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2) UNITED STATES V. WESTERN EUROPE ;
A COMPARATIVE STUDY OF SAFEGUARDING
PRACTICE AGAINST HAZARDS AT
THE POINT OF OPERATION
IN METAL FORMING SYSTEMS //

1) by
Jeffrey Joseph Schwalje

Thesis submitted to the Faculty of the Graduate
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APPROVAL SHEET

Title of Thesis: United States v. Western Europe
A Comparative Study of Safeguarding
Practice Against Hazards at the
Point of Operation in Metal
Forming Systems

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ABSTRACT

Title of Thesis: United States v. Western Europe
A Comparative Study of Safeguarding
Practice Against Hazards at the
Point of Operation in Metal
Forming Systems

Jeffrey Joseph Schwalje, Master of Science, 1981

Thesis directed by: Dr. Stan S. Thomas

The problem of assuring safety for the worker at the point of operation of a metal stamping system is complex by virtue of the multiplicity of combinations possible between all conceivable dies and a press of suitable capacity.

The means of providing safeguarding prescriptions is further compounded by maintaining a viable means to enforce the safety regulations as demanded by law.

A comparative study of the approach to this problem was made between the practices in the United States with that of Great Britain, France and West Germany.

This was accomplished through the study of the available standards, codes and pertinent literature. Further the author travelled to England where he spent 10 days to study and observe the methods used there.

The German and French approach to the problem were studied through those library documents which were available in translated form.

The conclusion obtained is that each country used a different philosophical approach to achieve the same

goal. However, the British approach based on strong governmental enforcement is the primary key to success.

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CHAPTER I

INTRODUCTION

The occurrence of injuries to personnel associated with the hazards at the point of operation of metal forming systems is well known. The remedy to minimize and hopefully to eliminate such injuries has been the subject of many publications, industrial standards, as well as government codes and regulations. Many standards and codes have been written in order to set guidelines for manufacturers, owners and users of metal forming systems in an endeavor to reduce the number of accidents associated with these systems.

It is the object of this study to investigate and compare the safeguarding practices in the United States with these of Western European countries as they relate to these efforts. In particular, the focus will be centered on the machine builder, owner employers, governmental agencies, as well as those standards and codes governing the parties involved in safeguarding metal forming systems.

In order that this subject can be discussed within a manageable context the study will be limited to the topics of research involving the particulars of metal forming systems associated with power presses and similar devices which produce work products formed with tools and/or dies mounted in the power press elements.

More specifically, this research will be limited to

metal forming systems which employ general purpose power presses and the other associated system components.

Thus, the aforementioned constraint excludes discussion and consideration of other metal forming systems related to product formations by means of metal casting, or other hot working processes, metal cutting and the joining of metals through fabrication.

Further, detail discussion will consider only metal forming systems which employ general purpose type power presses. It will not include in depth discussion of special purpose presses and other dedicated machinery.

Particular note is made that the multi-purpose (general purpose) Power Press Brake is also an elemental component of a metal forming system. However, this machinery is primarily intended for use for press brake functions rather than for power press functions.

Since power brake application offers unique circumstances where point of operation guarding cannot and/or should not be applied, this class of machinery is also excluded in this study.

In such special cases where power press brake may be adapted to the power press function, i.e., stamping applications, it should then be treated and modified by its uses to meet all of the requirements assigned to power presses.

In addition to the author's personal experience working

with power presses and his library research, the author has also travelled to the United Kingdom for the express purpose of studying first hand the practices they employ with the class of machinery under consideration in this paper.

Though the scope of this thesis is limited to those metal forming systems which use the general purpose power press as one of its components, various aspects of responsibility will be discussed. In particular, those aspects that relate to the component builder, the owner/user of the metal forming system as well as those involved in the sale of used system components.

It is the author's fervent hope that this thesis will provide a basis for further interest and study in preventing injury at the point of operation for this class of machinery.

Thus, in this attempt to compare various present practices, the complexity of the problems and their attempted solutions will be brought into sharper focus.

CHAPTER II

THE METAL FORMING SYSTEM

A discussion of the metal forming system as related to general purpose power presses is here included in order to bring about a better understanding of the problem to which this study addresses itself.

The role of the power press as it applies to the general purpose machine and its use in a metal forming system can be described as that of the component which provides the muscle or the power for a system. This system is devised, designed, or set up in order to satisfy the particular need in a manufacturing process.

Often when injuries occur in the use of a metal forming system involving the power press it is mistakenly inferred that the accident was the result of some inadequacy or design impropriety of the power press itself. Such inference is a total misrepresentation of both logic and fact when the role of the general purpose power press is fully understood. It must be understood that the power press is a machine that has no use other than that of providing a given amount of force, in a certain length of displacement acting at a particular speed. It unto itself is not a machine that can be used to produce a product. When the power press is used in conjunction with other components which represent the ultimate system to be used, a working machine is created which will be hereafter

referred to as the metal forming system.

Throughout this paper the working machine will be identified as the metal forming system rather than the power press which is frequently and incorrectly referred to as the punch press.

In reiteration, the power press is but one component of the metal forming system therefore the inadequacy of the complete system goes beyond the knowledge or control of the press builder. When an injury occurs as the result of improper guarding, it must be understood that the power press itself can be of proper design and construction while the system may be improperly constructed. Thus, it is essential to recognize that there are two distinctly different designs related to this problem. In essence there is the design of the individual component and that of the system which incorporates the component.

The working machine in its most basic form consists of six elemental components as follows:

- A. Press
- B. Die
- C. Die Feed Means
- D. Actuation Means
- E. Die Unload Means
- F. Point of Operation Safeguards¹

The press builder for example will supply the press and the means of actuation. The die or tools to be used

¹See Appendix 1.

on the press are either built within the press-user's own tool room or supplied by an independent tool and die builder. The feed and unload means will be determined by the user of the system and will depend on the product desired to be produced. Before the proper point of operation safeguards for the system can be selected, all other components of the system must be known. The designer/system builder who may often be referred to as the owner, employer, user or purchaser, has the responsibility to select the appropriate point of operation safeguard since he is the only one with knowledge of the other components assigned to the system.

It should also be understood that the individual function of each of the components does not constitute a complete or finished machine in itself. Therefore a component has no relevance to the safety of the system until it is incorporated into the complete system where its particular function can be defined.

The dies used in a power press as is true with all general purpose power presses are specifically designed for a particular operation. For this reason they assume many different forms and configurations. Quite often a given die is used for a short period of time or a given "run" which is a definite product quantity. Thereafter, it is removed and replaced by another die of different configuration and possibly a different feed and unload means.

Consequently, the press builder cannot possibly

anticipate the variety of tooling that will be installed in the press as part of the many systems with which it is to be used. It is understandable that the authorities on the subject of safeguarding as well as the various codes and standards that govern mechanical power presses all recognize that the press builder cannot possibly anticipate the variety of tooling that will be installed as part of the metal forming system.

It is for this reason that the selection and installation of an appropriate point of operation guard or device is the responsibility of the employer and/or tool and die builder since they dictate the exact role of the press operator.

Unfortunately, there is no single point of operation safeguard so universal that it can be applied to all systems to which the press may be used. Careful study of literature and research related to this particular class of machine indicates that from the earliest standards to the most recent standards numerous types of guards and devices are suggested for use. Examples of these include die enclosure guards, fixed barrier guards, interlocked gate guards, movable barrier guards, pull out devices, sweep devices, two hand control devices and presence sensing devices to name a few.

The choice of the most effective guard or device to be employed with a given system is related to the system

and would include many considerations. The press may be operated in the single stroke mode or the continuous mode and this will effect the type of safeguarding selected. In addition, the type of clutch included with the press (i.e., full revolution or part revolution type) will also have a bearing on the type of appropriate guarding. Further, the method of actuation, i.e., two hands, one hand or foot, and the number of operators to be used on the system must also be considered. The question of how the die will be fed and unloaded must be considered. Manual feeding may necessitate a particular type of guard or device which may be totally inadequate for automatic or semi-automatic feeding means.

The matter of design and construction of the die is also pertinent in this matter. To illustrate this, the A.N.S.I. B11.1-1971 standard states:

"6.1.1 Die Builder

It shall be the responsibility of the die builder to design and construct all new dies to eliminate the need for the operator to place his hands or fingers within the point of operation."²

"6.1.2 Employer

It shall be the responsibility of the employer to institute die procurement,

²American National Standards Institute, American National Standard Safety Requirements for the Construction, Care and Use of Mechanical Power Presses, B11.1-1971 (New York: American National Standards Institute, Inc., 1971), p. 42.

construction and modification policies and procedures that will eliminate within three years (36 months) after the approval date of this standard the need for the operator to place his hands or fingers within the point of operation. The employer shall:

- 1.) Use dies designed and constructed to eliminate hazards to operating personnel.
- 2.) Furnish and enforce the use of a hand tool specifically designed for the purpose of freeing or removing, or both, stuck work or scrap pieces from the die, to avoid requiring the operator to place his hands or fingers within the point of operation, and
- 3.) Furnish and enforce the use of hand feeding tools, when necessary, with manual feeding methods, to avoid requiring the operator to place his hands or fingers within the point of operation."³

In addition to the die builder the standard specifically spells out the responsibilities of the employer in regard to die procedures. The main reason for the employer's involvement is to assure that the dies are maintained and used in a proper fashion. The employer can help eliminate operator injury by using automatic or semi-automatic feeding with an appropriate guard. Whenever manual feeding is used, it is desirable to use a guard; but, if this proves impossible, a hand tool used with a safe-

³Ibid, p. 42.

guarding device must be used. Only the employer can enforce this and insure operator safety.

The metal forming system is simple in theory but complicated in practice. It can be seen that many components go together to create a given system. There can be many variations in the components and each change creates a new system. In order to effectively protect the operator from point of operation hazards, each responsible party must do his part in providing a safe working system. An in depth look at the codes and standards relating to power presses will indicate a clear picture of how authorities in the field believe the safeguarding of power presses must be accomplished.

CHAPTER III
U.S.A. PRACTICES

The state of the art in the use of power presses in metal forming systems and the practice of protection against point of operation hazards first appeared in standards in the early 1920's.

With The National Safety Council acting as sponsor, the Committee on Safety Code for Presses, B11, was formed by the American Engineering Association in 1920. The main purpose of this committee was to comprise standards to provide reasonable safety for the health and well-being of those associated with the daily operation of the mechanical power press. In addition, the written standards would serve as a guide for state governments in adopting laws to govern the use of power presses.

The first documented standard governing the use of power presses was published in 1922 and was entitled Safety Code for Power Press and Foot and Hand Presses. In 1926 the standard was revised to include a more detailed description of the standard's scope and purpose. This document was adopted by the U.S. Department of Labor. Subsequently, the B11.1 standard was updated again in 1937, 1948, 1960 and 1971 which is the latest revision to date.

A careful study of the various editions of the B11.1 standards from 1922 to 1971 reveals that selection of the

type of safeguarding at the point of operation is based on the method of feed to the system.

The general purpose press as used in a metal forming system can be fed in the automatic, semi-automatic or manual mode and the type of safeguarding supplied will be determined by the method of feed. It is clear that the standards serve as a guideline to indicate that the guarding of the point of operation does not become the function of the press, but rather a function of the system since the die and the method of feeding are components beyond which is normally included with the press itself. To further illustrate this point the following table is taken from the B11.1 standard published in 1926.

"One or more means of safeguarding the press hazards at the point of operation shall be provided and used on every press depending upon the method of feeding, and in accordance with the following:

<u>Method of Feeding Press</u>	<u>Safeguarding Method</u>
I. Automatic Feed	Inclosure of ram (see rule 111), or limitation of ram stroke (see rule 112), or gate guard (see rule 113).
Automatic Roll Feed	
Automatic Push or Pull Feed	
Automatic Plunger Feed	
Feed	
II. Semiautomatic Feed	Inclosure of ram (see rule 111) or limitation of ram stroke (see rule 112), or gate guard (see rule 113).
Chute Feed	
Slide Feed	
Sliding Dies	
Dial Feed	
Revolving Dies	

III. Manual Feed

Inclosure of ram (see rule 111), or limitation of ram stroke (see rule 112), or gate guard (see rule 113), or two hand tripping device (see rule 113), or sweep guard (see rule 113), or special hand tools (see rule 114)."⁴

A table similar to the 1926 table was listed in the B11.1 1937 and 1948 standards.

The standards up to, but not including the 1971 standards were to serve as consensus documents which encompassed the opinions of different groups. Individuals representing government agencies, industry insurance companies and safety organizations with a common interest in power press safety contributed to the formulation of these standards.

The primary function of these standards was to provide a guide for state legislatures and those government agencies responsible for the safety of the worker in developing legislation pertinent to the safety of the worker. It was the hope of the Standards Committee that similar laws would be adopted by each state, so that the same law that protected the worker in California would also govern worker safety in New York.

⁴American Engineering Standards Committee, Safety Code For Power Presses and Foot and Hand Presses, No. 430 (Washington D.C.: U.S. Dept. of Labor, 1926), p. 6.

There are many different factors that contribute to the problem of point of operation injury from metal forming systems. The wide variety of operations that are performed on power press systems and the numerous different operating conditions to which the worker is subjected make for a complex problem. The press element can differ in size for example from a small 2-3 ton press to a large 500-1,000 ton machine. Consequently, the speed of the slide can range from a very slow stroke, 10-20 strokes/minute, to a much faster speed of 120-160 strokes/minute (examples of press sizes and speeds are not to be considered absolute minimums and maximums but are meant only for relative comparisons).

The workpiece is also an important factor to be considered. The size of the workpiece will decide which type of safeguard can be used in a particular system. A thick workpiece will reduce the daylight clearance from the slide bottom to the point of contact. The kind of material and the physical properties associated with the material will be an important factor in system design. Other factors which effect system design are the construction and configuration of the dies, required accuracy of the finished work, the level of operator skill, and the frequency of set up changes in the system. All of these conditions must be studied carefully and only then can the proper feeding methods and safeguarding means be defined.

Until the 1948 A.N.S.I. B11.1 standard was developed the choice of safeguarding methods was limited to barrier guards, gate guards, ram enclosures, two hand devices, and sweep guards. Although pull-out devices were first commercially introduced in the late 1920's, it was not until 1948 that discussion of this safeguarding device first appeared in the B11.1 standards. A pull-out device consists of a hand or wrist attachment that is connected to cables that are incorporated in a pulley system. One end of the cable is attached to the upper die or slide of the press. The other end of the cable is fastened to the operator's hands by the wristlet attachments. As the slide descends, the operator's hands are pulled back and clear of the point of operation before the dies create a pinch point. When the slide is in the top position the operator is free to have access to the die area. This safeguarding device became very popular and was especially useful when other safeguarding methods were impractical.

The 1948 standard also produced another form of safeguarding that was previously not part of the B11.1 standards. The electronic safety device was introduced and this device further broadened the scope of safeguarding press systems. This device, when it was first introduced, consisted of a light beam source and an electric eye receiver. The electric eye was interlocked with the control circuit of the press to stop the ram stroke if the light beam was

interrupted. The standard states the ram must stop immediately if the photo electric field is broken. This device saw wide use in the metal forming industry but was limited to partial revolution clutch presses. The reason for this is on a full revolution clutch press, once the clutch is engaged, the ram will complete one stroke regardless of any signal sent to the press control circuitry. Despite the limitations of the electronic safety device, the system designer now had one more safeguarding device at his disposal.

In the appendix section of the A.N.S.I. B11.1-1948 standard, the wording more clearly substantiates the relationship between safety, the power press and the various other components of the metal forming system.

The die designing phase was recognized as an important step in providing operator safety. The section states that the feeding method should be considered by the die designer for each particular job. It is important that the 1948 standard makes note of the fact that automatic or semi-automatic feed methods depends primarily on the die design. Feeding devices and guards must be attached to the die when possible. The practice of safeguarding is starting to focus on the system component manufacturers rather than the power press element. It is finally realized that the method of feeding and ejecting the workpiece are directly related to die design as opposed to only press design.

The development of the state of the art with respect to the design of the metal forming system can easily be traced through the subsequent B11.1 Power Press Safety Standards.

For example, the 1948 revision strongly suggests the importance of the die design and its relationship to the safety of the press operator. There it states that feeding methods should be provided to eliminate the need for the operator to place his/her hands in the point of operation. The feeding means, other than manual, requires, where economically feasible, that it be an integral part of the die design and would further minimize the operator's exposure to the point of operation. This would further minimize the operator's exposure to the point of operation. B11.1-1948 Safety Standard does set forth acceptable methods of die loading. These include manual, gravity, push, automatic magazine, roll and transfer.

Thus, it is noted that although hands in die are discouraged by these various feeding methods, the standard does recognize the need for and does not negate manual feeding methods. The B11.1-1948 Standard also prescribes die unloading methods which are consistent with its objective of minimizing operations that require hands in die. Thus, the topic of part ejection from the die is covered in this standard. Here it is suggested that either compressed air, knockouts, spring-loaded strippers or gravity from an

inclined press be employed so that the operator need not reach into the danger zone to remove a finished workpiece. Again, it is evident that use of many of the aforementioned means of ejection are not mutually independent from the design of the die itself.

The B11.1-1948 Standard also recognizes that scrap removal from and above the die was also a source of operator injury. Thus, the standard discourages such systems that require scrap removal from the die area by the operator. It recommends a number of different methods that could be used; the most common being air blow-off systems which remove the scrap after each stroke of the ram.

The assignment of responsibility for proper guarding of the point of operation begins to take form in the B11.1-1948 Standard when it recognizes that this can only be done in the work place where the metal forming system is set up, maintained and monitored. There it states "Die setters must be held responsible for setting up operation in accordance with approved safety practices (National Safety Council Safe Practice Pamphlet No. 18 on Power Presses)."⁵ The individual who performs the die setter

⁵American Standards Association, American Standards, B11.1-1948, (New York, NY: American Standard Association, 1948), p. 15.

function shall also be assigned the responsibility for the proper press system. This requires that he must assure that the guarding means is in working order before he releases the press for production by the operator.

In such cases where a barrier guard is employed, it is required that the die setter provide fencing of all openings, where possible, to prevent the operator from reaching into the point of operation. The objective of this requirement is to insure against either inadvertent actions or expediencies by the operator to perform remedial work required by jams or other die and/or feed problems. In addition, the die setter is charged with the responsibility of assuring the proper function of the system. This necessitates production operational tests with trial runs to observe the effectiveness of the safeguarding means. This will allow him to correct for improper operation, make possible adjustments and observe general press behavior. He is also responsible for providing random or periodic inspections of the safeguarding system after it is released for production. The frequency and nature of such inspections are obviously related to the particular safeguarding method being used as well as the length of the production run related to that particular system.

The B11.1 standards were again revised in 1960 and reflected numerous philosophical clarifications which sharpen the focus of the role of the entire system with

respect to operator safety. This is opposed to the lack of clarity which heretofore mistakenly led to contention that associate the hazards at the point of operation with that of the design of the power press which, in effect, serves only as an elemental component. This is perhaps best illustrated by the forward included with the B11.1-1960 standard which, in part, states

"This revision of the standard has been developed on the premise that maximum safety can be obtained by providing the means that make it unnecessary for the operator to place his hands or any other part of his body into the point of operation. This objective can be achieved by:

(1) Automatic or semiautomatic loading and unloading of the dies, with proper point-of-operation enclosure guards; or

(2) Limiting any point-of-operation opening to 1/4 inch; or

(3) If the methods outlined in (1) and (2) cannot be applied, auxiliary protective devices should be used to control access to the point of operation. In addition to the use of safety devices, full consideration should also be given to the use of hand tools or feeding and stock-removal methods, which would make it unnecessary for the operator to place his hands into the point-of-operation."⁶

Here the B11.1-1960 standard strongly reiterates the necessity of the system design to relieve the operator

⁶American Standards Association, American Standard Safety Code for Power Presses, (New York, NY: American Standards Association, 1960), forward page.

from placing his hands into the point of operation. There is a very strong suggestion in the section quoted above that proper die design is essential to limit hands in die operations. This is directly related to the method of feeding and ejection of the workpiece and obviously is not related to the power press element itself. It must be pointed out that the general power press element when shipped by its builder does not contain a die and is intended to accept dies of infinite configurations whose designs and uses are limited only to the sheet height, displacement tonnage and speed of the press. Hence, the point of operation and its consequent hazard is offered by the die design and not the press. When the press and its assembled system is determined and ready for use, the point of operation is defined by the die and to some extent by its loading and unloading means. Thus, logic dictates that the die maker is in the best position to assure that points 1, 2 and 3 of the previously stated objectives be fulfilled.

The design, construction and setting of dies is discussed in some detail in the B11.1-1960 standard. It states that "all new dies shall be so designed and constructed as to permit the use of guards as required in 5.2, or to permit safeguarding with point of operation devices as required in 5.3."⁷ This is significant for two reasons.

⁷Ibid., p. 14.

First, it specifically states that all dies must be safeguarded and secondly, the standard makes a definite distinction between guards and devices.

It is also evident from the 1960 standards that there is a strong inference that the responsibility of safeguarding the point of operation is not the responsibility of the press builders, but is the responsibility of the die makers and/or those who determine the feeding and piece ejection methods.

In summary of the standards discussed to this point, it is fairly evident that from 1922 to 1960 the discussion of responsibility for safeguarding the point of operation has been very limited, if mentioned at all.

Such specific assignment of responsibility is not necessarily an apparent oversight in the various standards themselves. The explanation for such an omission becomes obvious when the primary purpose of the standard is understood. Namely, that the standard was to provide a consensus agreement of all interested parties of the state of the art and practices as they relate to the class of machinery under discussion. Further, such documentation was to be used primarily by the individual sovereign states of this country which would in their appropriate governing departments promulgate codes and regulations which could be enforced through whichever authority was legislated by that individual state. It would therefore have been

presumptive on the part of the authors of the standard to have assigned responsibilities which more properly are in the realm of authority of each sovereign states.

The American National Standards Institute (A.N.S.I.), the successor organization of the American Standards Association (A.S.A.) through the B11.1 committee published the latest revision of the safety standards related to the construction, care and use of mechanical power presses. This document is known as the A.N.S.I. B11.1-1971 Power Press Safety Standard. This standard is a distinct departure from past practice in that individual responsibilities are clearly defined there.

Particular note is made of Section 5 entitled Safeguarding the Point of Operation. There under Paragraph 5.1 the following

"5.1 Responsibility

It shall be the responsibility of the employer to provide and insure the usage of either a point of operation guard or a properly applied and adjusted point of operation device on every operation performed on a mechanical power press."⁸

It further points out in section 5.1 that a guard is the preferred method of safeguarding but since physical

⁸American National Standards Institute, American National Standard Safety Requirements for the Construction, Care and Use of Mechanical Power Presses, B11.1-1971 (New York: American National Standards Institute, Inc.), p. 33.

guarding is sometimes not possible, a properly used device will be considered an adequate safeguard against point of operation hazard.

Further notice is made of Section 6 entitled "Design, Construction, Setting and Feeding of Dies."⁹ There under Section 6.1 the responsibility of the die maker and employer in regard to die design, die procurement, construction and modification is discussed. This section specifically assigns these responsibilities to the die maker and employer. In essence, it states that since the employer is the only one that can enforce the safe and proper use of the dies, it is his responsibility that this is accomplished. The die builder must design and construct the dies to eliminate the need for the operator to place his hands in the point of operation. The dies should be designed wherever possible for automatic or semi-automatic feeding and ejecting. If manual feeding is to be used, the die builder must provide easy access to the nesting region to permit the operator to load and unload the die by the use of hand tools. Here again, responsibilities related to die design further establishes the fact that the power press must be treated as a component since the die which defines the point of operation is an unknown variable to the press builder.

⁹Ibid., p. 42.

It should be pointed out that the discussion with respect to the matter of responsibility and enforcement of assuring safe operation of power press systems was the burden of the individual states and that the various B11.1 standards served as guidelines to develop enforceable codes.

A significant shift from individual state responsibility occurred with the advent of the Williams-Steiger Occupational Safety and Health Act of 1970. This act set forth the establishment of the Occupational Safety and Health Administration (O.S.H.A.) within the U.S. Department of Labor. The purpose of this administration was to establish and enforce regulations as they relate to workplace health and safety matters.

Pursuant thereto certain O.S.H.A. regulations were published as part of the Federal Register. Thus, legislation governing the safety of the worker for the first time is under federal jurisdiction rather than that of each state. The entire matter pursuant to the safe use of mechanical power press systems has been delegated to federal authority.

In particular, with the publication of O.S.H.A. regulations in the Federal Register, a portion of the regulation as included under Sections 1910.211 through 1910.217 specifically covers power press safety. These sections closely followed the A.N.S.I. B11.1-1971 standard but the O.S.H.A.

regulations unlike the A.N.S.I. standard is enforceable as a matter of federal law. These regulations are enforced and administered throughout the U.S. through its ten regional offices.

Each regional office employs a number of inspectors who are charged with the responsibility to enforce the O.S.H.A. regulation. Related thereto their primary pre-occupation is that of investigating industrial accidents and to inspect the conditions at the industrial work places as time permits.

Nearly every workplace in the U.S. which employs power presses may be subject to inspection by O.S.H.A. representatives. This, however, is more theory than fact due to the preponderance of power presses as well as the ever changing numbers of different systems which are associated with a given press. For example, a small job shop with five to ten presses may never have seen a federal O.S.H.A. inspector, yet the small number of presses may have used hundreds of different metal forming systems in the course of a year's operation. The propriety of their design and the safety of their use will only come to light after the occurrence of a serious accident.

Where O.S.H.A. inspectors find infractions, citations are issued and the alleged violation is required to be corrected within a fixed period of time. Citations may also be contested through litigation in such cases where the

employer contents the allegations. It is through this system that the press operator is supposedly assured that the federal regulations intended for his safety are enforced. More specifically, that Section 1910.217 of the O.S.H.A. regulation entitled "Mechanical Power Presses" is strictly enforced and which states in section C(1)-(1)

"C Safeguarding the Point of Operation-(1)
General requirements (i) It shall be the responsibility of the employer to provide and insure the usage of point of operation guards or properly applied and adjusted point of operation devices on every operation performed on a mechanical power press."¹⁰

It is evident from this section of the O.S.H.A. regulation that the responsibility of safeguarding the point of operation rests totally with the employer.

The entire matter of the intent of A.N.S.I. B11.1-1971 and the O.S.H.A. regulations without question reconfirm the state of the art as it relates to safeguarding the operator against the hazards of the point of operation. In conclusion, the responsibility for employing, administering and maintaining proper point of operation safeguards cannot be logically assigned to any party other than the employer/press owner since he is the sole source of knowledge of the ultimate configuration of the metal forming system.

It bears repeating since there is no one single (uni-

¹⁰Occupational Safety and Health Administration, Occupational Safety and Health Standards, (Washington D.C., U.S. Dept. of Labor, 1974), section 1910.217 c(1)-i.

versal) guard or device, the appropriate safeguarding means cannot be selected until the system is defined.

Effective enforcement of O.S.H.A. regulations would undoubtedly be a significant advancement toward reduction of injuries incurred by workers, from the hazards at the point of operation, in metal forming systems.

It is without question that the preponderance of accidental injuries in the U.S. which are related to power press operation are the result of system design improprieties, in that the worker is not sufficiently protected from the hazard at the point of operation. This is opposed to the often alleged impropriety of design of the individual components that are used to build the system. The O.S.H.A. regulations and/or the equivalent state codes and regulations lack a viable means of enforcement to each and every metal forming system which is assigned to a given power press. For example, a particular press including a die, assigned feeding, actuation, unloading means and properly safeguarded against point of operation hazards may have undergone an O.S.H.A. inspection and at that time be deemed safe. Records would accordingly show that the particular "press was properly guarded." This same system by change of die-set alone, still using all other components of a previously inspected system, may now offer serious hazards to the worker at the point of operation. Yet should an accident occur, under the circumstances of an altered

system, the official O.S.H.A. records, if pursued, would show that the said accident had occurred on a properly guarded press.

CHAPTER IV

WESTERN EUROPEAN PRACTICE

This chapter will discuss the practices of point of operation guarding in metal forming systems as they apply to Western Europe with particular focus on Great Britain. The writer, in addition to study of literature, visited Great Britain for the express purpose of reviewing press safeguarding practices. The basis of understanding practices in other European countries was established from available literature and library references.

GREAT BRITAIN

Great Britain has had laws pertinent to workplace safety dating back to the nineteenth century. Laws were directed toward general safety practices and not toward the dangers of point of operation injury until the Factories Act of 1961. These laws, with their subsequent revisions, show an evolution of concern from general workplace practices to the exposure of the obvious dangers from transmission systems such as belt drives, open gearing, and other types of general exposure. It was not until the advent of the 1961 Factories Act that special attention was directed to guarding every part of a machine where a worker's safety was involved.

It is of special interest to note that the 1961 Factories Act did not specify any particular kind or class

of machinery. Further, the portion that is applicable to the subject under discussion is contained in the following quotation from the 1961 Factories Act.

"14.-(1) Every dangerous part of any machinery, other than prime movers and transmission machinery, shall be securely fenced unless it is in such a position or of such construction as to be as safe to every person employed or working on the premises as it would be if securely fenced.

(2) In so far as the safety of a dangerous part of any machinery cannot by reason of the nature of the operation be secured by means of a fixed guard, the requirements of subsection (1) of this section shall be deemed to have been complied with if a device is provided which automatically prevents the operator from coming into contact with that part

(3) Where the Minister is satisfied that there is available and suitable for use in connection with machinery of any class any type or description of safety device which ---

- (a) prevents the exposure of a dangerous part of machinery whilst in motion; or
- (b) stops a machine forthwith in case of danger;

he may make regulations directing that the type or description of device shall be provided for use in connection with such class of machinery as may be specified in the regulations."¹¹

¹¹Minister of Labour, Factories Act 1961, 9 & 10 Eliz. 2, Ch. 34, (London, England, Her Majesty's Stationery Office, reprinted 1979), p. 8.

It is obvious from the wording of this law that it imposes the necessity of appropriate safeguarding to be applied at the point of operation of all power press metal forming systems. It also states that this protection shall be provided by a guard (fencing) or where fencing is impractical that some other means or device shall be used to provide protection from the hazard. The particular instruction of this act allows for special regulations to be issued by the Minister of Labour where greater amplification and clarification is required.

Accordingly, the Minister of Labour in 1965 issued a special regulation to cover power press applications. This is known as "1965 No. 1441 Factories, the Power Presses Regulations 1965."¹² The regulation was briefly amended by "1972 No. 1512 Factories, the Power Presses (Amendment) Regulations 1972."¹³ It is through these regulations that the British government has been able to successfully and cogently prescribe provisions of the Factories Act as it relates to the safe use of power press metal forming systems.

¹²Minister of Labour, 1965 No. 1441, Factories, the Power Presses Regulations 1965, (London, England, Her Majesty's Stationery Office, reprinted 1978), p. 1.

¹³Minister of Labour, 1972 No. 1512, Factories, the Power Presses (Amendment) Regulations 1972, (London, England, Her Majesty's Stationery Office, reprinted 1979), p. 1.

It is of special interest that the force of direction of adherence to this Act and the complete responsibility of the fulfillment in its practice is on the employer or administrator of the workplace. It does not direct the responsibility for point of operation guarding on the power press builder as is so frequently and incorrectly alleged.

The agency responsible for the enforcement of regulations included in the Factories Act 1961 and Power Presses Regulations 1965 and 1972 prior to 1974 was Her Majesty's Factory Inspectorate. The Inspectorate was a government organization comprised of a number of inspectors whose responsibility it was to inspect workplaces and assure safe working conditions. It was also their function to investigate accidents occurring at the workplace.

In 1974 the Health and Safety at Work Act was passed by Parliament. This new legislation was an update of the Factories Act of 1961. The most significant addition to this Act was the formation of the Health and Safety Commission and the Health and Safety Executive. The name Factory Inspectorate was changed to the Health and Safety Executive, but the basic function of the organization remained the same. The Executive was responsible for enforcing the laws of the Factories Act and the Health and Safety at Work Act. The Commission was formed to oversee the Executive and consisted of a chairman and six to nine

other members appointed by the Secretary of State. The Executive consisted of a chief inspector of factories and several hundred factory inspectors who, as in the Factory Inspectorate, had the responsibility of enforcing the laws and codes in the Factories Act and Health and Safety at Work Act.

Since it is the responsibility of the purchaser to provide the guarding for his power press system, it is the purchaser/owner who may exercise certain options in achieving this goal. 1.) He may have the press builder ship the press directly to his premises as would be the practice in the U.S. There the purchaser would make arrangements to have an appropriate guard built to satisfy the needs of his particular metal forming system's characteristics. 2.) Since each such press and guard application must be certified by a "competent person" hereafter called competent person (outside), according to procedures set forth by the Power Press Regulations 1965 & 1972, it is often more convenient and expedient to accomplish the same end by having the purchaser perform this task while the press is still on the premises of the press builder. Under any circumstances, however, it must be understood that the press, with its intended system, cannot be placed into production until form F2197¹⁴ is completed and signed

¹⁴See Appendix 2.

by the "Competent Person" (outside).

"Examination and Testing of Power Press and Safety Devices

5.-(1) No power press or safety device shall be taken into use in any factory for the first time in that factory, or in the case of a safety device for the first time on any power press, unless it has been thoroughly examined and tested, in the case of a power press, after installation in the factory, or in the case of a safety device, when in position on the power press in connection with which it is to be used, by a competent person.

(2) No power press shall be used unless it has been thoroughly examined and tested by a competent person

(a) in the case of a power press on which the tools are fenced exclusively by means of fixed fencing within the immediately preceding period of twelve months; or

(b) in any other case, within the immediately preceding period of six months.

(3) No power press shall be used unless every safety device (other than fixed fencing) thereon has within the immediately preceding period of six months when in position on that power press, been thoroughly examined and tested by a competent person.

(4) The competent person carrying out an examination and test under the foregoing provisions of this Regulation shall make a report of the examination and test in the approved form and containing the approved particulars and every such report shall within fourteen days of the completion of the examination and test be entered in or attached to a register kept for the purposes of this Regulation."¹⁵

¹⁵Minister of Labour, 1965 No. 1441, Factories, The Power Press Regulations 1965, (London, England, Her Majesty's Stationery Office, reprinted 1978), p. 3.

This certifies a particular system for a fixed period. This certification must be repeated every twelve months in the case of a fixed guard and every six months for all other types of guarding. Each time an inspection is made, form F2197 must be filled out and kept on file in the owner's safety records.

In addition to the foregoing certification, continued operational inspection is assured by the mandatory completion of a daily inspection form in accordance with Section 7 of the Power Press Regulations 1965 and 1972.¹⁶

The individual who is authorized to perform this inspection is also called "Competent Person" as defined in Section 4 of the 1965 Power Press Regulations.¹⁷ Parenthetically it should be pointed out that said Competent Person is different from that individual who also bears the same title and is authorized to provide certification under form F2197.

Thus the individual who will perform the daily inspection duties per Section 7 of the 1965 Power Press Regulation will hereafter be referred to as the Competent Person (inside).

¹⁶Minister of Labour, 1965 No. 1441 Factories, The Power Press Regulations 1965, (London, England, Her Majesty's Stationery Office, reprinted 1978), p. 4.

¹⁷Ibid., p. 2.

The daily inspection as prescribed in Section 7, Power Press Regulations 1965 and performed by Competent Person (inside) requires that an inspection must be performed on a power press system during each operating shift and in addition whenever the tools within a given press system are changed.

The Competent Person (inside) is usually the die setter, however, he may not be limited to that trade and can be any individual who may qualify under Section 3 of the 1965 Power Press Regulation.

Section 7 is very specific and states that the power press cannot be used after the setting, resetting or adjustment of the dies until the Competent Person has tested every safety device associated with the system and found it to be operating properly. The Competent Person (inside) has four hours after the start of the shift to inspect each press within his jurisdiction. After the fourth hour has passed, any presses that have not been inspected cannot be used until the Competent Person (inside) has tested the press system for safety. Upon completion of his inspection the Competent Person (inside) must sign and date a certificate in accordance with Section 7 of the Power Press Regulations 1965 & 1972. The certificate is signed only after every safety device is found to be in working order.¹⁸

The certificate is then posted on the press and daily

¹⁸See Appendix 3.

entry made thereon. This certificate is replaced when all entry blanks have been filled and the completed form containing as many as one week's inspections is then filed and required to be available for governmental inspection for at least six months.

After the press system has been tested and its daily inspection certificate signed, the system is permitted to be operated. The employer, however, has further responsibilities in regard to power press system safety. A register of all Competent People (inside) must be kept by the employer.¹⁹ This register must follow the guidelines of Section 11 in the Power Press Regulation 1965 and 1972. The Factory Inspectorate has the authority to check the register and the employer must keep the records for a period of two years after the date of the last entry in the register.

When a guard is changed on a system which has been previously certified, the new press system with the new guard configuration must be recertified using form F2197, as previously discussed.

If in the course of any inspection by the Competent Person (outside), whether periodic or for a guard change, a defect or impropriety is found which in his opinion is an immediate hazard or a potential hazard, he is obligated to notify the employer in writing. A copy of form F2197

¹⁹See Appendix 4.

must be sent by the Competent Person to the Health and Safety Executive describing the defect. If in the opinion of the Competent Person (outside) the defect presents an immediate danger to the operator, he will recommend to the employer that the press system shall not be used until the necessary remedial work has been performed to restore the safety of the system.

If the defect in the press system is not corrected within the time specified by the Competent Person (outside) said system is not permitted to be used until the defect has been corrected to the satisfaction of the Competent Person (outside).

It is also possible that the Factory Inspectorate upon receipt of form F2197 may conduct its own inspections of the impropriety cited by the Competent Person (outside). This inspection procedure would be the same as that which would be made by the Factory Inspectorate where an injury has been reported on a power press system and would include the following process.

The Factory Inspectorate would dispatch an inspector to examine the system under question. In the course of such inspection, if the cited defect or any new defects are found, the system would be ordered shut down.

Under such circumstances where the inspector would find that the employer has allowed dangerous conditions to exist effecting the safety of the worker, he would

gather such evidence as would be required to prosecute the employer. If it is found in such evidence discovery that the employer violated the laws, a summons would be issued and the employer would then undergo prosecution procedures through the court system. If found guilty, the employer would be subject to fines and/or imprisonment for up to two years.

It can be seen that the British system relies heavily on strict enforcement through a process of governmental control on the employer who must be the guardian of safe operations at the workplace.

Great Britain has substantially decreased the number of accidents relating to point of operation injury by holding the owners of power press systems accountable for the safety of the people using these systems. Thus, the number of injuries are significantly reduced by strict and viable enforcement procedures.

FRANCE

In 1945 the French government initiated legislation which required all owners and users of power presses to safeguard power press operations. The movement to guard all power press systems was slow until 1976 when the government started to pursue strict enforcement of the laws concerning power press safety.

The enforcement branch of the French government concerned with safety in industry is the Departments of the Work Inspectorate. The Inspectorate is composed of Higher Works Inspectors who perform a variety of functions related to safety.

It is one of the Inspectorate's responsibilities to visit all metal stamping facilities which employ power press forming systems. These inspections occur at periodic intervals for the purpose of examining the metal forming systems in use in an attempt to assure that safe practices are being used. The procedure, although lacking continuous surveillance, relies upon such periodic inspections which occur on the average of 3-6 months.

The Higher Work Inspector through his periodic visits may in the course of his examination determine unsafe practices or defects exist. The inspector thereupon has the full authority to require that production cease on the effected system until such time that its shortcomings are rectified to his satisfaction.

The Inspectorate also becomes involved when a new press is built and sold. The Inspectorates function along with the process involving the delivery of a power press for ultimate use in a metal forming system is under the following procedure.

The purchaser who possesses the knowledge of the entire system wherein the press will be used may on his own initiative provide the necessary guarding. Accordingly, he, in concert with a guard builder, will determine the specific safeguarding needs required to be used with the intended power press system.

Thereafter, the guarding is built and the guard builder will install same on the press at the press builder's facility. Upon completion of the guard installation, the Work Inspector will inspect the safeguard and its related system and if satisfactory certify same to be used in the workplace.

In such cases where the purchaser of the press does not specify a preference, the Inspectorate then assigns a guard design which to the best of his ability will satisfy the expressed intended use of that press by the purchaser. This safeguard under the advice of the Inspectorate is constructed and installed by the guard builder on the press while it is on the premises of the press builder. The cost incurred for such a guarding device is passed on to the purchaser of the press as an added cost to the price of the press. This is done as an expediency to facilitate billing

and does not suggest that the guarding is part of the press. It must again be pointed out that this procedure in no way intends or infers that said guard is part of the press design nor an integral part of the press. The guard is a system component intended for a given metal forming system.

The French system attempts to assure a safe workplace by imposing fines and successively higher social security rates on employers with incidences of high accidents.

In the French system each employer pays approximately 3%-5% of his payroll to the government to cover the cost of social security insurance. This provides the cost for benefits to the worker similar to workmen's compensation insurance that each employer must pay in the U.S. There are no private insurance companies in France to serve this function, consequently, all workmen's compensation benefits are derived from this government operated social security system.

This allows the government to impose monetary burden on the employer who fails to maintain a safe workplace. In an instance where an employer has numerous accidents, his social security burden could reach as high as 15% of his payroll. In addition, he could also be fined for each accident which was the result of an improperly safeguarded system.

It is through this double economic jeopardy as well as legal actions that can be brought against the employer by

the government or the employee himself which is the basis of incentive for the employer to insure the worker protection from the hazards at the point of operation.

Since the 1976 safety laws, France has been very successful in preventing accidents on power press systems. This is due largely to the government's strict enforcement procedures and economic penalties levied against the employer that violates the safety laws. As a result, the French have experienced a steady decrease in the number of injuries relating to power press systems.

FEDERAL REPUBLIC OF GERMANY(WEST GERMANY)

The Federal Republic of Germany practices of insuring proper safeguarding of metal forming systems centers around the Industrial Inspectorate. These factory inspectorates are responsible for enforcing the DIN-31001 standard which is the guideline every industry must follow to safeguard machinery.²⁰ DIN meaning German Industrial Standard evolved from DIN-31000 (Preliminary Standard).

The DIN-31001 primarily deals with safe reaching distances of adults and children, but is also related to Accident Prevention Regulations for power operated equipment (in course of preparation) and to DIN-31000 (Preliminary Standard) "Safety design of technical products' general principles."

Every industry must attempt to safeguard their machinery according to the DIN-31001 but if this is not possible the factory inspectorate has guidelines for each industry to follow. The division of the Inspectorate responsible for the metal forming system has a set of standards that employers must use to safeguard their power press systems. These standards are

²⁰ Bundesanstalt für Arbeitsschutz und Unfallforschung (Federal Institute for Industrial Safety and Accident Research), Safety Design of Technical Equipment, Safety Devices Definitions, Safety Distances for Adults and Children, DIN-31001, 1976.

written by a consensus of interested parties such as engineering societies, insurance companies, and the Inspectorates who possess a knowledge of power press system safeguarding. The government must approve all guidelines that are adopted by the Inspectorate.

The Industrial Inspectorate is responsible for enforcing the guidelines approved by the government. They have the authority to see that employers conform to the guidelines and provide safe working conditions.

In the West German system, the responsibility of safeguarding against the hazards of the point of operation is assigned to the employer.

As a result of the strong enforcement by the Industrial Inspectorate, the Federal Republic of Germany has reduced the number of accidents relating to point of operation injury in metal forming systems.

The West German system, however, somewhat philosophically different from most countries, does place a greater responsibility on the action of the worker to see that safe practice procedures are fulfilled.

It should be noted that the research on the German practices has been limited in scope due to the difficulties associated in translation of German literature.

CHAPTER V
CONCLUSIONS

The practice of safeguarding the point of operation of the power press in the metal forming system in the U.S. has had a somewhat unique evolution. Quite different from other countries, the U.S. up to 1970 has the laws as related to workplace safety, within the jurisdiction of each of its sovereign states. Hence, there was no central or federal jurisdiction which could create an equal measure of either enforcement or prescription of means to achieve safe working conditions.

The entire matter of effective point of operation guarding for power press operations relies on two factors. The first is associated with the propriety and/or prescription of the guard or device used with the given system. The second has to do with the enforcement of its proper use, adjustment and maintenance.

The U.S. again different from other countries studied, has allowed these two requirements to evolve through two independent tracks as opposed to the Western European countries who have used a single track to bring these two factors into play.

It is through the B11.1 committee that a series of power press safety standards have been promulgated including the first publication in 1922, followed by subsequent revisions in 1926, 1937, 1948, 1960. Therein lies a treatise

related to proper use of guards and devices which serves as a complete prescription for the innumerable safeguarding needs of the power press in a metal forming system. They became available as a source of information to be used by the individual states in formulating their codes or regulations.

The track of enforcement, however, was subject to whatever impetus was provided by any given state through its codes and regulations. The effectiveness of enforcement in any state then depended upon the codes or regulations that were promulgated for that particular state, as well as the vigor with which that state chose to enforce their codes or regulations.

It was not until 1970 with the advent of the Occupational Safety and Health Act (O.S.H.A.) that the authority for enforcement of regulations related to the safety of the workplace became a federal responsibility.

In apparent concert therewith, the B11.1-1971 standards revision had reflected this philosophy, namely that the assignment of responsibility would not vary among the various states, but would be common to workplaces in all states. Thus, the B11.1-1971 standards had emphatically set forth the various responsibilities including those which relate to protecting the point of operation of a power press in the metal forming system. There, as well as with the O.S.H.A. regulations the assignment for the responsibility of proper

safeguarding of said point of operation is that of the employer and the employer alone.

Although the O.S.H.A. act provided a unified set of regulations and centralized means of enforcement, it has yet to show that it has the capability to effectively enforce those provisions related to power press operations and measurably reduce the incidence of accidents associated with point of operation hazards.

Great Britain, on the other hand, had not until 1965 provided any specific prescription or viable means to enforce safety at the point of operation for power press systems. Passage of the Factory Act and all its implications caused a very effective prescription and enforcement system to evolve by the issuance of the Power Press Regulations 1965.

Through the Factory Inspectorate and its successor the Health & Safety Executive, a very effective and workable enforcement means has been developed. Regular inspections and maintenance ensures that adequate safeguarding is provided for the metal forming system.

The British approach and administration of safe practice enforcement is by far the most effective deterrent against injury at the point of operation when compared to the enforcement and prescription means as practiced in the U.S. or the other European countries studied.

The French approach to the problem of reducing injury at the point of operation seems to lack both the detail of prescription when compared to the U.S. and the detail of enforcement shown in the British approach. It seems to rely on the incentive to avoid heavy imposition of costs resulting from high social security contributions and fines levied as the result of accidents and injuries which occur.

The German approach toward safeguarding practice relies on prescriptions as are developed by the Inspectorate which has jurisdiction for a given user's industry. Here again, the onus of responsibility is on the employer/owner of the power press system. It is through the enforcement efforts of the Inspectorate that the function of maintaining the safety of the worker is achieved.

The West German philosophy is somewhat different from all others discussed herein in that greater emphasis for the enforcement of safe working procedures relies on the responsibility assigned to the employer.

It is the goal of all the countries studied to provide safety to the operator at the point of operation though the approach and technique to that end varies. However, as logic would dictate those means which employ the stricter enforcement produce the most desirable results.

CHAPTER VI

RECOMMENDATIONS

Upon completion of this study the practices as they are employed in various countries in regard to safety against hazards at the point of operation, it has become evident that much is yet to be done in the United States to reduce the number of injuries that result in power press related operations against the hazards at the point of operation.

In order to achieve a better safety result the following recommendations are made in the areas which require further study and consideration to achieve this end to wit.

- A.) A survey should be conducted of present O.S.H.A. inspectors to determine their knowledge of power press systems. If the survey results indicate a lack of qualified people, O.S.H.A. should hire the necessary number of new inspectors and train them to the technicalities of examining power press systems.
- B.) A program should be established to include a mandatory examination of all new power press systems and annual inspections should be performed of every existing mechanical power press system in the United States. The feasibility and means of implementation of such a program must also be studied.

- C.) The methods and feasibility of performing daily power press system inspections and the establishment of a working system that is overseen by the Occupational Safety and Health Administration should be investigated. The inspection system should be conducted by trained employees in every establishment that uses power press systems. The inspection certificates should be signed and dated by the trained employee and posted on the power press element of the system in plain view of the operator.
- D.) Workmen's compensation insurance benefits should be increased to more adequately compensate the injured worker for his or her loss. This program should be coordinated through representatives of the American Insurance Association and the U.S. Department of Labor. Upon approval, the new program should be adopted by all insurance companies providing workmen's compensation insurance.
- E.) An adequate enforcement system should be developed to bring action against an employer who allows unsafe work conditions to exist on his premises. The enforcement should be instituted by O.S.H.A. and include the immediate shut down of all dangerous power press systems discovered along

with heavy fines imposed on the owners of the facilities that allow the hazardous conditions to exist. In the event of a serious injury that is a direct result of employer negligence, the employer should be held accountable for his actions both in civil and criminal court.

- F.) The methods of guarding the point of operation in press brakes comparing the United States and Western European approaches should be studied to suggest proper safeguards to be used.

APPENDIX

1. Glossary pp. 55-57
2. Figure 1 - The Basic Metal Forming System.. p. 58
3. Form F2197 pp. 59-61
4. Certificate of Inspection Form
used by competent person (inside)
for daily inspection of power
press systems p. 62
5. Register of competent people
(inside) kept in each facility
that use power press systems p. 63

GLOSSARY

The definitions in this glossary pertain to power presses and metal forming systems.

Automatic Feeding - The placing of material in the point of operation by a device or method that does not require the operator to load the point of operation with each stroke of the ram.

Competent Person Inside - The employee(s) or person(s) within the firm assigned the responsibility to insure all power press systems are inspected daily and deemed safe for operation.

Competent Person Outside - An inspector usually from an insurance company who must inspect all new press system installations and the safeguarding of such systems on a periodic basis.

Clutch - The coupling mechanism used on mechanical power presses to join the flywheel to the crankshaft.

Code - A set of rules and regulations that are adopted by each state and are considered law.

Continuous Stroke - Uninterrupted multiple strokes of the slide without stopping at the end of each stroke cycle.

Device - A safeguarding attachment that is used in press systems to protect the operator from inadvertently reaching into the point of operation or prevents press operation if the operator's hands are in the point of operation or automatically withdraws the operator's hands if they are within the point of operation.

Die - The tooling or working part attached to a press for the purpose of producing work.

Die Set - A tool holder held in correct alignment by guide posts and bushings.

Ejection - The process by which a finished workpiece or scrap is removed from the point of operation upon completion of the press stroke.

Feeding - The process of placing and positioning material to be worked in the point of operation.

Guard - A physical barrier that prevents entry of the operator's fingers or hands into the point of operation during the stroke of the slide.

Hand Feeding Tool - A hand held tool used by the operator to feed and remove material from the point of operation.

Manual Feeding - Placing a workpiece into the point of operation which requires the operator to load the die after each stroke of the slide.

Semiautomatic - The process of feeding that incorporates an auxiliary means for placement or removal of the workpiece that is controlled by the operator on each stroke of the press.

Single Stroke - The upward and downward motion of the slide until completion and termination of one stroke.

Slide - Also referred to as the ram; it is the moving, reciprocating member of the press to which the upper die is fastened.

Standard - A consensus of various opinions which is used as recommendations to follow so that state governments have a basis for writing codes and law.

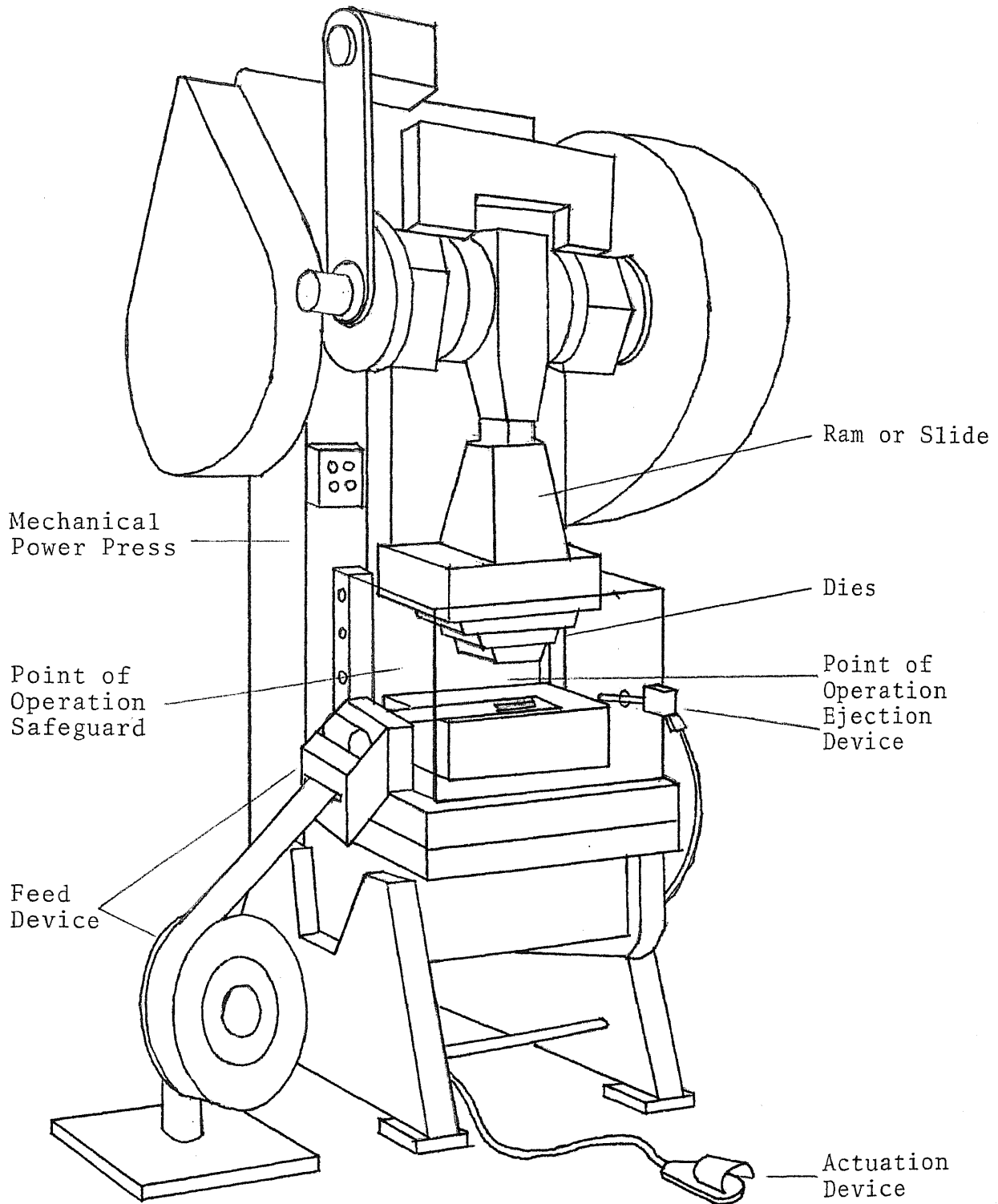


FIGURE 1 - THE BASIC METAL FORMING SYSTEM

DEPARTMENT OF EMPLOYMENT
 FACTORIES ACT 1961, THE POWER PRESSES REGULATIONS 1965 (SI 1965 No. 1441)
 and 1972 (SI 1972 No.1512)

F 2197

POWER PRESSES AND SAFETY DEVICES THEREON

Report of Thorough Examination and Test and Record of Repairs

(Form approved by HM Chief Inspector of Factories under Regulations 5 and 6)

See Notes and space for continuation of entries overleaf.

Name of Occupier

Address of Factory

<p>1 Make, type and date of manufacture (if known):</p> <p>(a) Power Press</p> <p>(b) Safety Device(s)¹</p>	
<p>2 Identification mark or No.</p> <p>(a) Power press</p> <p>(b) Safety device(s)</p>	<p>Maker's..... Occupier's.....</p> <p>Maker's..... Occupier's</p>
<p>3 Are the following parts of the press and safety device(s) in good working order?² If not, state what defects have been found</p> <p>(a) Power Press</p> <p>(i) Clutch mechanism ...</p> <p>(ii) Clutch-operating controls ...</p> <p>(iii) Brake</p> <p>(iv) Flywheel bearing(s) ...</p> <p>(v) Other parts affecting safety at the tools... ..</p> <p>(b) Safety device(s)</p> <p>(i) Interlocking guard ...</p> <p>(ii) Automatic guard</p> <p>(iii) Fixed fencing (inc. that associated with (i), (ii), and (iv))</p> <p>(iv) Other type of safety device (e.g. photo-electric)</p>	

4 What parts (if any) were inaccessible?

5 Repairs, renewals or alterations to the power press and safety device(s) to remedy defects which are or may become a cause of danger to employed persons (Regulation 6(1)), which are required²

(a) immediately

(b) within a specified time, the said time to be stated

If no such repairs, renewals or alterations are required enter "NONE"

6 Defects (other than those specified at 5 above) which require attention.

I hereby certify that on..... I thoroughly examined and tested the power press and the safety device(s) thereon specified above and the results of my examination and test are as shown.

If employed by a Company or Association give its name and address; if self-employed or employed by occupier please state accordingly.

Signature:

Qualification:

Address:

If any defects require action as noted at 5 above please give date of ² notification of such defects (under Regulation 6(1)) to the occupier.....

(Continued overleaf)

For the For use of the Occupier or his Agent.

7 Record of repairs, renewals or alterations carried out in accordance with 5 of this report.³

Signature and Date

Notes:

The report and certificate must be completed—striking out whatever is inappropriate—in respect of the press and/or the safety device(s) examined, by the person making the examination. Where, for a given press, a report and certificate deal with the press only, or its safety device(s) only, (a) separate current report(s) and certificate(s) must also be available for the items not covered.

¹ Specify all items forming the fencing or other safeguard provided for the tools.

² All parts which, if defective or omitted, would affect safe working at the press must be considered. In every case where notification has been given under this paragraph a

copy of the report made under Regulation 5(4) shall be sent by the competent person to the inspector for the district within fourteen days of the completion of the examination and test.

³ 7 should be completed by the occupier or his agent, specifying the repairs, renewals or alterations effected and the date these are carried out, as soon as is practicable after each defect has been remedied. Alternatively, where it is impracticable to do this on this Report, a separate record of these matters should be made and attached as soon as practicable to this Report (Regulation 6(3)).

Suitable Form of Certificate of Inspection and Test (Regulation 7)

FACTORIES ACT 1961
THE POWER PRESSES REGULATIONS 1965
(S.I. 1965 No. 1441)

Certificate of Inspection and Test of Safety Devices (regulation 7(3))

Identification Particulars of Power Press:

Identification Particulars of Safety Device(s):

I hereby certify that every safety device indicated above is on the power press to which this certificate relates and is in efficient working order:

*Signature of appointed
or authorised person*
*Date and time of
inspection and test*
*Signature of appointed
or authorised person*
*Date and time of
inspection and test*

<i>Signature of appointed or authorised person</i>	<i>Date and time of inspection and test</i>	<i>Signature of appointed or authorised person</i>	<i>Date and time of inspection and test</i>

NOTE: The occupier or his agent must be notified immediately if any necessary safety device is not in position, is not properly in position, is unsuitable or is defective.

**Specimen Sheet for a Register—
Appointment of Persons to Prepare Power Presses for Use (Regulation 4)**

Persons appointed to carry out on a power press all or any of the duties specified in regulation 4(1) of the Power Presses Regulations 1965

<i>APPOINTMENT</i>					<i>REVOCATION</i>	
<i>(1) Name of person appointed</i>	<i>(2) Class or description of power press and/or safety device for which appointment is made</i>	<i>(3) Duties to which appointment relates</i>	<i>(4) Date of appointment</i>	<i>(5) Signature of occupier or his agent</i>	<i>(6) Date of revocation of appointment</i>	<i>(7) Signature of occupier or his agent</i>

REFERENCES

- American National Standard Safety Requirements for the Construction, Care and Use of Mechanical Power Presses, B11.1-1971, American National Standards Institute, Inc., New York, New York, 1971.
- American Standard Safety Code for Power Presses, B11.1-1960, National Safety Council sponsor, American Standards Association: New York, New York, 1960.
- American Standard Safety Code for Power Presses and Foot and Hand Presses, B11.1-1948, National Safety Council sponsor, American Standards Association: New York, New York, 1948.
- American Standard Safety Code for Power Press and Foot and Hand Presses, B11.1-1937, National Safety Council sponsor, American Standards Association: New York, New York, 1937.
- Barrett, James A., Personal Interview. 7 March 1981
Factory Inspector, The Health and Safety Executive,
Birmingham, England.
- Factories Act, 1961, 9 & 10 Eliz. 2. Ch. 34, Her Majesty's Stationery Office: London, England, Reprinted, 1979.
- Federal Register, vol. 39, no. 125, Part II. Washington D.C.: Department of Labor, Occupational Safety and Health Administration, 1974.
- Federal Register, Reprinted from Sections 1910.211 and 1910.217 in their entirety, June 27, 1974 and December 3, 1974. Washington D.C.: Department of Labor, Occupational Safety and Health Administration.
- Handbook of Accident Prevention for Business and Industry, Fifth Edition. Chicago, Illinois: National Safety Council, 1964.
- Health and Safety at Work etc. Act 1974, Chapter 37, Her Majesty's Stationery Office: London, England, Reprinted 1980.
- Industrial Safety Handbook, William Handley. London: McGraw-Hill Publishing Company Limited, 1969.

Minister of Labour, Power Presses Regulations 1965, Her Majesty's Stationery Office: London, England, 1965.

Power Press Safety Manual, Second Edition, Chicago, Illinois: National Safety Council, 1972.

Safety Code for Power Presses and Foot and Hand Presses, National Safety Council sponsor; Washington Government Printing Office: Washington D.C., 1926.

Safety Devices, DIN-31001, Bundesanstalt fur Arbeitsschutz und Unfallforschung (Federal Institute for Industrial Safety and Accident Research): Dortmund, West Germany, 1976.

Safety in the Use of Mechanical Power Presses, Health and Safety Executive, Her Majesty's Stationery Office: London, England, 1970.

The Power Presses Regulations 1965 & 1972 A General Guide, Her Majesty's Stationery Office: London, England, 1973.

Udal, J. Robin, M.A. Personal Interview. 8 April 1981, Director, J.P. Udal Ltd., Birmingham, England.