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**SAFETY CODE SERIES**

**SAFETY CODE FOR FORGING  
AND HOT METAL STAMPING**

**AMERICAN DROP FORGING INSTITUTE AND  
NATIONAL SAFETY COUNCIL, SPONSORS**

**TENTATIVE AMERICAN STANDARD**  
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## SAFETY CODE FOR FORGING AND HOT METAL STAMPING INTRODUCTION

1. This code was formulated by the following committee under the joint sponsorship of the American Drop Forging Institute and the National Safety Council, which committee functioned under the procedure of the American Engineering Standards Committee:

Name and title	Affiliation	Representing—
Chairman, G. A. Kuechenmeister	Dominion Forge & Stamping Co. (Ltd.), Walkerville, Ontario.	American Drop Forging Institute.
Owen F. Luckenbach.....	29 Wall Street, Bethlehem, Pa.....	American Society of Mechanical Engineers.
Howard L. Johnson.....	Baldwin Chain & Manufacturing Co., Worcester, Mass.	Do.
R. H. Leveridge, chief bureau of electrical and mechanical equipment.	New Jersey Department of Labor, Trenton, N. J.	Association of Governmental Labor Officials of United States and Canada.
John P. Mead, director division of industrial safety.	Department of Labor and Industry, Boston, Mass.	Do.
S. N. Clarkson, executive secretary.	Electric Power Club, B. F. Keith Building, Cleveland, Ohio.	Electrical Manufacturers' Council (for Electric Power Club).
MacDonald S. Reed.....	Erie Foundry Co., Erie, Pa.....	Erie Foundry Co. <sup>1</sup>
Lucian W. Chaney.....	Bureau of Labor Statistics, Washington, D. C.	International Association of Industrial Accident Boards and Commissions.
R. McA. Keown, engineer.....	Industrial Commission, Madison, Wis.	Do.
Reginald Steel.....	R. Steel & Sons (Inc.), 482 Vernon Avenue, Long Island City, L. I.	Master Blacksmiths' Association.
George J. Earl, secretary.....	Master Blacksmiths' Association, 30 Church Street, New York City.	Alternate.
W. J. Graves, safety engineer.....	Michigan Mutual Liability Co., Detroit, Mich.	National Association of Mutual Casualty Companies.
W. S. Paine, research engineer.	Aetna Life Insurance Co., Hartford, Conn.	National Bureau of Casualty and Surety Underwriters.
T. M. Nial.....	National Bureau of Casualty and Surety Underwriters, 120 West 42d St., New York City.	Alternate.
G. A. Orth.....	American Car & Foundry Co., 165 Broadway, New York City.	Railway Car Manufacturers' Association.
Hugo P. Frear.....	Bethlehem Shipbuilding Corp., Bethlehem, Pa.	Society of Naval Architects and Marine Engineers.
S. J. Owen, Jr.....	Bureau of Standards, Washington, D. C.	U. S. Bureau of Standards.
Capt. H. C. Minton.....	Watertown Arsenal, Watertown, Mass.	U. S. War Department.
Wm. H. Doolittle, safety engineer.	National Metal Trades Association, People's Gas Building, Chicago, Ill.	Independent expert.
Prof. Chas. F. Park, director....	Mechanical Laboratories, Massachusetts Institute of Technology, Cambridge, Mass.	American Society of Mechanical Engineers.
E. R. Frost, manager.....	National Machinery Co., Tiffin, Ohio.	National Machinery Co..
E. C. Clarke, vice president and general manager.	Chambersburg Engineering Co., Chambersburg, Pa.	Do.
Chas. E. Lehr, chief engineer...	Bethlehem Steel Co., Bethlehem, Pa.	National Safety Council, metals section.
J. L. Thompson.....	Travelers Insurance Co., Hartford, Conn.	National Safety Council.
Secretary, W. Dean Keefer, director industrial division.	National Safety Council, 108 East Ohio Street, Chicago, Ill.	Do.

<sup>1</sup> Forging equipment manufacturers are not organized.

2. The nature of any industry invariably reflects the nature of the product manufactured. If the product is a refined machine, extremely accurate and finely finished, like an adding machine, the factory in which it is built is likely to be a model for highly developed processes, economical methods for handling material, faultless housekeeping, excellent working conditions, etc. Manufacturing establishments so conducted are generally profitable.

3. If on the other hand, the product is rough, black, and unfinished, like forgings, raw castings, etc., the work place is more likely to be dark, smoky, dusty, and crude, and uneconomical methods are more likely to prevail. Business under such conditions is generally unprofitable.

4. The forge shop is the result of evolution. It started as a hand smithy and many things which featured the old-time blacksmith shop still prevail. It is unfortunate, economically, that this is so. Comparing the forging industry with others, there is not one which offers so much chance as forging for improvement in the reduction of waste and the development of modern methods for economical production.

5. This code deals primarily with but one form of industrial waste—namely, accidents—but if, incidentally, it is the means of promoting greater interest in some of the business needs which have never been as profitable as might be, this code will doubly serve its purpose.

6. This is one of a number of safety codes on various subjects which have been or are being formulated under the general auspices of the American Engineering Standards Committee.

7. The code is designed to serve as a guide to State authorities in the formulation of laws or regulations. It is also intended for voluntary use by concerns in the forging industry or having a forge department. The code may be adopted by any such concern as a standard to be followed by its superintendents, foremen, designers, mechanics, and operators.

8. A similar code on power presses and foot and hand presses has recently been formulated under similar auspices and may be obtained from the National Safety Council, Chicago.

9. The illustrations contained herein are not a part of the code proper; they simply show how various manufacturers have met certain code requirements.

## SECTION 1. SCOPE AND PURPOSE

### Rule 10. Scope.

This code applies to all classes of power-forging machinery for both drop forging and flat-die forging, including steam hammers, pneumatic hammers, mechanically operated hammers, hydraulic presses, trimming presses, bulldozers, upsetting machines, and bolt-heading and rivet-making machines, hot saws; and incidental operations in connection with such machinery.

### Rule 11. Purpose and exceptions.

The purpose of this code is to provide reasonable safety for life, limb, and health. In cases of practical difficulty or unnecessary

hardship the enforcing authority may grant exceptions from the literal requirements of this code or permit the use of other devices or methods, but only when it is clearly evident that reasonable safety is thereby secured.

**NOTE.**—It is suggested that in cases where exceptions are asked, the enforcing authority consult with the committee on Safety Code for Forging, in care of American Engineering Standards Committee, 29 West Thirty-ninth Street, New York, or National Safety Council, 108 East Ohio Street, Chicago, or American Drop Forging Institute, Union Bank Building, Pittsburgh. Such consultation will tend to bring about uniform application of the code and will keep the committee informed of criticisms which should be considered if and when the code is revised.

## SECTION 2. DEFINITIONS

### Rule 20.

The word "shall" is to be understood as mandatory and the word "should" as advisory.

### Rule 21.

The word "approved" means approved by the authority having jurisdiction.

### Rule 22.

Power hammers may be classified in either of two ways:

(a) They may be called "forging hammers" or "drop hammers," and the distinction is usually based upon the type of work that is done and upon the manner in which the anvil is assembled with reference to the operating mechanism and machine supports; or

(b) They may be called "steam hammers," "pneumatic hammers," or "mechanical hammers," and the distinction is based upon the manner in which the ram is actuated.

### Rule 23.

Forging hammers are so constructed that the anvil assembly is separate from the operating mechanism and machine supports; it rests on its own independent foundation. In such hammers flat dies are most generally used, or dies that do not require perfect alignment. Certain exceptional forging hammers are made with the frame mounted on the anvil; for instance, the smaller single frame hammers are usually made with the anvil and frame in one piece. Practically all forging hammers which are operated by steam or air are double acting.

### Rule 24.

Drop hammers are so constructed that the frames and upper parts of the machines are held and maintained in alignment with the anvil in such a manner as to insure matching of the die impressions. The entire assembly of the hammer is supported by the anvil which in turn rests on a single foundation. Flat dies are rarely used in drop hammers; the purpose of this type of hammer being to shape the finished forging exactly to the impression machined in the dies; excess metal is extruded as "flash" or "fin" which must later be trimmed off. Practically all air or steam drop hammers are double acting.

**Rule 25.**

Steam hammers may be either single or double acting, and all steam hammers can be adjusted to operate equally effectively with compressed air furnished from some exterior source. Steam hammers are built in both "drop hammer" and "forging hammer" types and are still essentially steam hammers, in ordinary parlance, even though operated by compressed air instead of steam. Another type of hammer has an air compressor built integral with the hammer, and in this type there is a definite relation between the movement of the compressor piston and the hammer ram. The compressor of the hammer is operated by a motor, by belt drive, or by similar mechanical power. The name "pneumatic hammer" is believed to be the usual and clearest name for this type, which is of the "forging hammer" class. Mechanically operated hammers (i. e., direct mechanical drive without the interposition of compressed air) are made in both drop hammer and forging hammer types. Drop hammers in this class include both board drop hammers and hammers which have the ram suspended by ropes or belts lifted by a crank, by a drum on which the belt is wound, or by similar means. These hammers drop by gravity only. Forging hammers in this class are of numerous types and are made principally in small sizes. Typical examples are helve hammers and hammers with rams having flexible connection, such as a spring to the actuating mechanism which is belt or motor driven. In these hammers, the ram may be driven downward.

**Rule 26.**

Terms not defined are understood to be used with their usual significance.

**SECTION 3. REFERENCES TO OTHER CODES****Rule 30.**

This code is supplemented by the following codes:

Safety Code for Power Presses and Foot and Hand Presses.

NOTE.—Copies may be obtained from National Safety Council, 108 East Ohio Street, Chicago.

Safety Code for the Use, Care, and Protection of Abrasive Wheels.

NOTE.—Copies may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C.

Safety Code for the Construction, Care, and Use of Ladders.

NOTE.—Copies may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C.

Safety Code for Mechanical Power-Transmission Apparatus.

NOTE.—Copies may be obtained from the American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York City.

National Electrical Safety Code.

NOTE.—Copies may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C.

National Electrical (Fire) Code.

NOTE.—Copies may be obtained from National Board of Fire Underwriters, 76 William Street, New York City.

**Safety Code for Walkway Surfaces.**

NOTE.—This code is now in preparation, but tentative draft may be obtained from the American Engineering Standards Committee, 29 West Thirty-ninth Street, New York City.

**Code of Lighting Factories, Mills, and Other Work Places.**

NOTE.—Copies may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C.

**Safety Code for the Protection of the Heads and Eyes of Industrial Workers.**

NOTE.—Copies may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C.

**SECTION 10. GENERAL REQUIREMENTS****Rule 100. Working space. (See fig. 1.)**

Machines shall be so located as to give (a) enough clearance between machines so that the movement of one operator will not interfere with the work of another; (b) ample room for cleaning machines and handling the work, including material and scrap. The arrangement of machines shall be such that operators will not stand in aisles.

**Rule 101. Aisles. (See fig. 1.)**

Aisles shall be provided, of sufficient width to permit the free movement of employees bringing and removing material. A minimum aisle width of 4 feet 6 inches is recommended. This aisle space is to be independent of working spaces and storage spaces. Aisle space should be defined by marking where practicable.

NOTE.—The marking of aisles is desirable to discourage piling or leaving material, tools, etc., therein.

**Rule 102. Platforms.**

If wooden platforms are used on the floor in front of machines, they should be substantially constructed and a separate platform should be provided for each machine.

NOTE.—Long platforms serving a row of hammers or presses are difficult to keep in repair and are often neglected.

**Rule 103. Goggles.**

Goggles shall be provided for all hammer operators, heaters, helpers, and cold-trim press operators as required by the Head and Eye Protection Code.

**Rule 104. Lighting.**

Machinery and equipment should be so located with respect to sources of both natural and artificial light that light of sufficient intensity will fall on the work. Direct or reflected glare and shadows including moving shadows should be avoided.

NOTE.—For specific requirements see Code of Lighting Factories, Mills, and Other Work Places.

## SECTION 11. ALL HAMMERS

**Rule 110. Scale removers and oil swabs. (See fig. 2.)**

Oil swabs or scale brushes or similar devices to remove scale shall be provided which are long enough to enable a man to reach the full length of the die without placing the user's hand or arm between the dies.

**Rule 111. Treadle guard.**

All hammer treadles shall be substantially and effectively guarded to prevent accidental tripping. The portion of the treadle at the rear of the hammer shall also be guarded so that scrap or other material can not collect below this portion of the treadle and prevent it from returning to normal position. (See figs. 3 and 5.)

**NOTE.**—Treadle latches or locking devices, while preventing accidental tripping of the treadle, do not always prevent the descent of the ram. This is particularly true of steam drop hammers where a shutoff in the steam line will allow the ram to fall, regardless of treadle movement.

**Rule 112. Blocking hammer. (See fig. 4.)**

A proper timber or bar shall be provided at each hammer for blocking up the ram when changing or otherwise working on the dies or hammer, and shall be either—

(a) A timber not less than 4 by 4 inches, preferably of hardwood with a ferrule on each end and preferably with a handle on the side; or

(b) A rail or structural shape carefully squared at the ends; or

(c) A pipe not less than  $2\frac{1}{2}$  inches inside diameter, with a flange on each end; or

(d) A forked clutch on the side of hammer frame which is independent of the actuating mechanism. (This is applicable only to hammers actuated by mechanical power.)

The size of timber blocks shall be such that the stress will not exceed 800 pounds per square inch under the weight of the hammer plus steam or air pressure in the case of a steam or air hammer. The size of shapes or pipe shall be such that under similar conditions the safe working load will not be exceeded. (See fig. 6.)

**NOTE.**—Hardwood blocking from railroad cars may be used.

**Rule 113. Scale guard.**

A scale guard of substantial construction shall be provided on the back of every hammer, so arranged as to stop all flying pieces. This guard may be pivoted on one side to permit easy access to dies, or scale guards may be supported on floor standard or may be suspended from the ceiling by chains with hooks at the bottom. (See fig. 7.)

**Rule 114. Hammer die keys.**

Hammer die keys shall be of material that will not crack or splinter or fly off and shall not project so as to endanger workmen.

**NOTE.**—It is suggested that hammer die keys be made of open-hearth material (Mn 0.40 to 0.50 per cent; C 0.50 to 0.60 per cent); that they be machined accurately to fit notches; and that the ends be tempered to prevent spreading, upsetting, or breaking. The ends of keys should be redressed when necessary. For backing out keys a "key backer" held by a fixture is recommended. (See figs. 8, 9, and 10.)

Another method which has been found satisfactory is to use softer keys (C 0.37 to 0.50 per cent), heat treated by quenching in oil until black and then cooling in the air. These keys upset before they will split. This necessitates frequent dressing but is reported to be much better than using hard keys. If the small end of the key upsets before it starts out of the die, the key is driven up as far as possible, then the end is burned off with an acetylene torch and the key driven out.

**Rule 115. Feeding cold material.**

Pliers or other suitable devices shall be provided for feeding material (for example, where hammers are used for straightening malleable castings) so that the operator's hand need not be placed under the hammer at any time.

## SECTION 12. STEAM AND PNEUMATIC HAMMERS

**Rule 120. Clearance and cushion.**

Every steam or air hammer shall have a sufficient steam or air cushion or an equally effective spring head to prevent the piston from striking the top cylinder head. The cushion or spring should be placed at the top of the cylinder, so as to strike the piston head rather than the ram; thus it will be effective should the rod break or pull out of the ram, whereas the stop springs placed between the bottom of the cylinder and the top of the ram are not effective in such cases and, on the contrary, tend to drive ram off the rod.

**Rule 121. Stop valves.**

Every steam hammer shall be provided with a stop valve in the admission pipe line, in a convenient location.

**NOTE.**—This valve must be closed while repairing the hammer, changing dies, or doing any other work on hammer or dies. The steam or air pressure at the hammer should be fairly constant and not higher than the pressure for which the hammer was designed. If the pressure is higher, or if it fluctuates, a reducing valve or automatic regulating valve supplemented by a safety valve shall be used. When stop valve is out of reach place sprocket wheel and chain on valve stem. Valve can then be easily operated from the floor.

**Rule 122. Drain cock.**

If the steam hammer cylinder is constructed without a self-draining arrangement, a drain cock shall be provided, preferably of the quick-acting type, which should be piped to a sump or drain pipe. If discharging into the air, it shall be so located as not to endanger passers-by.

**Rule 123. Steam pipes.**

All steam pipes shall be covered where exposed to contact. Steam pipes to hammers should be placed in floor trenches where practicable. Proper pipe supports or other equally effective means shall be provided to prevent failure from vibration or expansion.

## SECTION 13. MECHANICALLY OPERATED HAMMERS

**Rule 130. Means of disconnecting power.**

Every mechanically operated hammer shall be provided with means for disconnecting power. Acceptable methods are:

(a) Individual motor drive; if the switch or starter is so constructed and located that the motor may be accidentally started, provision shall be made to permit locking or latching in off position.

(b) Tight and loose pulleys on countershaft, with belt shifter which can be locked or latched in off position.

(c) Clutch on drive pulley, with clutch handle that can be locked or latched in off position.

(d) Belt porch or idler pulleys to facilitate throwing the drive belt off and on.

NOTE.—A belt porch should be used only where other disconnecting devices are not practicable. Whatever disconnecting device is used shall conform to the requirements of the Mechanical Power-Transmission Code.

#### **Rule 131. Safety stops.**

On mechanically operated hammers where only one hand is used for holding the material, a safety stop, dog, or catch should be provided which will prevent the hammer coming down until such device has been released and held out of the way by the other hand, or a hand lever instead of the foot treadle shall be provided for tripping the hammer. On hammers where neither hand is used for holding the material a safety stop or tripping lever, or both, should be provided which will require the use of both hands to trip the hammer. (See figs. 11, 12, and 13.)

NOTE.—The purpose of this rule is to keep both hands out of the danger zone whenever the hammer is descending or may accidentally descend.

#### **Rule 132.**

Inclosure of springs suspending the ram in power-driven hammers is recommended.

NOTE.—Such inclosure will prevent injury to the operator in case the spring breaks and will also prevent long stock being caught in the spring.

#### **Rule 133. Shaft failure.**

Suitable means should be provided to prevent the flywheel or driving pulley falling to the floor in case the shaft should break.

### **SECTION 14. BOARD DROP HAMMERS**

#### **Rule 140. Inclosure for board.**

On every board drop hammer a substantial guard shall be provided around the board above the rolls to prevent the board falling in case the board breaks or comes loose from the ram. (See fig. 14.)

#### **Rule 141. Overhead platform and ladder.**

On board drop hammers where it is necessary for work to be done at or near the rolls a platform with standard railing and fixed ladder should be provided for such purpose. (See figs. 15 and 16.)

NOTE.—In the case of a battery of hammers an overhead platform or runaway may be constructed, providing access to the rolls of all hammers. On newer types of board drop hammer, where the roll adjustments are made at the base of the hammer, a platform and ladder are still desirable for belt adjustment, oiling, and general maintenance.

**SECTION 15. OTHER MACHINES****Rule 150. Hydraulic presses—Valves.**

If operating valves are not a part of or attached to the hydraulic press, they shall be located so that the operator will have a clear and unobstructed view of the press when standing in the usual operating position. If for any reason this is impossible, a mirror giving full view of the press shall be installed in front of the operator.

**Rule 151. Hydraulic presses—Blocking.**

When making repairs or changing dies, suitable blocks shall be provided to prevent the press from closing accidentally.

**NOTE.**—Cast-steel blocks 9 by 12 inches have been found suitable for this purpose. These blocks are placed on top of one another at opposite corners of the press.

**Rule 152. Cold-trim presses.**

Cold-trim presses shall comply with all requirements of the Safety Code for Power Presses (American Standard) obtainable from the American Engineering Standards Committee or the National Safety Council.

**NOTE.**—As it is not practicable to use automatic or semiautomatic feeds for cold-trimming work, it will be necessary to provide such presses with an approved sweep guard, gate guard, or two-hand tripping attachment, or to use pliers or other hand tools for feeding. A nonrepeat device is desirable.

**Rule 153. Cold heading and similar machines—**

Shall be provided with a screen guard to prevent injury to the eyes from flying pieces. If machines have relief springs, such springs should be guarded to prevent the bolt or nut from being thrown out in case of breaking. (See fig. 17.)

**NOTE.**—Gears, pulleys, and flywheels must be guarded.

**Rule 154. Bulldozers.**

Measures should be taken to decrease the danger of a workman stepping between the dies and being caught. Such precautions include:

(a) A guard attached to side of moving head and lapping past stationary head to prevent anyone stepping between dies. (See fig. 18.)

(b) The base plates may be notched out so as to leave room for a man's leg.

(c) In all cases the clutch should be kept in good order to prevent repeating.

**NOTE.**—In addition to the foregoing, the guarding of the side gears on a bulldozer is most important.

**Rule 155. Bolt-heading and rivet-making machines.**

(a) Treadles shall be substantially and effectively guarded to prevent accidental tripping.

(b) Suitable blocking materials shall be provided and used for blocking the treadles when setting or adjusting dies.

**Rule 156. Hot saws.**

Every hot saw shall be provided with a guard of not less than one-eighth inch sheet metal to stop flying sparks.

NOTE.—A tank of water placed below the saw is also desirable.

**Rule 157. Power shears and punches.**

Shears and punches shall be provided with means of disconnecting power. When setting knives or punches or otherwise working on such machines they shall be blocked up. The maximum size of material which can safely be cut or punched should be plainly marked on the machine. (See fig. 19.) Shears should not be arranged so as to run continuously when not in use. Alligator shears should not be so located as to face a passageway or aisle.

**Rule 158. Grinding wheels and tumblers.**

For guarding of grinding wheels, see the Safety Code on Abrasive Wheels. For guarding of tumbling mills, see the Safety Code for Foundries.

**SECTION 16. FURNACES**

(See fig. 20)

**Rule 160. Front of furnace.**

The radiation of heat from the front of the furnace or door shall be decreased either by using a water jacket or spray in front of the opening or door, or by using sheet steel or chains hung in front of the furnace with water flowing down them, or by other equally effective method. Whenever disk fans are used for cooling the operator, they shall either be permanently mounted on elevated brackets, or the blades shall be closed with wire mesh or other suitable material so no one can come in contact with the blades.

**Rule 161. Insulation of sides.**

The sides of heating furnaces shall be insulated with asbestos board, kieselguhr, or equally effective material.

NOTE.—When the furnaces are so located that there is sufficient room, a casing of sheet metal can be built around the furnace, with sufficient air space between the furnace and casing to decrease heat radiation.

**Rule 162. Hood.**

A properly designed hood or hoods should be placed over every furnace when insulated. Such hoods are also advantageous on furnaces not so insulated.

**Rule 163. Pressure release devices.**

Paper seals or automatic dampers on air lines to heating furnaces are recommended, to relieve the pressure in case of an explosion caused by gas getting back into the air lines.

NOTE.—For prevention of fire in connection with the storage and use of fuel oil, see the regulations of the National Board of Fire Underwriters, 76 William Street, New York City.

## SECTION 17. MISCELLANEOUS

**Rule 170. Accumulator pits—**

Should be protected by a wire mesh screen.

**Rule 171. Shower-bath and locker rooms—**

Centrally located, should be provided for forge-shop workmen. A drying room, well heated, should adjoin the shower-bath room. The lockers should be of steel, well ventilated, and thoroughly cleaned and fumigated at regular intervals.

**Rule 172. Potassium or sodium cyanide—**

Used in casehardening is a dangerous poison. It should be stored in air-tight metal cans marked "Poison," and workmen should be cautioned not to get any in the mouth nor to inhale the fumes. A hood connected to an exhaust fan should be provided to remove such fumes. Many "patent" casehardening compounds contain relatively large amounts of cyanide and are dangerous.

**Rule 173. Transfer trucks.**

(a) Transfer trucks shall be constructed in a safe and substantial manner.

(b) The top face or table of each truck shall be covered with sheet metal at least one-eighth inch in thickness, securely fastened in place.

NOTE.—Elevating trucks are recommended.

**Rule 174. Storage racks for dies.**

Racks or shelves above 36 inches in height should be equipped at the front edge with flanges at least one-half inch high to prevent dies from falling to the floor.

**Rule 175. Taking lead casts.**

(a) A suitable place shall be set aside where dies may be set up and lead casts taken without the possibility of interference from or injury to other workers.

(b) Such location shall be at a reasonable distance from any source of water supply to eliminate the danger of getting water into the dies before the metal is poured in.

**Rule 176. Ramps.**

Ramps between die vaults, die-sinking department, yard, or forge shop shall not exceed an angle of 10° from the horizontal.

**Rule 177. Housekeeping.**

Aisles and working spaces shall be kept in good order and free of obstructions at all times. Material should be safely piled, hot forgings put into steel boxes or barrels, or piled onto steel trays. The "flash" should not be permitted to accumulate, but should be piled onto trays as it comes from the trimming presses. (See figs. 1 and 22, 23, 24, 25.)

NOTE.—Bar stock may be stored on end in separate racks, with the stock extending below the floor of the aisle between racks, thus insuring a clear aisle and making it easy to handle the stock.

**Rule 178. Storing material.**

Loads on racks should be checked regularly to prevent overloading. For small forgings, bins are recommended. Barrels of forgings or parts should not be piled in tiers. Out-of-door racks, if made of steel, should be set on concrete foundation and the lower members of the steel structure kept clear from dirt and painted at intervals to prevent rust and consequent failure of the structure.

**Rule 179. Inspection and maintenance.**

Regular inspection shall be made to insure proper condition of all bolts, screws, keys, valves, etc., which might become loosened by vibration; all parts of treadle, clutch, and other operating mechanism.

**SECTION 25. OPERATING RULES****Rule 250.**

The following rules should be adopted by the employer, prominently posted in the forge shop, and strictly enforced by the foremen.

(a) *Changing dies or making repairs.*—Always place a substantial timber under the hammer, shear, or punch. In the case of hydraulic presses use cast-steel blocks. In the case of steam or air hammers make sure the valve is tightly closed. In all cases block the treadle to prevent accidental tripping while working on dies or hammer.

(b) *Projecting keys.*—When setting dies, make sure that the keys do not project so as to cause injury.

(c) *When not in use.*—At end of the day's work or at noon, the hammer should always be left with the upper die or hammer resting on the bottom to prevent accidental tripping and injury to a passer-by.

**NOTE.**—When it is necessary to have men come to work early in the morning for the purpose of heating the dies before the hammer crews begin work, it may be good policy to have the ram securely blocked in the up position. Heated pieces of steel can then be placed on the die, the block knocked out, and the upper die allowed to fall onto the hot steel. This will obviate the necessity of men, inexperienced in the operation of a hammer, handling the hammer under power.

(d) *Mushroomed tools* should not be used; take them to the tool room or blacksmith for repair.

(e) *Use tongs or steel fork* for handling hot metal on the floor. Pieces of metal may give a severe burn even if color does not indicate heat.

(f) *Replacing board.*—When replacing board in a board drop hammer, do not place hands on top of the ram while the board is being put through the rolls; otherwise the board may fall and catch the hands.

(g) *Adjusting board mechanism.*—When adjusting the mechanism of a board drop hammer, do not place the hand under the roll-releasing mechanism or over the knock-off mechanism; otherwise the mechanism may fall and crush the hand.

(h) *Feeding cold material.*—Use pliers, stick, or pick for feeding so as to keep hands out of danger in case the hammer or press should repeat.

(i) *Cold trimming.*—Forgings that have been quenched for quick inspection should be reheated so as not to be too hard, before sending to the cold-trim presses.

(j) *Goggles* should always be worn when operating a hammer or cold-trim press. Hammermen can wear goggles comfortably by wearing a sweatband on the forehead.

(k) *Safe clothing.*—For protection against flying scale wear asbestos or leather aprons; asbestos or leather gloves or canvas gloves with leather palm (the latter are cooler); Congress shoes, and leggings. For handling rough stock wear hand leathers.

(l) *Furnaces.*—Oil or gas furnaces should be lighted by placing a piece of burning oily waste into the furnace near the burner. Allow fuel from the burner to flow over the waste and ignite. If air is used, it should then be turned on slowly. When lighting a furnace the operator should open all furnace doors; he should also use a long-enough rod to insert the burning waste so he can stand back in the clear to avoid burns in case of explosion or flareback.

(m) *Dies 200 to 500 pounds.*—All die blocks exceeding 200 pounds in weight shall have holes drilled on both ends to a depth of 2 inches or more, and not less than three-fourths inch in diameter, so rods can be inserted into these holes to facilitate lifting and moving the dies.

(n) *Dies 500 to 1,000 pounds.*—Die blocks weighing between 500 and 1,000 pounds shall have holes not less than seven-eighths inch in diameter.

(o) *Dies more than 1,000 pounds.*—Die blocks weighing more than 1,000 pounds shall have holes drilled on four sides not less than 1 inch in diameter and 3 inches deep.

(p) *Transfer boards.*—Transfer boards shall not be used to transfer dies between workbench and machine; transfer trucks shall be used for this work.

## ILLUSTRATED DESCRIPTIONS

[These illustrations are not a part of the code proper; they simply show how various manufacturers have met certain code requirements]

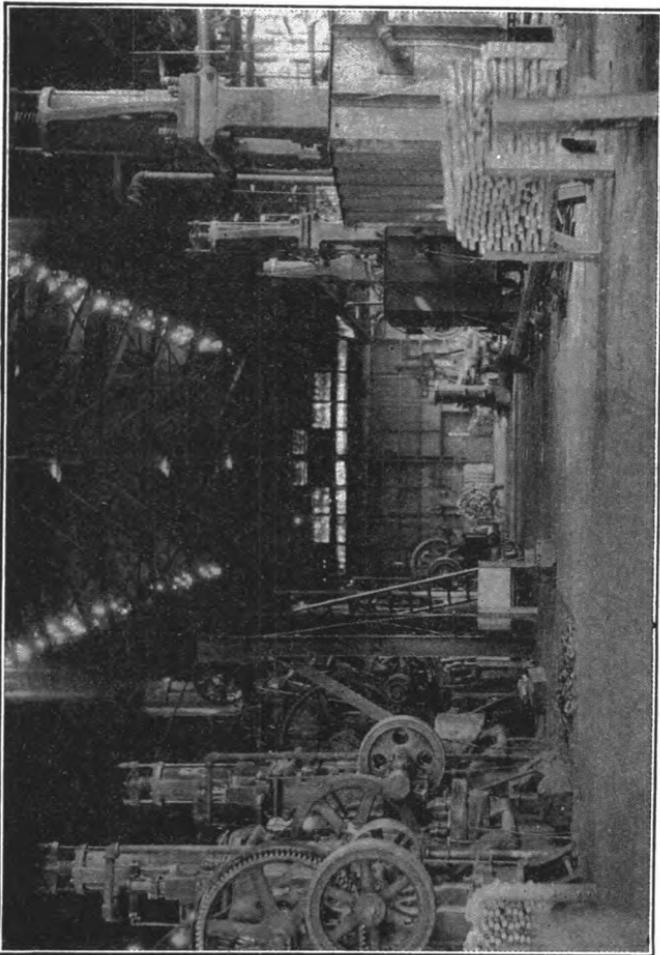


FIG. 1.—Wide aisles kept clear and clean with stock and material piled safely. (Rules 100 and 101)

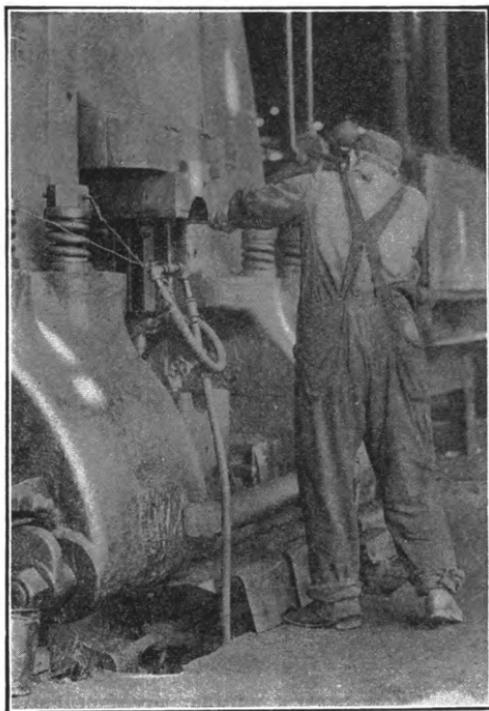


FIG. 2.—Long swab for removing scale permits worker to keep hands out of danger. (Rule 110).

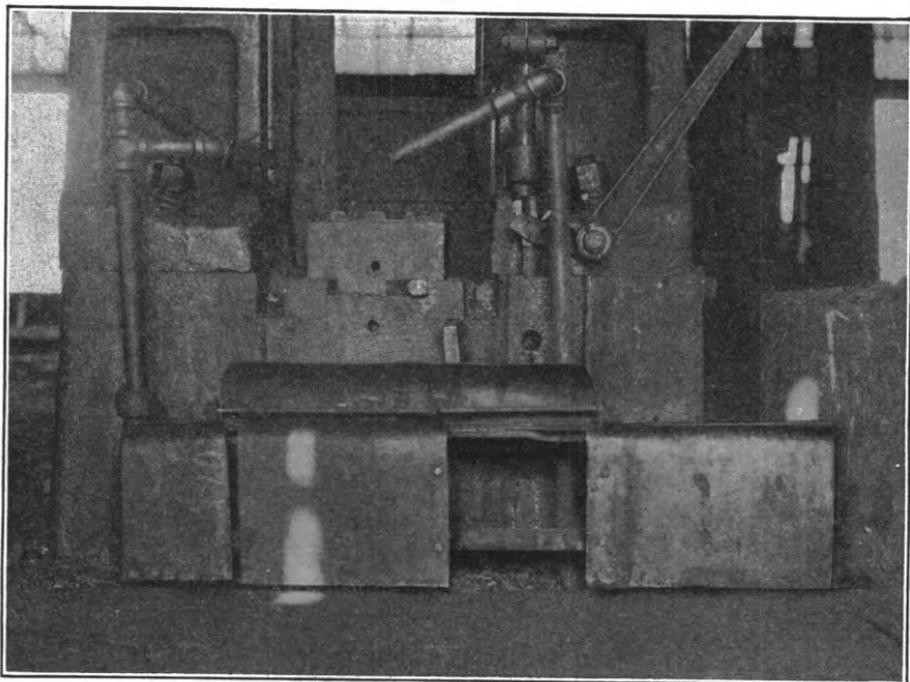


FIG. 3.—This treadle guard, to protect against accidental tripping, is easily removed for making repairs as it is held in place only by two hooks on the base of the hammer. The sliding section of the guard permits operation of the hammer by either foot. (Rule 111)

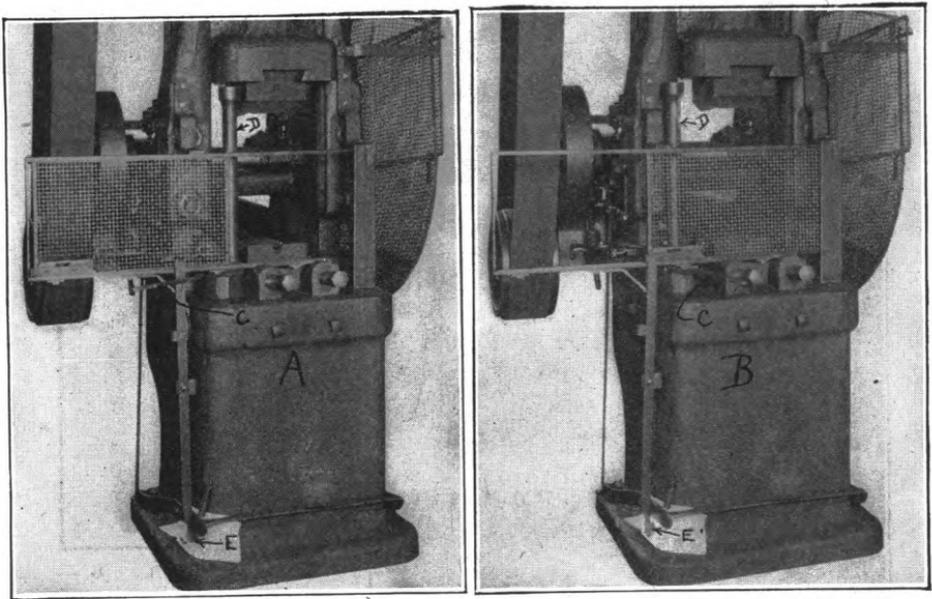


FIG. 4.—Sliding gate guard and stop post on drop hammer. In "A," gate is open and stop post "D" is under ram. Foot treadle can not be operated because of the latch at "E." Gate is closed in "B" by moving hand lever "C," which swings post "D" out of the way. Guard for belt and pulley has been removed temporarily to show detail of operation. (Rules 111, 112, and 131)

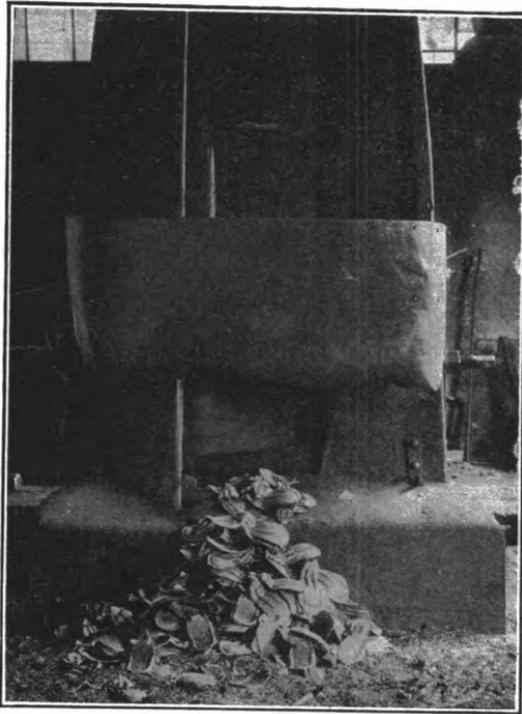


FIG. 5.—Guard for extension of treadle at rear of hammer to prevent same being held up by accumulation of scrap or forgings. (Rule 111).

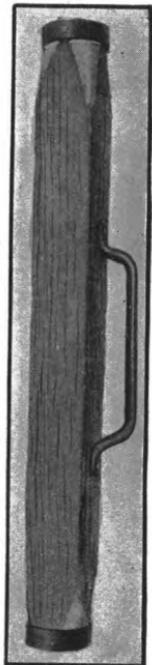


FIG. 6.—Hardwood timber for blocking hammer; ferrule on each end, handle on side. (Rule 112)

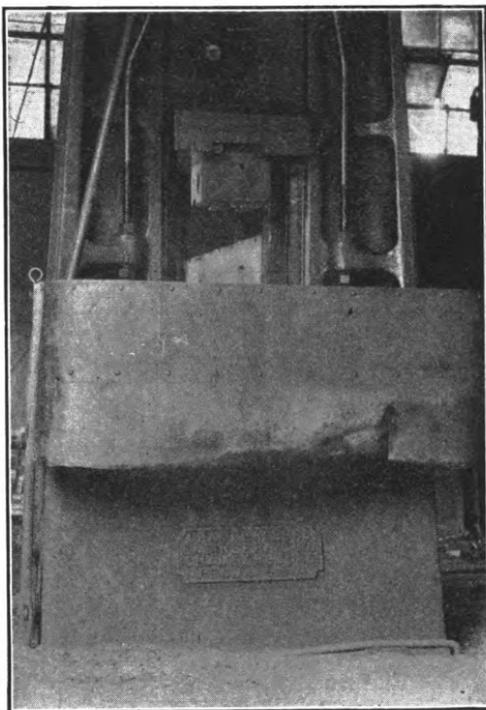


FIG. 7.—Scale guard to prevent scale and forgings from flying across aiseways; pivoted at left and can be easily swung aside for working on dies. (Rule 113)

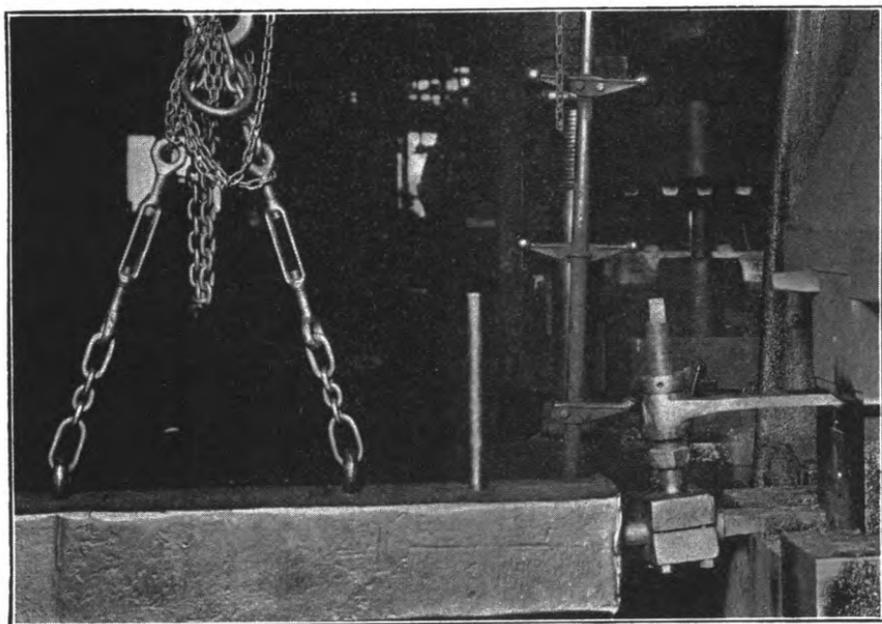
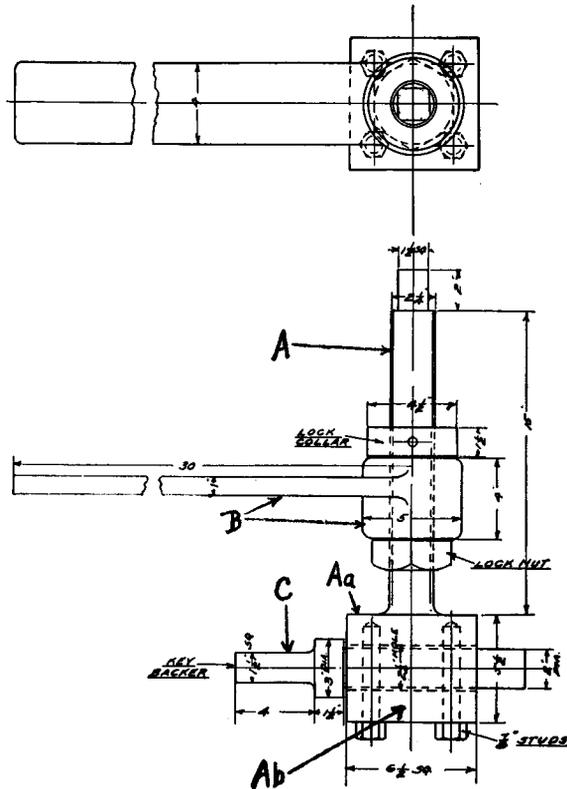


FIG. 8.—Fixture for holding key backer. (Rule 114)



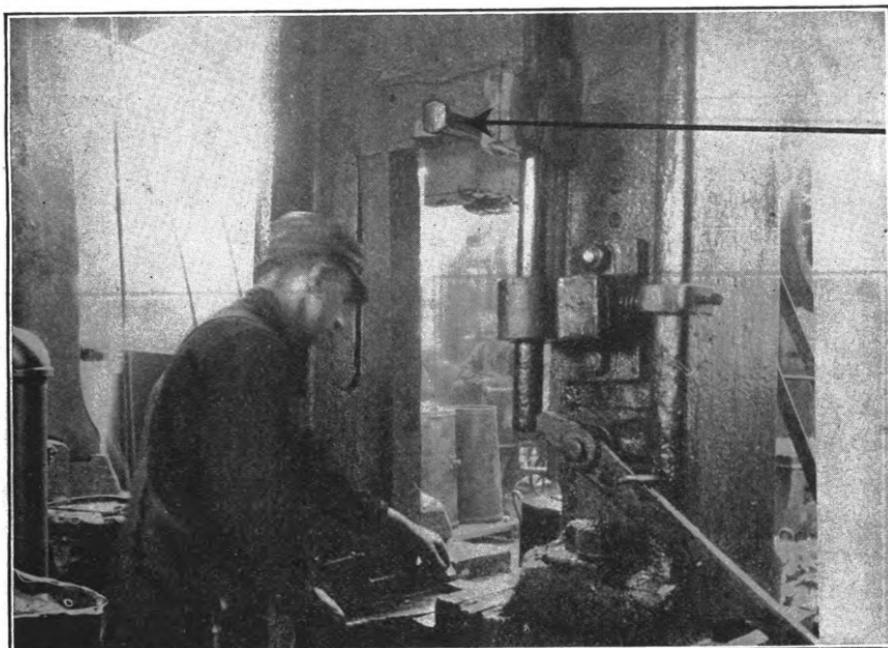


FIG. 10.—Carelessly allowing a key to project beyond the edge of the ram has caused serious injuries. (Rule 114)

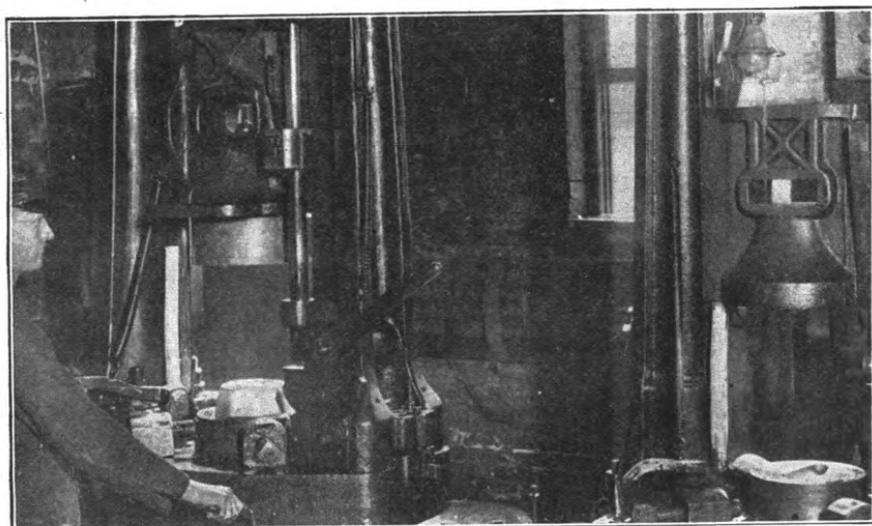


FIG. 11.—Vertical bar, at left of hammer, prevents its descent until tipped forward by operator's left hand. (Rule 131)

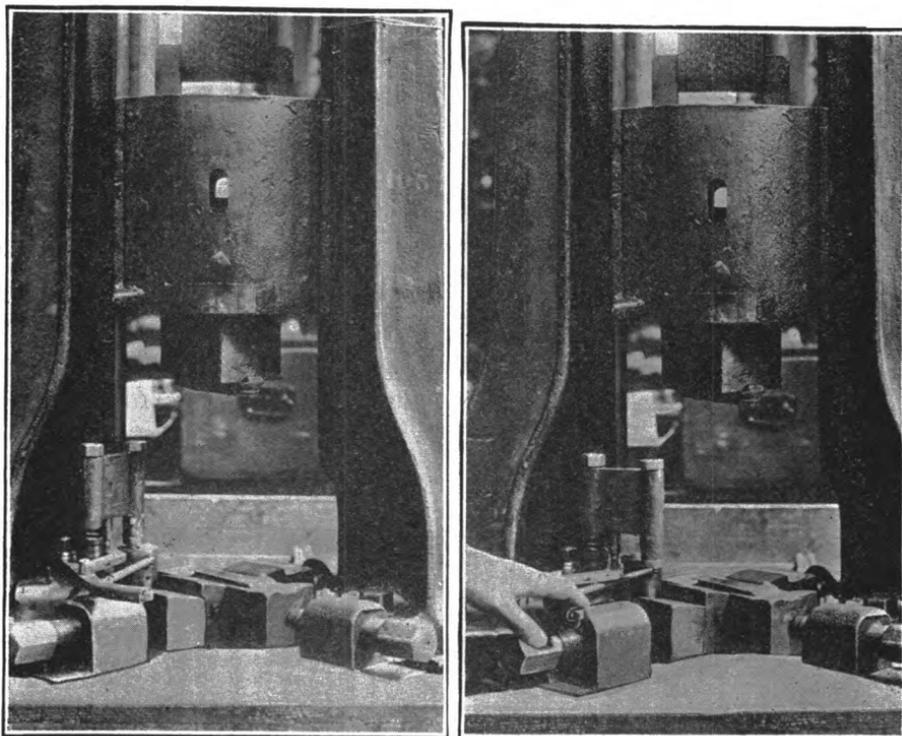


FIG. 12.—Vertical pin, at left, prevents descent of the hammer until the pin is pulled by the operator's left hand. (Rule 131)

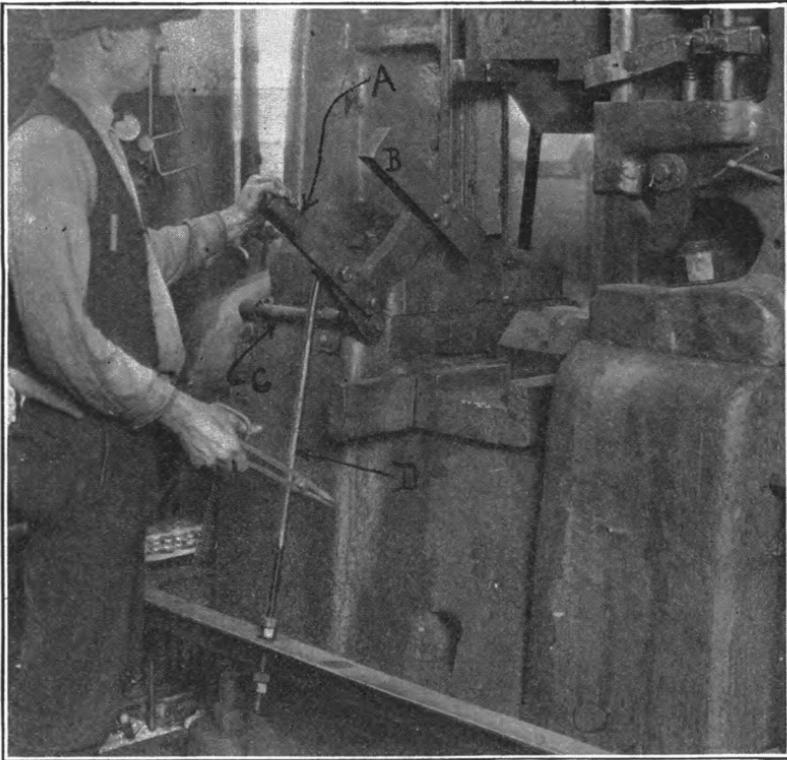


FIG. 13.—Hammer trip and hammer stop. Stop "B" normally is in vertical position between ram and lower die to prevent operation of the machine. When operator pulls handle "A" toward him, "B" is lifted out of the way and rod "D" depresses the operating lever causing the ram to descend. Cover guard for foot treadle has been removed temporarily to show details of operation. (Rule 131)

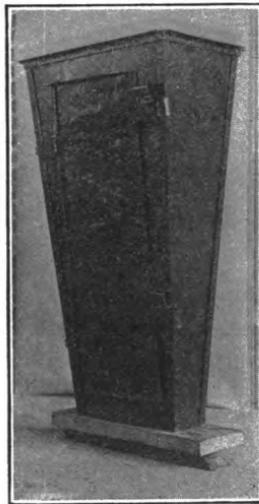


FIG. 14.—Inclosure for board. (Rule 140)

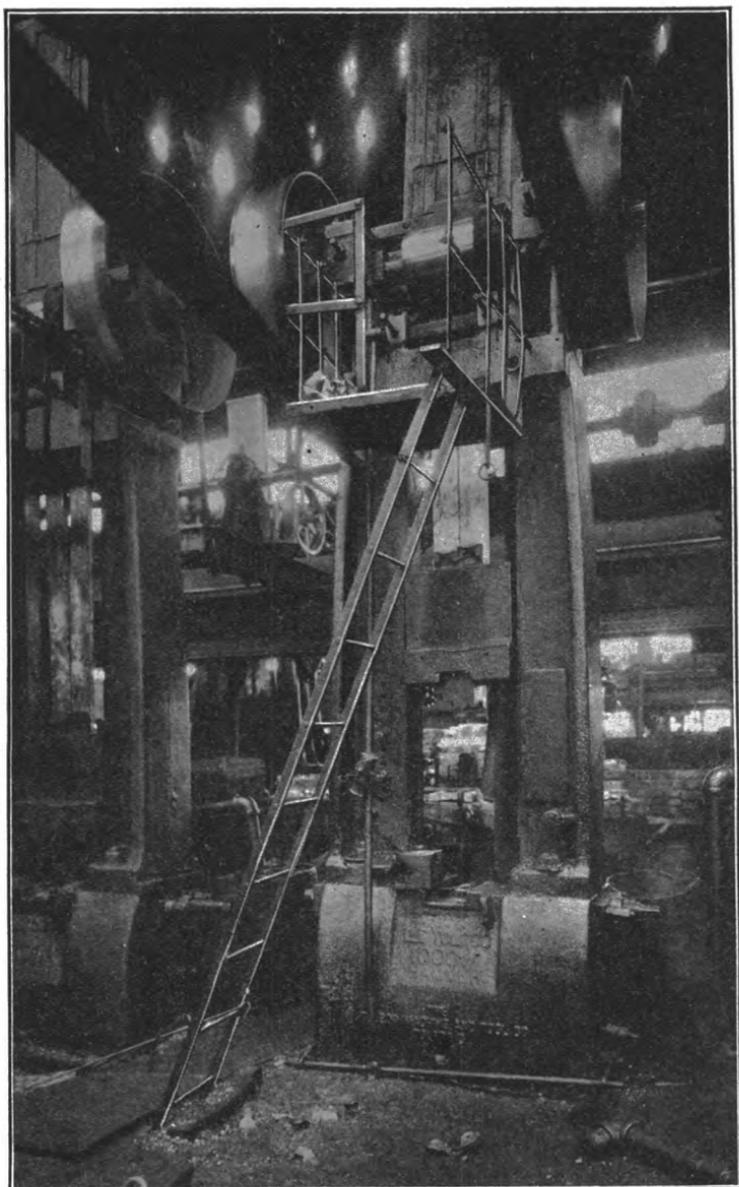


FIG. 15.—Overhead platform with railing and ladder, for working on rolls. Rolls and treadle should be covered. (Rule 141)

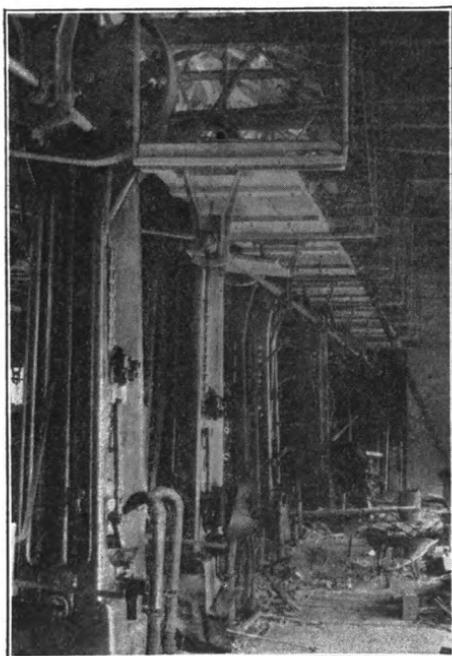


FIG. 16.—Overhead platform giving access to rolls of a battery of hammers. Standard railing should be provided on platform. (Rule 141)

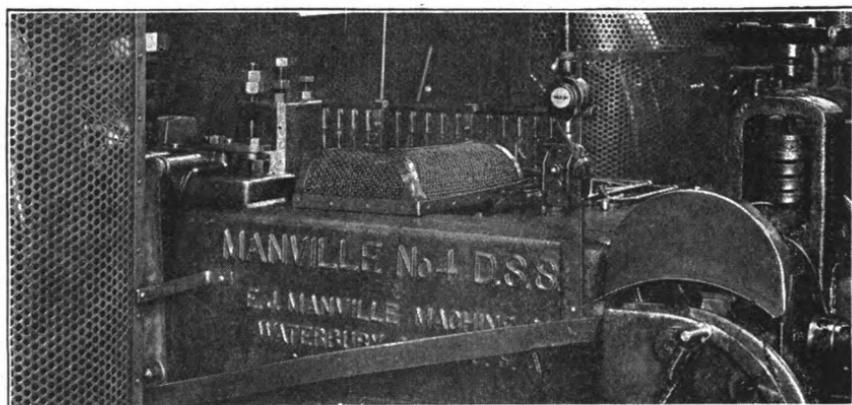


FIG. 17.—Cold header with screen guard at top to stop flying pieces. Flywheel (at left) and gears (at right) also guarded. (Rule 153)

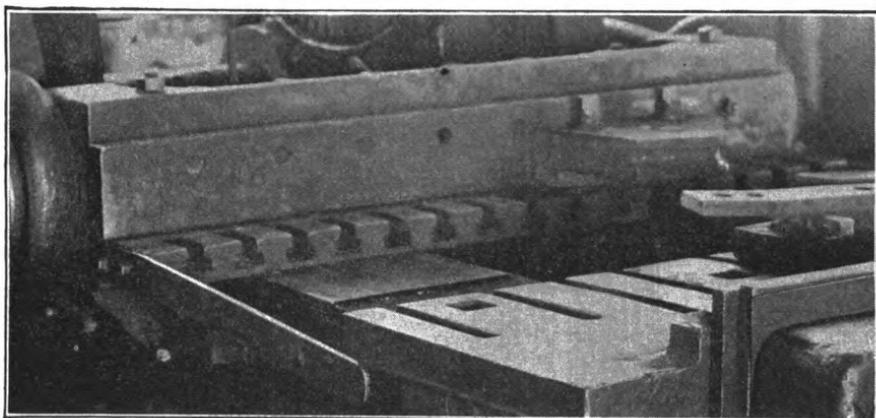


FIG. 18.—The flat bar attached to side of moving head extends past the stationary head and prevents stepping between dies. (Rule 154)

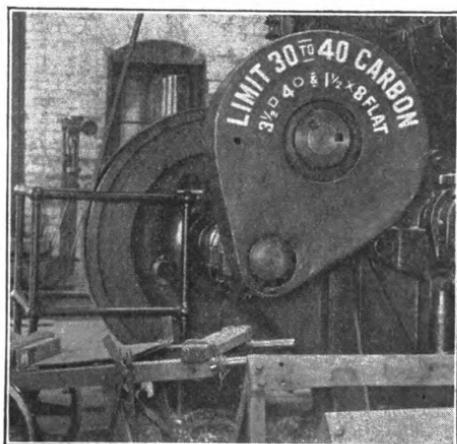


FIG. 19.—Size and hardness of material which can safely be sheared, plainly marked on side of machine to prevent overloading. (Rule 157)

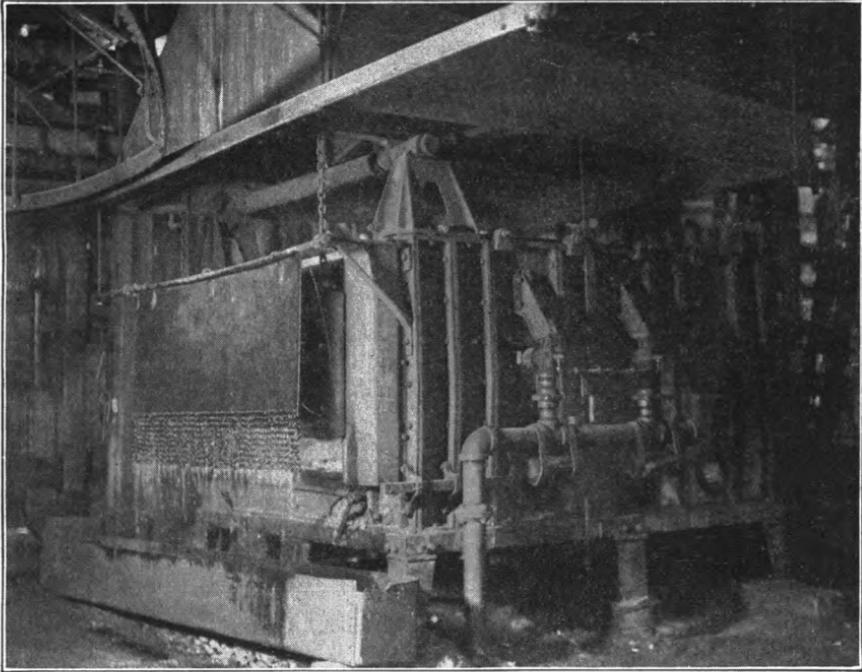
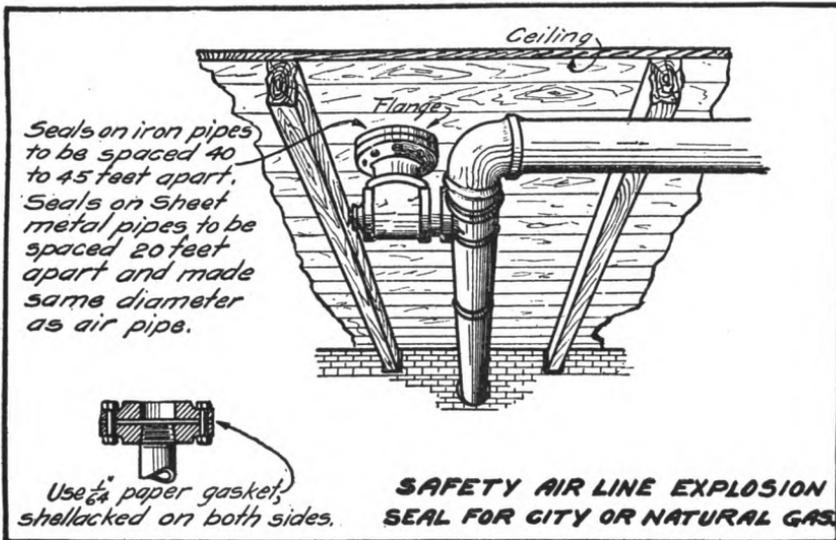


FIG. 20.—Front of furnace is equipped with combination sheet steel and chain screen over which water is sprayed to protect operator from excessive heat radiation. A hood is also installed to exhaust excess heat and fumes. (Rules 160, 161, and 162)



Courtesy Ford Motor Co.

FIG. 21.—Paper seals to relieve explosion pressure. (Rule 163)

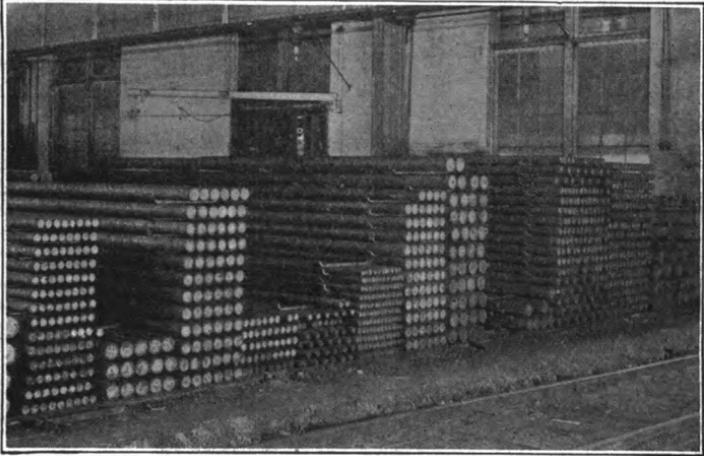


FIG. 22.—Good storage of bar stock. (Rule 177)



FIG. 23.—Special bucket for removing scrap. This bucket is picked up by an electric truck. (Rule 177)

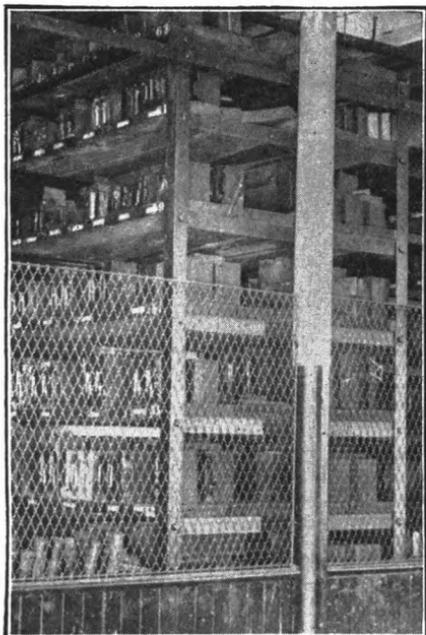


FIG. 24.—Good storage of small and medium sized dies on racks. (Rules 177 and 178)



FIG. 25.—Good storage of large die blocks. (Rules 177 and 178)

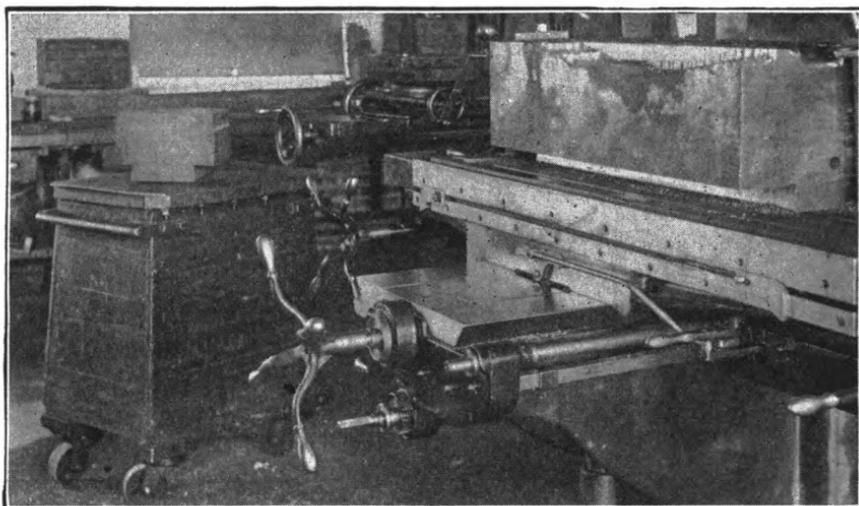


FIG. 26.—Special table truck (at left) for moving die blocks. Blocks are slid from the top of table onto the die-sinking machine. (Rule 250 (a) )



FIG. 27.—The latest trend points to the installation of forges just outside the building, with openings in the wall through which the oven is fed. This shows an arrangement which has the advantage of excluding all objectionable features of heat, smoke, and gases from the workroom

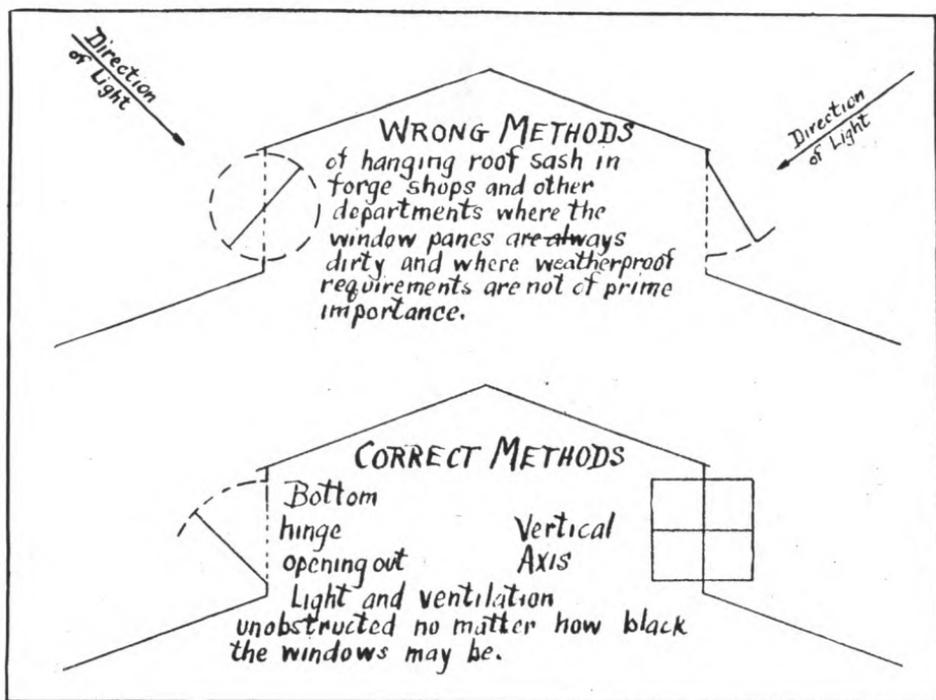


FIG. 28.—Roof construction for forge shops

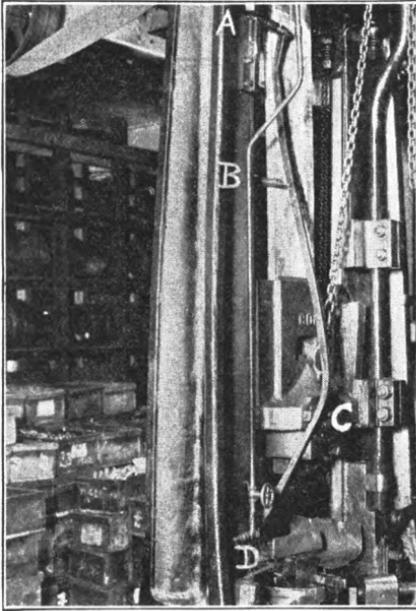


FIG. 29.—A device consisting of a long arm pivoted at A, fitted with a spring B, and a flat strip at D. As the ram descends, the roller at C moves the arm toward the operator, pushing his hands out of danger zone

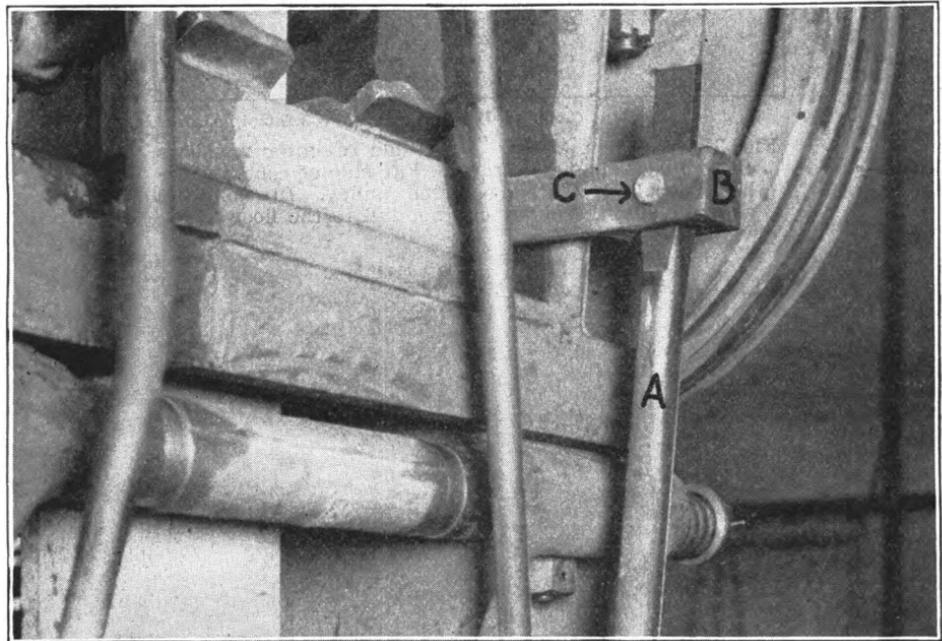
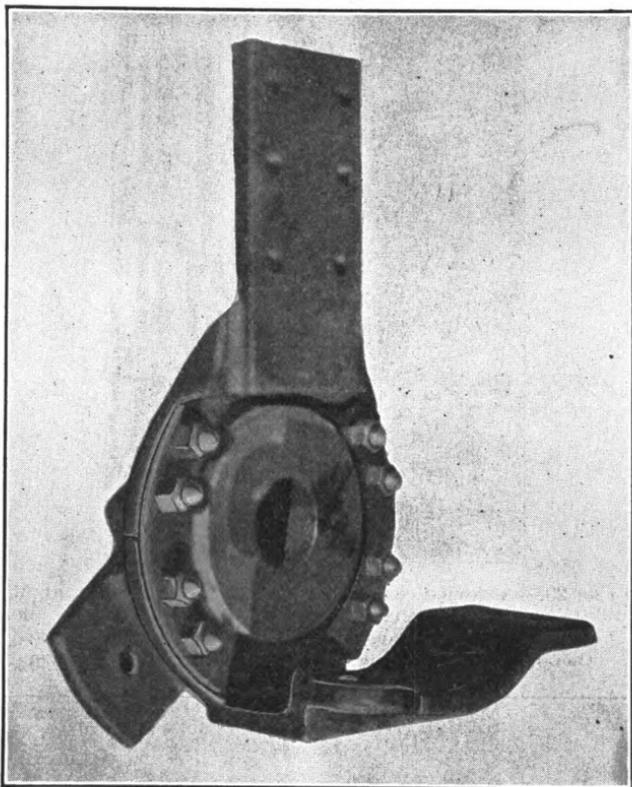


FIG. 30.—On the average machine of this type, bar "A" is held in upper position by a pin passing through two sides of an open-jawed fork. "B" shows how this fork has been looped over. Bar "A" has been extended, so if pin "C" should break or drop out, bar "A" can not fall to the floor



Courtesy Detinning Forge & Stamping Co.

FIG. 31.—Pulley retainer. Near side of outer members are bolted to hammer frame. Far side of center member is bolted to the machine pulley. In case the shaft breaks, the pulley can not fall to the floor.

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*The following is a list of all bulletins of the Bureau of Labor Statistics published since July, 1912, except that in the case of bulletins giving the results of periodic surveys of the bureau only the latest bulletin on any one subject is here listed.*

*A complete list of the reports and bulletins issued prior to July, 1912, as well as the bulletins published since that date, will be furnished on application. Bulletins marked thus (\*) are out of print.*

### **Conciliation and Arbitration (including strikes and lockouts).**

- \*No. 124. Conciliation and arbitration in the building trades of Greater New York. [1913.]
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- No. 411. Twelfth, Salt Lake City, Utah, August 13-15, 1925.
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