

Year Ending	Tuition Evening Technical and Special Courses	Tuition College Under-graduate	Tuition College Graduate	Tuition Federal Board	Smith Hughes Act	State Board of Regents and/or State Board of Education	Other State and City Grants	Total Income
4/30/15	$ 2,596	$	$	$	$	$	$ 30,000	$ 35,000
4/30/16	2,989						30,000	41,000
4/30/17	4,067						30,000	39,000
4/30/18	4,111						30,000	39,000
4/30/19	5,759						30,000	44,000
6/30/20	24,306			40,620	1,345		50,000	134,000
6/30/21	20,018	3,812		50,891	966		60,000	147,000
6/30/22	22,124	5,497		39,767	3,561		79,148	163,000
6/30/23	26,255	7,265		31,597	3,201		50,000	126,000
6/30/24	28,196	10,868		15,503	4,542		60,000	127,000
6/30/25	32,396	13,635		520	4,420		60,000	119,000
6/30/26	40,128	16,789		160	5,427		70,000	139,000
6/30/27	42,349	21,910		-(22)	2,479		80,000	153,000
6/30/28	56,293	30,867			1,968		90,000	189,000
6/30/29	63,826	37,583			1,002		90,000	202,000
6/30/30	77,262	43,441			561		100,000	232,000
6/30/31	82,545	58,060				18,700	105,000	273,000
6/30/32	70,099	75,501				28,610	105,000	287,000
6/30/33	51,119	86,023				38,400	95,000	279,000
6/30/34	50,140	98,025				34,560	80,000	271,000

Year Ending	Tuition Evening Technical and Special Courses	Tuition College Under-graduate	Tuition College Graduate	Tuition Federal Board	Smith Hughes Act	State Board of Regents and/or State Board of Education	Other State and City Grants	Total Income
6/30/35	$ 47,742	$104,790	$	$	$	$ 34,560	$ 80,000	$275,000
6/30/36	47,545	118,464				38,940	80,000	294,000
6/30/37	64,220	128,204				38,940	85,000	327,000
6/30/38	84,420	131,872				57,426	95,000	379,000
6/30/39	74,613	137,717				55,000	99,250	381,000
6/30/40	78,162	162,719				55,000	99,250	413,000
6/30/41	87,528	184,784				65,000	99,250	460,000
6/30/42	94,084	194,135				70,000	99,250	492,000
6/30/43	48,285	195,369				82,703	99,250	459,000
6/30/44	26,642	152,706				91,700	99,250	408,000
6/30/45	25,943	113,567				104,801	105,100	397,000
6/30/46	26,835	265,066	4,998			94,505	105,100	601,000
6/30/47	14,187	574,309	16,453			154,300	105,100	998,000
6/30/48	15,005	642,690	23,853			145,000	105,100	1,213,000
6/30/49	24,157	657,098	28,790			173,984	109,300	1,123,000
6/30/50	40,336	604,475	53,686			255,944	119,006	1,187,000
6/30/51	49,450	523,476	73,731			277,898	129,203	1,175,000
6/30/52	82,156	447,340	83,011			398,663	139,606	1,355,000
6/30/53	85,697	478,513	85,229			593,905	155,799	1,618,000
6/30/54	120,525	512,951	92,056			621,125	159,657	1,771,000

FEDERAL GOVERNMENT AGENCY PAYMENTS TO THE COLLEGE
FOR WARTIME TRAINING AND OTHER SERVICES

	Federal Defense/War Training	Army Specialized Training Program	Veterans' Selection & Guidance	Army Ordnance Contract	U. S. Navy Contract	National Defense Committee
1941-1942	$ 9,705	$	$	$	$	$
1942-1943	22,351					
1943-1944	27,371	18,962				551
1944-1945	24,785	79	7,620	6,643		6,999
1945-1946	2,818		75,831	1,822		581
1946-1947			56,686		833	
1947-1948	52,104	16,000	53,496	3,200		2,000
1948-1949			43,440			
1949-1950			40,477			
1950-1951			17,985			

The growth of the institution is properly reflected in these tabulations. Student enrollment is somewhat deceptive in that groups of students vary over a wide range in hours of attendance.

There are certain notes taken from the early board meeting minutes and from some of the early financial reports which would seem to be of more than passing interest. The following items are copies from the first book of minutes of the Board of Trustees. On the meeting of May 19, 1887, the Treasurer presented his annual report showing the balance at the end of the year of $6,509.86. In the minutes of May 17, 1888, the Auditing Committee reported that it had examined the reports of the Treasurer up to May 14, 1888, and found it correct. Following is a summary of the report now on file with the Secretary:

On hand May, 1887		$6,509.86
Rec. from State for 1886-1887		123.10
Rec. from State for 1887-1888		4,565.00
		11,197.96
Rec. Subscriptions on account 1887-1888		4,375.85
		$15,573.81
Paid by Checks	$7,249.23	
Cash in Bank	8,324.58	$15,573.81

The first mention in the Minute Book of an appropriation from the City of Newark is made in the Treasurer's report of May 9, 1889. It would appear that at that time there were some subscriptions still coming in and it is not quite clear why the State of New Jersey did not meet in full payment from the appropriation of the City of Newark.

"Treasurer's Account with Newark Technical School to May, 1889."

Cash balance May, 1888	$ 8,324.58	
Collected May 11 to August, 1888	186.25	
From State of N. J. Sept. 10, 1888	4,319.10	
From City of Newark Sept. 20, 1888	5,000.00	
From Colton merchandise sold	290.00	
From Subscribers	3,165.80	$21,285.73
Paid Accounts per Statements	$ 8,057.96	
Balance Essex County Bank	10,634.93	
Balance Merchants Bank	2,592.84	$21,285.73

Another type of early financial report is the following which was found in the minutes of September 4, 1891. The items shown are the only ones giving financial reports, covering a year in each case in the minute book between the years of 1884 and 1913.

"The Director presented his Annual Report and Balance Sheet for the year ending April 30, 1891."

BALANCE SHEET

	Dr.
Cash on Hand May 1, 1890	$1,397.47
Received from State - 1889-1890	5,000.00
Received from State - 1890-1891	5,000.00
Received from Sales of Merchandise	400.65
Received from Tuition Fees	100.00
	$11,898.12

	Cr.
Salaries	$ 5,792.00
Expenses	1,421.66
Lighting	566.62
Merchandise	361.19
Building	150.00
Real Estate	71.79
Library	111.10
Dept. of Chemistry & Physics	55.32
Dept. of Drawing	32.92
Furniture	4.68
	$ 8,567.28
Petty Cash on Hand April 30	1.09
	$ 8,568.37
Balance on Hand May 1, 1891	3,329.75
	$11,898.12

APPENDIX B

Notes on The Board of Trustees of Schools for Industrial Education of Newark, New Jersey

The members are listed in the order of first appointment by the Governor of the State of New Jersey.

The Governor of the state and the Mayor of the city of Newark, New Jersey, are ex-officio members of the Board. The Governor was listed as the President of the Board from 1885-1917. Later one of the appointed members was elected President by the members of the Board.

EX-OFFICIO MEMBERS OF THE BOARD AND APPROXIMATE TERMS OF OFFICE

Governors

Leon Abbett	1885-1887
Robert S. Green	1887-1890
Leon Abbett	1890-1893
George T. Werts	1893-1896
John W. Griggs	1896-1898
Foster M. Voorhees	1898-1902
Franklin Murphy	1902-1905
Edward C. Stokes	1905-1908
John Franklin Fort	1908-1911
Woodrow Wilson	1911-1913
James F. Fielder	1914-1917
Walter E. Edge	1917-1919
William N. Runyon	1919-1920
Edward I. Edwards	1920-1923
George S. Silzer	1923-1926
A. Harry Moore	1926-1929
Morgan F. Larson	1929-1932
A. Harry Moore	1932-1935
Harold G. Hoffman	1935-1938
A. Harry Moore	1938-1941
Charles Edison	1941-1944
Walter E. Edge	1944-1947
Alfred E. Driscoll	1947-1954
Robert B. Meyner	1954-

Mayors

Joseph E. Haynes	1884-1894
Julius A. Lebkuecher	1894-1896
James M. Seymour	1896-1903
Henry M. Doremus	1903-1907
Jacob Haussling	1907-1915
Thomas L. Raymond	1915-1918
Charles P. Gillen	1918-1921
Alexander Archibald	1921-
Frederick C. Breidenbach	1922-1925
Thomas L. Raymond	1925-1928
Jerome T. Congleton	1928-1933
Meyer C. Ellenstein	1933-1941
Vincent J. Murphy	1941-1949
Ralph A. Villani	1949-1953
Leo P. Carlin	1953-

APPOINTED MEMBERS OF THE BOARD

*APPROXIMATE TERM OF OFFICE **

		Term of Office	Industrial or Professional Connection
Edward Goeller	V. P.	1884-1894	Comptr. State Banking Company Pres. Home Brewing Company
Moses Bigelow	Treas.	1884-1897	M. Bigelow & J. C. Kirtland Varnish Manufacturers
William N. Barringer	Sec'y	1884-1898	Superintendent of Schools Newark, New Jersey
Augustus F. R. Martin	M.	1884-1894	Banker and Broker
"	V. P.	1894-1897	
James F. Connelly	M.	1885-1886	McCormick & Connelly Patent and Enameled Leather
Edward Weston	M.	1884-1895	President, Weston Electrical Instrument Corporation
George H. Phillips	M.	1884-1904	Treasurer, Hewes & Phillips Iron Works
Pierson O. Dodd	M.	1886-1887	Member of Common Council Finance Board
George W. Ketcham	M.	1887-1907	Vice-President,
"	V. P.	1907-1911	Central Stamping Company
James L. Hays	M.	1894-1897	Postmaster, Newark, N. J.
"	V. P.	1897-1907	
James W. Miller	M.	1895-1899	Manufacturing Jeweler
Daniel T. Campbell	M.	1895-1897	President,
"	Treas.	1897-1904	Watts-Campbell Company
Francis M. Tichenor	M.	1899-1906	Attorney, Counsellor-at-Law
Benjamin Atha	M.	1898-1902	President, Newark Steel Works of Benjamin Atha & Illingsworth Company
John B. Stobaeus	M.	1898-1910	Manufacturer of Chemicals
"	Treas.	1910-1918	Charles Cooper & Company
Moses Straus	M.	1899-1910	Manufacturer of Leather M. Straus & Sons
George R. Howe	M.	1902-1903	Manufacturing Jeweler
"	Treas.	1903-1910	
Moses Plaut	M.	1904-1919	Merchant, L. S. Plaut Company
Abram B. Garner	M.	1904-1908	Manager, Murphy Varnish Company
Samuel E. Robertson	M.	1906-1911	Practising Physician
"	V. P.	1911-1917	
"	M.	1917-1928	
Franklin Phillips	M.	1908-1914	President, Hewes & Phillips Iron Works
Abram Rothschild	M.	1909-1921	Manufacturer of Leather Stengel & Rothschild
Peter Campbell	M.	1910-1917	President, Nairn Linoleum Company
"	V. P.	1917-1927	
"	Pres.	1927-1928	
Frederick L. Eberhardt	M.	1910-1928	President, Gould & Eberhardt
"	V. P.	1928-1943	Machine Tools
"	Pres.	1943-1946	
Herbert P. Gleason	M.	1911-1918	Manufacturer of Shoes
"	Treas.	1918-1929	Johnson & Murphy
John A. Furman	M.	1911-1927	Superintendent, Celluloid Company

APPOINTED MEMBERS OF THE BOARD (Cont.)

		Term of Office	Industrial or Professional Connection
Halsey M. Larter	M.	1914-1927	Manufacturing Jeweler Larter & Sons
William L. Morgan	M.	1919-1927	Counsellor-at-Law
"	V. P.	1927-1928	
"	Pres.	1928-1943	
William O. Stobaeus	M.	1924-1925	Secretary,
"	Asst Treas.	1925-1929	Charles Cooper & Company
"	Treas.	1929-1938	Chemicals
John H. Clark	M.	1927-1936	President, Clark Thread Company
Felix Fuld	M.	1927-1929	L. Bamberger & Company
Edward F. Weston	M.	1927-1944	Chairman of the Board,
"	V. P.	1944-1946	Weston Electrical Instrument
"	Pres.	1946-	Corporation
Robert Campbell	M.	1928-1930	Financier - Retired
"	Asst Treas.	1930-1938	
"	Treas.	1938-1946	
"	V. P.	1946-	
Cyrus Loutrel	M.	1929-1938	President, National Lock
"	Asst Treas.	1938-1946	Washer Company
Thomas N. McCarter	M.	1929-1944	President of the Board Public Service Electric & Gas Company
Joseph M. Byrne, Jr.	M.	1935-	Chairman of the Board, Joseph M. Byrne Company
George W. Mc Rae	M.	1938-1948	Vice President & General Manager New Jersey Bell Telephone Company
Robert G. Cowan	M.	1943-1946	President, The National Newark &
"	Treas.	1946-	Essex Banking Company of Newark, N. J.
Frederick O. Runyon	M.	1943-	Professional Engineer
Edward F. Bataille	Asst Treas.	1946-	NEWARK EVENING NEWS
Chester C. Campbell	M.	1946-1948	President, Otis Elevator Company
Frederick W. Birkenhauer	M.	1948-	President, Wagner Baking Corporation
William J. Brennan, Jr.	M.	1948-1954	Justice, Supreme Court of New Jersey
John H. Yauch, Jr.	M.	1954-	Attorney, Counsellor-at-Law Member Gilhooley, Yauch, Fagan

* Because of conflicting records it has been impossible to determine exactly the terms of office of some of the first members of the Board of Trustees. This was due, to a considerable extent, to the changes in the method of appointing members of the Board. The dates, however, are believed to be substantially correct.

APPENDIX Q

ENROLLMENT

Evening - Technical School and Special Courses

	Number Enrolled N.T.S.	Special Courses	Diplomas	Certificates	Graduates
Spring 1885	88				
1885-1886	125				
1890-1891	286		2	4	6
1895-1896	204		6	8	14
1900-1901	274		5	9	14
1905-1906	331		3	14	17
1910-1911	393		1	12	13
1915-1916	404		4	14	18
1920-1921	763		12	21	33
1925-1926	1005		35	18	53
1930-1931	1685		70	—	70
1935-1936	787		92	—	92
1940-1941	1163		140	—	140
1945-1946	142	767	20	—	20
1950-1951	—	366	—	—	—
1953-1954	—	818	—	36	36

STUDENT ENROLLMENT - GRADUATES - DEGREES

Newark College of Engineering Undergraduate - Day and Evening

	ENROLLMENT		DEGREES			
	Under-Graduate	Graduate	B. E.	M. S.	Professional Engineer	Honorary D. Sc.
1919-1920	23					
1920-1921	54					
1921-1922	65					
1922-1923	93		11			
1923-1924	125		14			
1924-1925	145		18			
1925-1926	175		16			
1926-1927	230		31		4	1
1927-1928	272		30		1	
1928-1929	324		37		4	
1929-1930	368		45		1	
1930-1931	442		70		3	
1931-1932	552		79		8	
1932-1933	626		76		1	
1933-1934	658		78		3	
1934-1935	707		96		9	
1935-1936	766		120		5	2
1936-1937	815		177		3	
1937-1938	817	18	129		3	
1938-1939	849	39	150		5	
1939-1940	942	51	148		1	
1940-1941	1088	120	151		1	
1941-1942	1258	127	153		2	
1942-1943	e 1156	94	167		4	
1943-1944	632	83	122			
1944-1945	e 404	44	58			
1945-1946	1229	113	48		3	
1946-1947	2274	235	131		1	
1947-1948	2298	260	200			1
1948-1949	2388	293	321	4	4	2
1949-1950	2423	392	396	26	2	2
1950-1951	2161	474	329	62	1	
1951-1952	2092	568	280	88		3
1952-1953	2130	602	258	100	1	
1953-1954	2257	700	233	110	1	2

e estimated

APPENDIX 9

NUMBER OF STAFF MEMBERS

Administration - Faculty and Instruction Staff - Lecturers*

	NEWARK TECHNICAL SCHOOL		NEWARK COLLEGE OF ENGINEERING Undergraduate Day and Evening			GRADUATE	
	Administration	Instruction Staff	Administration	Faculty & Instructors	Special Lecturers	Administration	Faculty
1885-1886	1	3					
1890-1891	1	8					
1895-1896	1	8					
1900-1901	2	11					
1905-1906	2	14					
1910-1911	2	22					
1915-1916	4	28					
1920-1921	10	35	10	20			
1925-1926	7	64	8	17			
1930-1931	9	112	8	29			
1935-1936	9	64	13	37			
1940-1941	6	63	16	66	12	• 5	25
1945-1946	• 8	60	18	51	15	• 5	13
1950-1951	• 8	53	26	141	30	• 8	24
1954-1955	• 8	115	20	130	34	• 9	45

• estimated

* Duplications of names have been eliminated in Bulletin used, but are not eliminated as between Day and Evening Bulletins, nor between Newark Technical School, Special Courses, and Graduate Courses.

APPENDIX E

Scholarships

In the bulletin for 1906-1907 we find the first announcement regarding scholarships, as follows:

"Beginning with the school year 1907-1908 two scholarships will be given annually as follows:

(1) To the student of the first year class showing the greatest improvement during the year, tuition for the second year class.

(2) To the student of the second year class showing the greatest improvement during the year, tuition for the third year class.

These scholarships shall be available only to those students who are taking the full course of study, and shall be awarded at the close of each school year by a jury composed of three members of the Manufacturing Jewelers Association, with the Director of the School as an ex-officio member.

The instructors in the course shall constitute an advisory committee to the Jury.

All scholarships held by students shall be subject to such rules as may be adopted from time to time by the Trustees of the School."

No other announcement of scholarships seems to have been made until we find this statement in the bulletin for the year 1920-1921:

"Many young men attending evening school show much promise along technical lines. To enable these men to follow a regular professional technical course leading to a degree, scholarships may be granted to evening students who wish to take up professional work in the College of Engineering. The scholarships have a minimum value of $125.00 per year. Applications should be made to the Director not later than September 1.

For the year 1920-1921 at least three scholarships are available: The Alumni Scholarship granted by the Alumni of the Newark Technical School to an evening student who wishes to take professional work in the College of Engineering; the Henry J. Reusch Scholarships granted to students in the evening school who have graduated in the General Technical Course and wish to take professional work in the College of Engineering."

The number of scholarships available increased from year to year as shown in the following statements:

In 1930-1931 twenty-five scholarships were offered to qualified applicants. Among these were ten donated by individual citizens and by the Class of 1927, N.C.E. Also there were two granted by the Board of Trustees of the College to recipients to be chosen by the Newark Council of the Boy Scouts of America.

Three other scholarships to be granted to graduates of the Newark Technical School were donated in memory of Henry J. Reusch and in honor of Charles A. Colton.

In 1940-1941 twenty-five scholarships were again offered to qualified applicants. Among these grants, not previously mentioned were: William F. Hoffman scholarships and seven scholarships by the will of Herbert P. Gleason.

By 1950-1951 there were available several additional scholarships under the John Christopher Denman Scholarship Fund and the John A. Schieck Memorial Fund.

Loan Funds were also available to worthy students in limited numbers under the Colton Memorial Scholarship Fund; the Newark College of Engineering Scholarship Fund;

the Abraham Rothschild Loan Fund; and the Sanford L. Kahn Loan Fund.

The Boy Scout Scholarships and the Herbert P. Gleason Scholarships were available also, as previously mentioned.

The College bulletin for 1954-1955 shows a listing of items of financial aid available which is reproduced here in the following paragraphs:

"Through the years the College has received applications for admission from students who showed a definite need for financial assistance in meeting their college expenses. For such needy young men who also possess the ability to carry on engineering study satisfactorily, scholarships are available.

BOY SCOUT SCHOLARSHIPS

The Board of Trustees has granted two scholarships, the recipients of which are to be chosen from Scouts in Newark, Belleville, and Irvington by the Robert Treat Council of Boy Scouts of America.

HERBERT P. GLEASON SCHOLARSHIPS

By the will of Herbert P. Gleason several scholarships are available for young men of character and ability.

COLTON MEMORIAL SCHOLARSHIP

Commencing with the scholastic year 1952-1953 a scholarship has been established in memory of Dr. Charles A. Colton, the first director of Newark Technical School.

The Newark College of Engineering Alumni Association recently effected an amalgamation of the Colton Memorial Scholarship Fund and the College Alumni Scholarship Fund. The combined funds are now administered by the College Alumni Scholarship Fund Trustees.

It is anticipated that each year this Colton Memorial Scholarship will be awarded for one year to the sophomore at the college who ranked number 1 in his class as a freshman.

ESSEX COUNTY ENGINEERING SOCIETY SCHOLARSHIPS

The Society will provide one or more scholarships in the amount of $150.00 annually, divided equally between two successive semesters. The student must have maintained a satisfactory academic record through one or more years at this institution and must need financial assistance.

Other things being equal, the son or daughter of a professional engineer shall be given preference. The student must be willing to take such tests as may be requested by the college committee appointed to select the recipient. The recipient will automatically become the nominee for the same award for the next year unless he no longer requires financial assistance, in which case the award will be made to another qualified student. The final selection of each candidate will be made by a committee of the faculty of the college.

HAMBO SCHOLARSHIP

This special scholarship award is granted to the member of a graduating class of Irvington High School who earns the highest four year average in science during his high school work.

The recipient of this scholarship must register for the course at the Newark College of Engineering leading to the degree of Bachelor of Science in Electrical Engineering. The award has a value of $625 per year for each year of our four year college course.

The Hambo Scholarship became operative for the college year which started in September of 1952. The recipient will continue to enjoy this privilege until the four years of college work are completed, provided the condition of satisfactory progress each year is met.

Requests for information regarding annual Hambo Scholarship awards should be directed to the Principal of Irvington High School.

UNION CARBIDE SCHOLARSHIP

Union Carbide and Carbon Corporation Scholarships in Electrical or Mechanical Engineering, sponsored by the Linde Air Products Company, a Division of Union Carbide and Carbon Corporation.

This scholarship carries a per annum scholarship of full tuition plus $200.00 to the recipient, awarded to a student for his senior year of study in Electrical or Mechanical Engineering.

JOHN CHRISTOPHER DENMAN SCHOLARSHIP FUND

This fund has been established to provide a scholarship for an evening school student who wishes to take professional work in the College of Engineering.

JOHN A. SCHIECK MEMORIAL FUND

By the will of Caroline D. Schieck, a scholarship fund has been established in the name of her brother, John A. Schieck. From time to time several scholarships will be available from this fund.

THOMAS E. HEATHCOTE SCHOLARSHIP FUND

Mr. Thomas E. Heathcote has created a fund to provide scholarship awards at Newark College of Engineering. The candidates for the awards are to be nominated by the Rotary Clubs of Hawthorne, Rockaway, Netcong-Stanhope, and Denville.

MATERIALS HANDLING PRIZE

The Silent Hoist and Crane Company Materials Handling Award is presented annually for the best papers on the subject of materials handling. Theaward is made from proceeds from a trust established by the Wunsch Foundation, Inc. of Brooklyn.

APPENDIX 5

Post Graduate Work at Newark College of Engineering

The Newark College of Engineering offered several special graduate and advanced courses to qualified persons starting in 1937-1938. This work was designed to prepare the engineer for special duties.

While the College did not then award graduate degrees, credit for this work was given by institutions granting such degrees.

Starting in 1940-1941 an agreement between this College and Stevens Institute of Technology provided for students to complete their work for the Masters Degree at the Graduate School of Stevens Institute after taking graduate credits at this College.

In 1946 the New Jersey State Board of Education authorised the establishment of the Graduate Division of the Newark College of Engineering and the granting, by its Board of Trustees, of the degree of Master of Science in Chemical, Civil, Electrical, and Mechanical Engineering; and in 1949, Master of Science with a major in the fields of Chemical, Civil, Electrical, Mechanical, and Management Engineering.

The Graduate Division of this College is filling a definite need in Newark and vicinity. This is shown by the growth of the student body in this division from 18 students in1937-1938 to 700 students in 1953-1954.