Maintenance of Way Cyclopedia

A REFERENCE BOOK

Covering

Definitions, Descriptions, Illustrations and Methods of Use of the Materials, Equipment and Devices Employed in the Maintenance of the Tracks, Bridges, Buildings, Water Stations, Signals and Other Fixed Properties of Railways.

Compiled and Edited by

E. T. HOWSON, Western Editor of the *Railway Age*, and Editor of the *Railway Maintenance Engineer*,

E. R. LEWIS, Formerly Chief Engineer of the Duluth, South Shore & Atlantic, and

K. E. KELLENBERGER (Signal Section), Editor of the *Railway Signal Engineer*,

Assisted by

HOMER HUGHES, Associate Editor, Formerly Assistant Field Engineer, Interstate Commerce Commission

IN CO-OPERATION WITH THE
AMERICAN RAILWAY ENGINEERING ASSOCIATION
COMMITTEE

H. R. SAFFORD, *Assistant to the President, Chicago, Burlington & Quincy*
L. A. DOWNS, *Vice President and General Manager, Central of Georgia*
G. H. BREMNER, *District Engineer, Division of Valuation, Interstate Commerce Commission*

Published by

SIMMONS-BOARDMAN PUBLISHING CO.

WOOLWORTH BUILDING, NEW YORK, N. Y.

TRANSPORTATION BLDG.
CHICAGO, ILL.

HOME LIFE BLDG.
WASHINGTON, D. C.

THE ARCADE
CLEVELAND, OHIO

34 VICTORIA ST., WESTMINSTER
S. W. 1, LONDON, ENGLAND

444 MAISON BLANCHE ANNEX
NEW ORLEANS, LA.

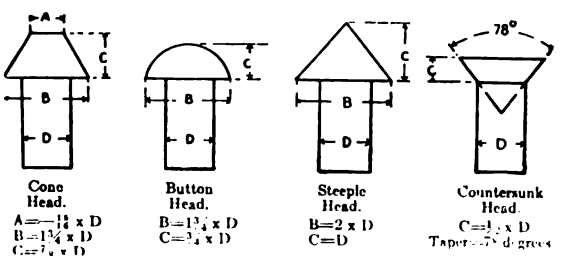
FIRST NATIONAL BANK BLDG.
CINCINNATI, OHIO

83

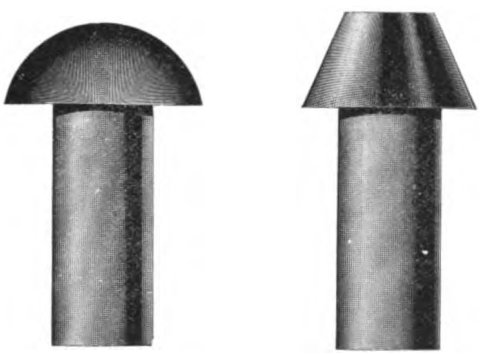
REFUGE BAY. A rectangular platform with a railing around three sides erected at one side of the track on a long bridge as a place of safety for employees while trains are passing. Refuge bays are built on cantilever beams, such as long bridge ties or special girders, or on members extending from the side of the span and braced from beneath. Space is usually provided to accommodate a hand car and several men. These structures are frequently placed from 500 ft. to 1000 ft. apart, alternately on the right and left sides of the bridge.

RIVET. A short metallic malleable bolt designed to pass through a hole and be so fastened as to keep pieces of metal, or sometimes other substances, together.

The fastening which distinguishes the rivet is the enlarging and flattening of the point into a head after insertion. Rivets in steel structures are usually hammered or pressed while red hot, so as to draw the pieces more firmly together by the contraction of the rivets in cooling. See Riveting.

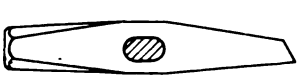


Proportional Dimensions of Rivet Heads



Boiler and Structural Rivets

RIVET BUSTER. A tool used to cut off the heads of rivets. A rivet buster commonly consists of a flat, wedge shaped cutting portion and a rectangular shank and beveled edged hammer head. The cutting portion terminates in a chisel-like cutting edge while the shank has a central eye to permit the insertion of a wood handle by which the tool is held while being struck with a maul. The rivet buster is used to remove the heads while a backing out punch is used to remove the rivet. See Punch, Backing Out. Also Riveting.



Rivet Buster

RIVET HAMMER (Hand). A one faced hammer designed for driving rivets.

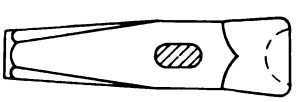
The head of a rivet hammer is usually made of a single piece of special tool steel, the pein is chisel pointed, the pole is plain with a slight taper, and the face is circular or sometimes octagonal. A rivet hammer suitable for bridge maintenance work weighs about 5 lb. The straight hard wood handle is about 18 in. long. See Rivet. Also Riveting.

RIVET PITCHING TONGS. Tongs used by forge-tenders or blacksmiths to toss hot rivets to a riveting crew.

Rivet pitching tongs consist essentially of two light steel rods working scissors-fashion on a pivot to form short, flat tapering jaws and long rounded handles. The end of one jaw is cupped to receive the shank of the rivet while the opposite jaw is straight throughout its length to hold the rivet in place as the handles are pressed together. As the rivet is released, the handles are pulled apart, the rivet dropping to the straight jaw and being released from the tool with a pitching motion. See Rivet. Also Riveting.

RIVET SET. A special hand hammer used to shape the head of a rivet under blows from a maul.

A rivet set consists essentially of a circular steel pein and a rectangular shank and hammer head. The working face of the pein is equipped with a cup-like receptacle which shapes the head of the rivet while an eyelet passing through the shank permits the attachment of a wood handle by which the tool is held in position. See Rivet. Also Rivet Hammer (Hand). Also Riveting.



Rivet Set

RIVET STICKING TONGS. Tongs used to place rivets in the rivet holes of structural members.

This tool is similar to rivet pitching tongs except that the jaws are bent upward while the ends are oppositely cupped to grasp the shank of a rivet and place it in the rivet hole. The jaws of a rivet sticking tongs are bent upword at an angle of about 45 deg. from the plane of the handles to enable the rivet handler to place the rivet squarely in the rivet hole when the jaws are flat against the structural member. See Riveting.

RIVETER. A man or a machine employed in fastening rivets into place by clinching the points and forming them into heads. See Riveting.

RIVETING. The act or method of joining with rivets.

Riveting is accomplished primarily by means of compression of the rivet endwise by hand or machine power. Severe compression of a red hot metal rivet causes the shank to expand until it fills the rivet hole, thus holding the metal plates or pieces more

firmly in position. The correct temperature of the rivet while being compressed is important, for overheating distorts the shape of the rivet and unless the metal is hot enough when hammered it cannot be made tight. Field riveting is not approved if the work can be done in the shop where hydraulic or pneumatic pressure riveting machines and convenient forges permit the best riveting to be done rapidly.

The act of field riveting consists usually of forming a button-like head of the pointed end against the flat metal surface around the hole, by hammering the protruding red hot point after it has been thrust through the rivet hole while the manufactured head at the other end of the rivet is held firmly against the metal on the opposite side of the joint. This holding is now frequently accomplished with a compressed air tool called a holder-on though usually a hand maul, a holding bar called a dolly and a head forming tool called a rivet set are used.

Pneumatic field riveting requires air compression and delivery of compressed air, bolting and drifting reaming rivet holes, heating rivets, passing heated rivets from the forge to the placer, putting heated rivets through the holes, backing up the heated rivets in place and hammering the joints into rivet heads.

Methods of bridge erection and of handling connections of bridge members bear directly on field riveting, which is done entirely with the hammer. Schemes may readily be worked out to avoid close corner field riveting on new work or extensive bridge alterations. On small work, such as reinforcing bridges under traffic or in place, renewing members of steel water tank supports, ferry boat transfer tables, track scales, building trusses and turntable cross frames, it is often impossible to avoid field riveting in close corners and places inaccessible except to the shortest special riveting tools such as jam riveting hammers and holders-on.

Although the personnel of a riveting gang varies with working conditions, each of these steps in the process of riveting demands the attention of one or more skilled workmen. The incidental work of placing and moving scaffolds, keeping materials at hand, inspecting and marking defective rivets and care of tools require prompt and careful attention. Rivets are inspected in new work to find and replace those which do not completely fill the rivet holes and those which are not driven tight. Rivet inspection should closely follow the driving in order to avoid recalling riveters, tools and equipment and rebuilding scaffolds. Individual skill, efficient teamwork, careful supervision and intelligent inspection are necessary to successful field riveting.

RIVETING HAMMER (Pneumatic). An air driven tool used to compress, clinch and form heads on rivets by means of repeated blows on the rivet point.

The hammer commonly used in field riveting in connection with the maintenance of railway bridges resembles a large pistol and is often called a riveting gun. It consists of a handle with a trigger and throttle valve, a barrel, a piston and control valve and a contact bit called a rivet set. Hammers driving rivets up to 1 in. in diameter are usually supplied for railway bridge maintenance. An average hammer of this capacity has a piston stroke of about 6 to 8 in., weighs about 25 to 30 lbs., is 18 to 25 in. long exclusive of the rivet set, strikes about 750 blows per minute and consumes 20 to 25 cu. ft. of free air per minute.

The air is supplied to the hammer through a flexible armored hose connected by a nipple inserted in the rear lower curve of the handle, which may be of open style like a pistol handle or closed like some saw handles. The trigger is a small steel lever which opens the throttle valve when depressed. It is usually placed on the back of the handle so that when the handle is grasped and held against the work the trigger is in line with the pressure of the wrist. Another style of hammer has the trigger placed on the inside curve of the handle to be gripped by the fingers instead of being pressed against the palm. The throttle valve is usually located in the hammer handle just above the air inlet and is controlled by a plunger under pressure of the trigger from above. Some hammers have the control valve or valve chamber in line with the main bore through which the piston moves. Other styles have the valve block at the side or over the main bore.

Riveting hammers generally are made in three main parts, the handle, the valve block and the barrel. These parts are united by various screws and fastenings. Some hammer barrels, valves and handles, however, are one-piece forgings designed to eliminate a number of fastenings. The piston used in the field riveting hammer described above is a 1 1-16 in. by 3 in. cylindrical pin of crucible steel.

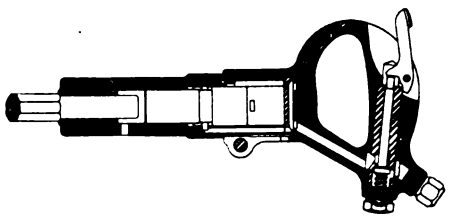
Control valves are variously constructed, the tendency being toward a reduction of the number of parts; prevention of injury to the valve by the piston; elimination of grit and dust from the air by straining it before it enters the valve; reducing the number and so increasing the areas of the ports to eliminate the tendency to clog the valve; and minimizing wear among the parts.

The barrel terminates in a part or fixture called a retainer which is designed to prevent the piston and rivet set from being accidentally discharged from the barrel. Some barrels contract near the muzzle, the bore being smaller for the tool shank than for the piston. While other styles of barrel have outside retainers converging over the muzzle so as to engage grooves or shoulders at the base of the tool shank, thus preventing the release of the piston and rivet set.

Rivet sets are contact tools usually made of crucible steel. The shanks are of standard designs either round or hexagonal. A shoulder or shoulders divide the shank from the striking head. The head is variously formed to give the desired shape to the rivet head. The commonly used standard shapes are the button head (most used in bridge work), cone head, pan head, and flush head. Other contact tools frequently used in pneumatic hammers are punches, drift bolt drivers and chisels for chipping rust or inequalities from metal surfaces and for cutting off rivet heads. A special short type of pneumatic hammer known as a jam riveter is used for work in close corners.

Until compressed air power came into general use for small tools, field riveting was done with hand riveting hammers. Hand riveting is comparatively slow, the blows struck are not always accurate nor

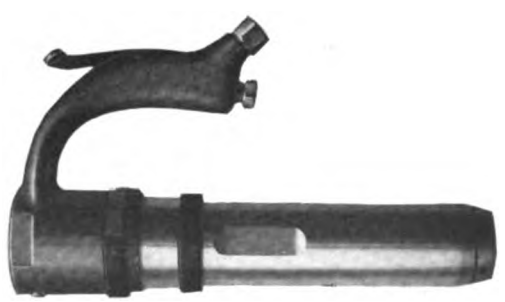
Cleveland Pocket-In-Head Riveting Hammer
The Cleveland Pneumatic Tool Co.



Little David Riveting Hammer
The Ingersoll-Rand Co.

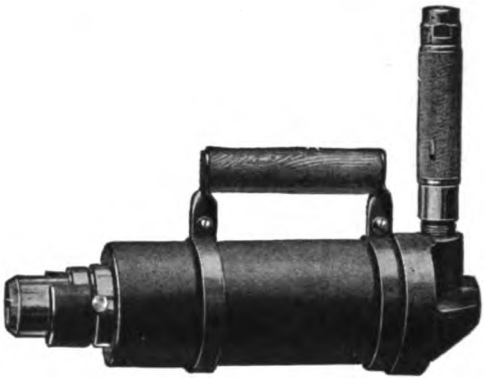
Thor Riveting Hammer
The Independent Pneumatic Tool Co.
(See Page 715)

Boyer Pneumatic Riveting Hammer
The Chicago Pneumatic Tool Co.
(See Page 666)



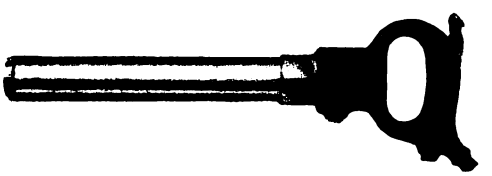
The Keller Master Riveter
The Keller Pneumatic Tool Co.

Little David Holder-On
The Ingersoll-Rand Co.



Boyer Holder-On
The Chicago Pneumatic Tool Co.
(See Page 666)

S. S. S. Riveter
The Standard Scale and Supply Co.



Helwig Riveter
The Helwig Manufacturing Co.

Duntley Riveting Hammer
The Duntley Co.

equally powerful, the rivet sometimes cools before the fit and head are perfected and there is a tendency to slight hand driving of rivets which are hard to reach. Portable air compressors and pneumatic tools at hand and ready for use are now generally recognized to be of distinct advantage to the bridge maintenance departments of railways. Although the extensive equipment and organizations of bridge fabricating and erecting concerns are necessary for the larger structural work on railways, there are many minor repairs and alterations which can be done

economically by company forces with portable machine tools. The usual outfit is an engine for developing power, and air compressors, compressed air receivers and the necessary connecting pipe, hose and fittings, all mounted on and housed in one covered car.

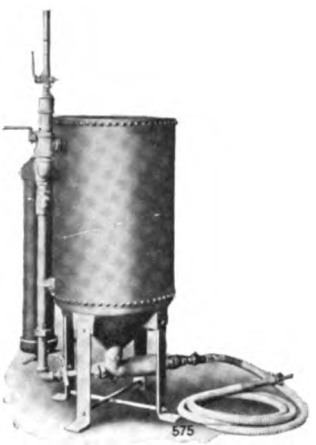
The use of pneumatic tools presupposes an ample supply of compressed air. It is well to provide machinery capable of compressing twice the air which the tools are calculated to consume. With an adequate set of air-driven tools and accessories, a riveting gang can accomplish several times the amount of work that is possible with the same number of men equipped with hand riveting hammers in a given period.

The pneumatic field riveting hammer is required to withstand severe usage. Possible adverse service conditions, especially frost, humidity, dust, sand, thickening oil and wear among the moving parts demand excellence in design, materials and manufacture of these tools. They must be light weight, strong, speedy, powerful, economical in use of air, delicate in throttle control, with a minimum of recoil and vibration, and safe to operate. In grip and finish the handle is designed to prevent slippage, and afford easy control. The accessibility of parts permits the careful and frequent cleaning and oiling which lengthens the service life of machine tools. See Riveting.

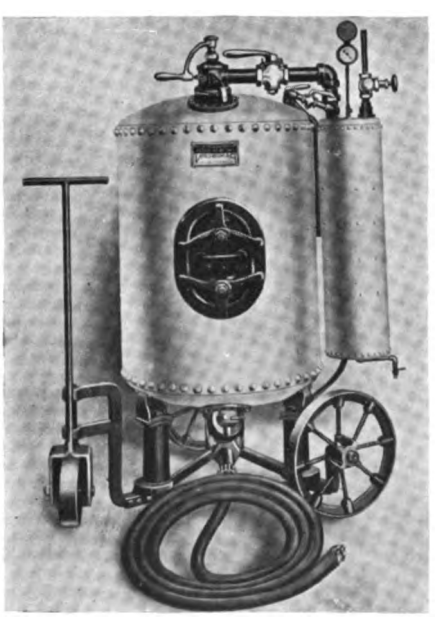
S

SAND BLAST. A stream of sand forcibly projected by means of compressed air or other power to remove old paint, rust, scale, etc., from metal surfaces to clean them, especially in preparation for painting.

The abrasive is discharged at high pressure from a nozzle, usually out of the sand chamber of the machine (where it is already under pressure) in combination with the compressed air. This method is known as the direct pressure system or hose system and is particularly adapted and in general use on extensive surfaces, such as bridge girders, although by this method anything can be handled which can be cleaned by any other type of machine. The suction system, in which the abrasive is carried to the nozzle by suction created by a jet of compressed air discharging through the nozzle and carrying the abrasive with it, is used for smaller work, usually in combination with an arrangement for reclaiming the used sand. In the gravity system the sand is brought to a point above the nozzle by gravity where it is combined with the compressed air and discharged. Although silica sand and sea sand are the cheapest and most used abrasives, they are more dusty than steel grit, shot and other metallic abrasives, and require frequent screening if reused from metallic abrasives. Dust, however, tends to settle on and adhere to the work, which is undesirable, especially in surfaces to be galvanized, etc.



The Doelcam Sand Blast Hose Machine
The Macleod Co.



Standard Pressure Hose Sand Blast Mounted on Hand Truck
The Pangborn Corporation

The volume of air flow is governed by the area of the aperture in the nozzle and by the pressure which should be of an intensity suitable to the resistance of the metal to impact. Moisture must be removed from the compressed air to avoid dampening the abrasive and clogging the sand blast machine. As in all other work done by pneumatic power it is advisable to have an air compressor of ample power and speed. Dust arrestors are usually indispensable for shop sand blasting but are rarely used in field work. A hose sand blast machine consists essentially of a cylindrical steel sand and compressed air container, a smaller cylinder in which are mounted alternate plain and perforated plates to separate moisture and oil from the compressed air, a length of air hose with suitable nozzles, all fitted by means of valves, pipes, etc., to connect the machine with the compressor plant. Operators are furnished with protective masks and gauntlet gloves. If properly used and maintained the sand blast is effective and economical for cleaning metal bridge members, etc., to prepare them for painting, especially extensive plates such as girder webs. The area which can be cleaned in a given time depends on many factors, especially on the adherence of old paint, the extent of corrosion, etc., as well as on the manipulation of the blast. Care is required to avoid excessive abrasion and removal of metal. Abraded surfaces quickly oxidize and should therefore be painted at once after applying the sand blast. Heavy bridge scale is chipped off as the sand blast will not remove it without excessive abrasion around the scale.

SHACKLE. A metal U-shaped link designed to be coupled to a ring or eyelet bolt by means of a removable bar or bolt passing through eyes at the