

Dec. 12, 1944.

T. H. SPELLER

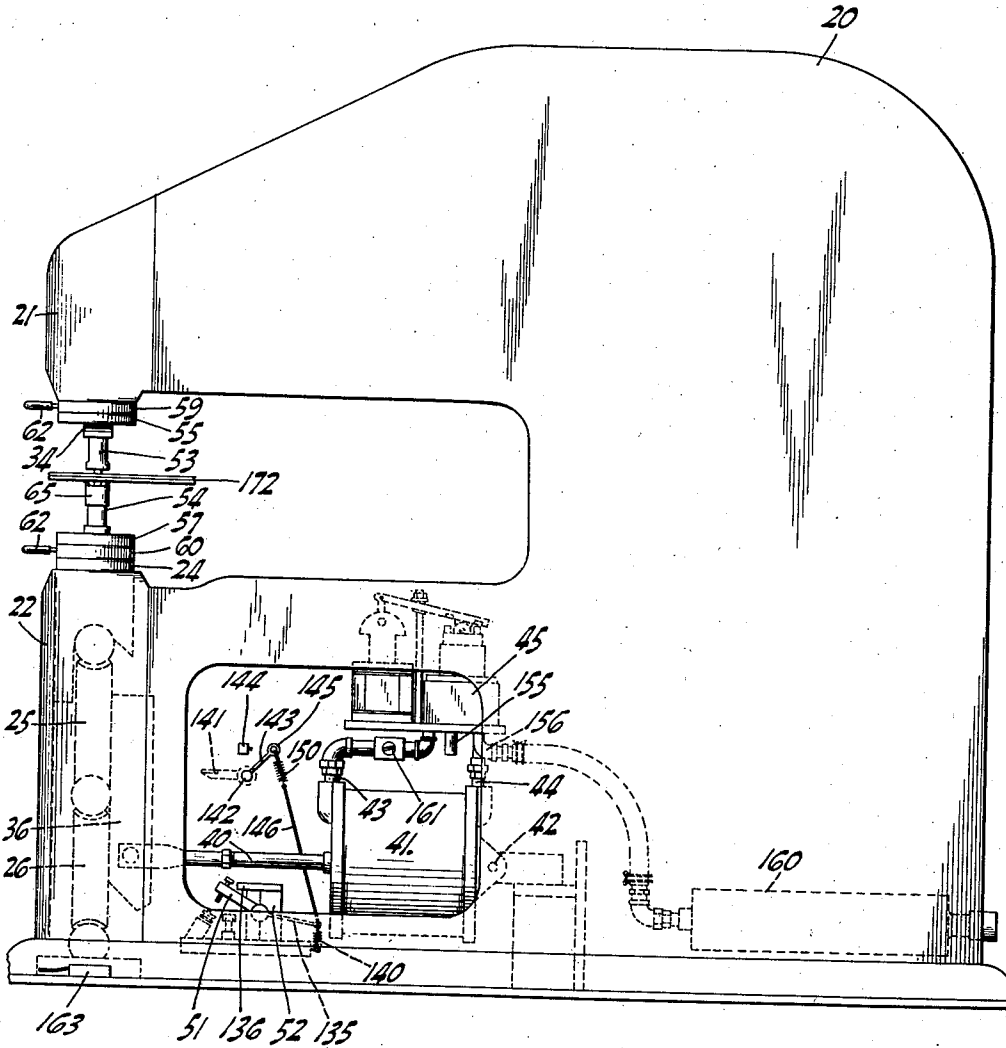
2,365,147

RIVETING MACHINE

Filed Jan. 31, 1941

4 Sheets-Sheet 1

Fig. 1.



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4 Sheets-Sheet 2

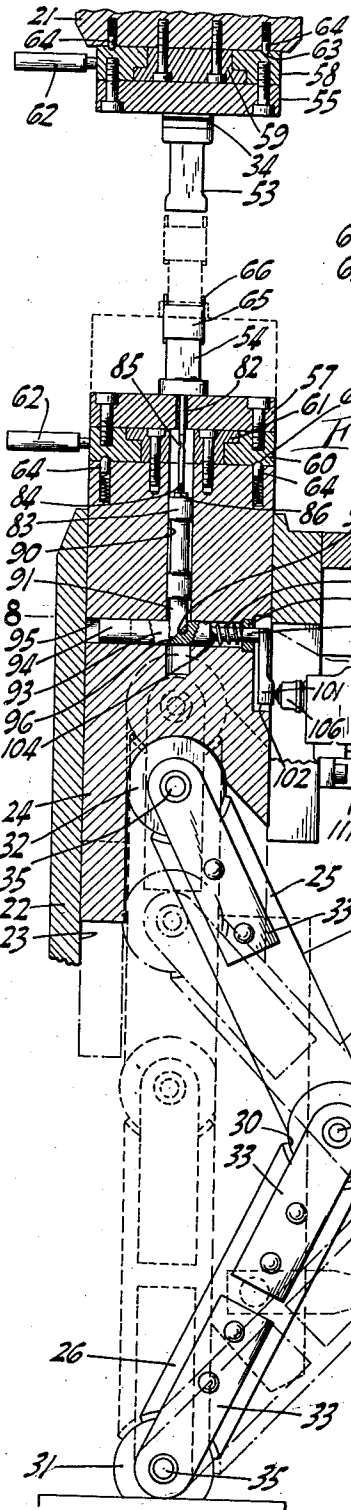


Fig. 3.

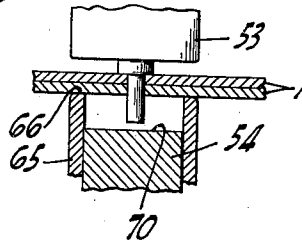


Fig. 4.

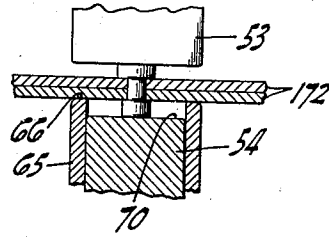
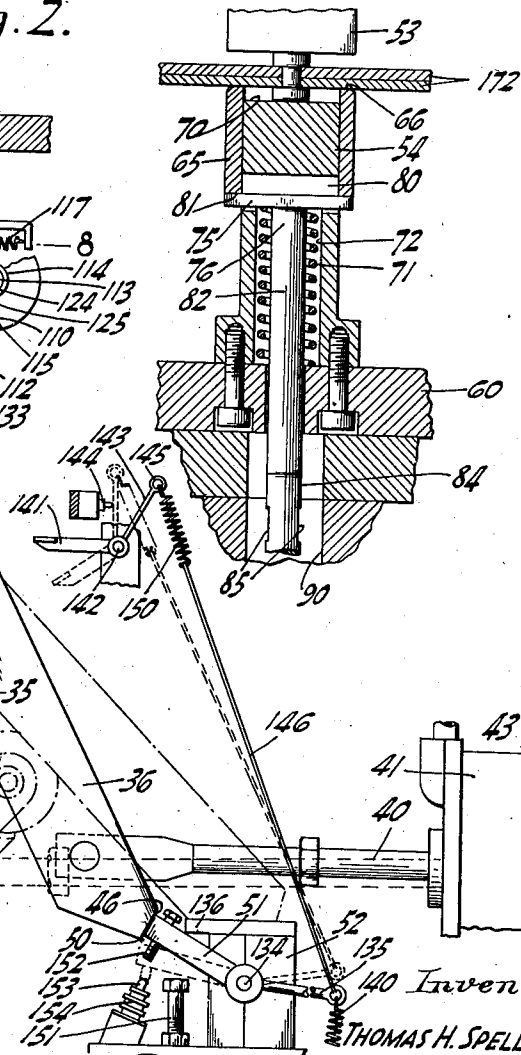


Fig. 5.



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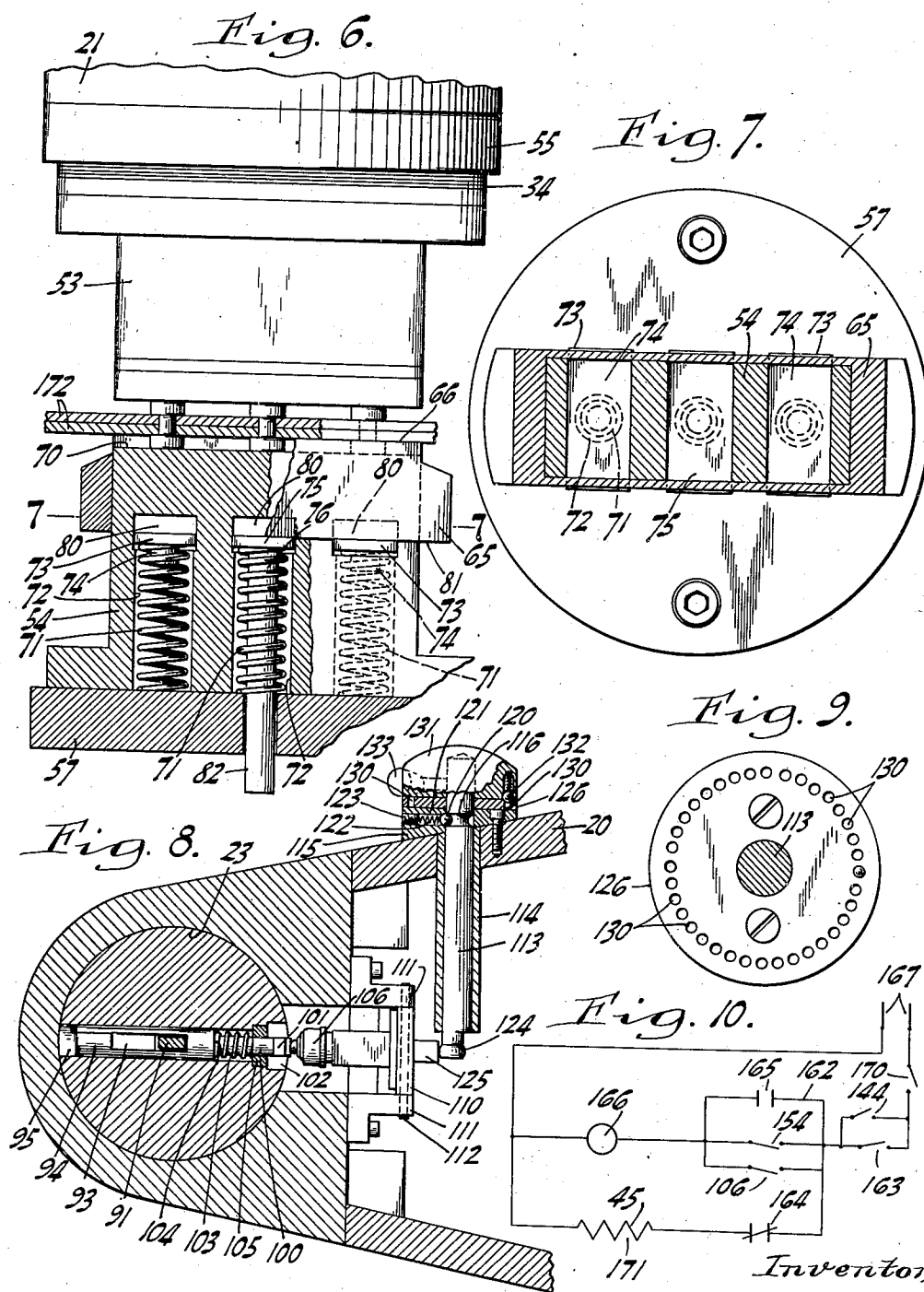
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RIVETING MACHINE

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4 Sheets-Sheet 3



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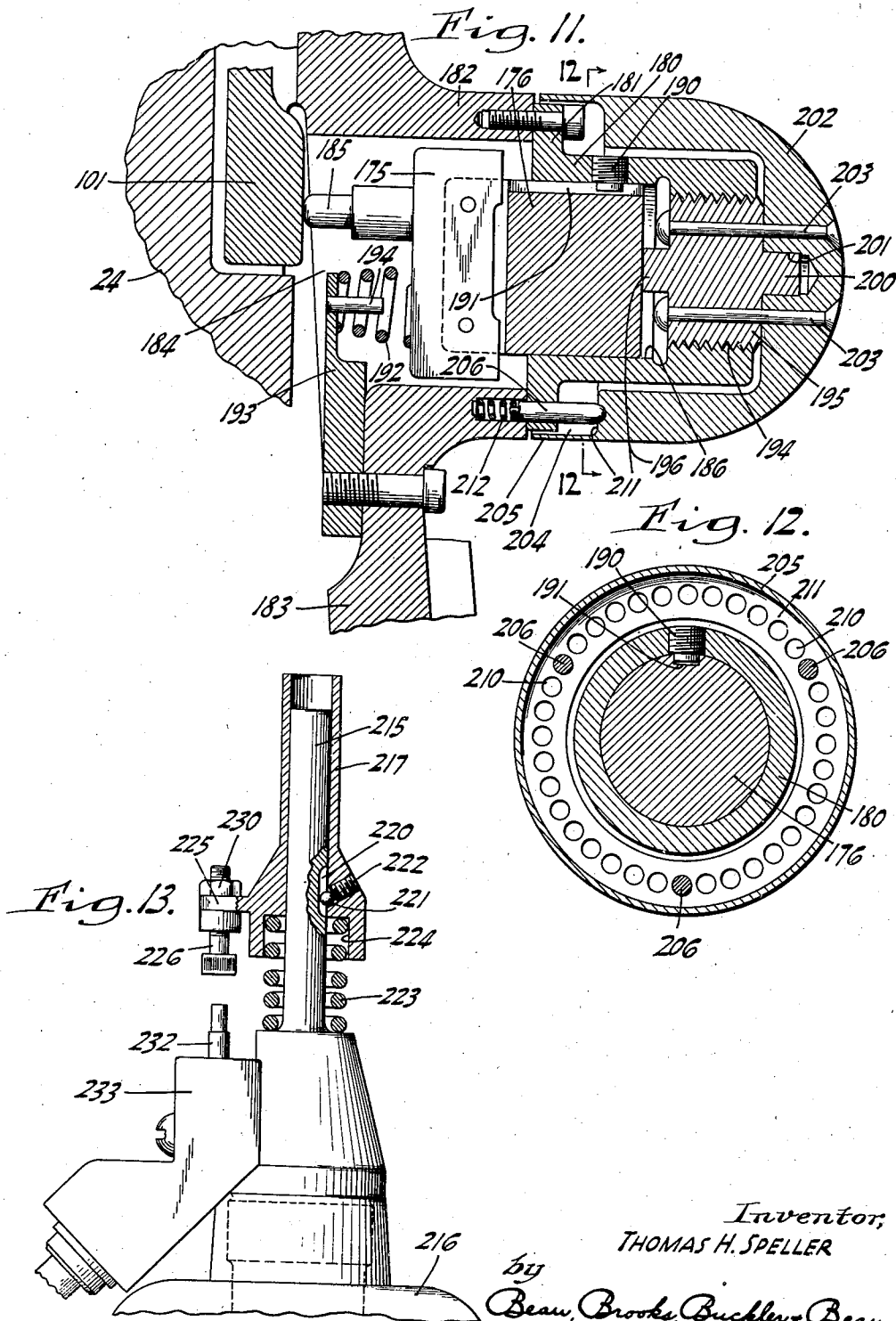
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RIVETING MACHINE

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,365,147

RIVETING MACHINE

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Application January 31, 1941, Serial No. 376,789

30 Claims. (Cl. 78—48)

My device relates in general to riveting machines and particularly to that type in which the riveting is accomplished by compression.

It is well known to those skilled in the art that in certain industries, as for instance the airplane industry, parts are fastened together by means of numerous rivets, and it is very important that the height of the rivet heads be accurately determined and uniformly maintained.

The principal object of my invention has been to provide a device of this nature in which the height of the head of the rivet being upset shall be the determining factor in gauging the dimensions thereof and in which such height may be accurately kept within predetermined limits.

Another object has been to provide a device in which the stroke of the ram may be instantly changed from a regular operating stroke to a stroke of greater distance for the purpose of loading.

A further object is to provide index means for the anvils on machines designed for riveting a row of rivets at the same time, whereby the anvils may be quickly and conveniently positioned to best accommodate the work being handled.

Furthermore, it has been an object to provide a device in which the height determining mechanism for the rivet head shall be governed by the relative movement of the movable anvil and the pressure rail.

Further, my device is provided with a number of electric switches whereby the manipulation of the device is made certain, safe and convenient.

Moreover, means are provided in my device for assuring the return of the movable anvil to the full limit of its downward stroke after the rivet head has been finished.

The above objects and advantages have been accomplished by the device shown in the accompanying drawings, of which:

Fig. 1 is a side elevation of the preferred form of my complete machine.

Fig. 2 is an enlarged, longitudinal section taken on the vertical centerline of the ram.

Figs. 3 and 4 are enlarged, fragmentary, sectional views showing, respectively, the rivet inserted in the work pieces and partially upset.

Fig. 5 is a similar view showing the rivet head finished and also showing a view of the associated parts.

Fig. 6 is an enlarged, side elevation partly in section of the upper and lower anvils.

Fig. 7 is a sectional view of the lower anvil taken on line 7—7 of Fig. 6.

Fig. 8 is a transverse, sectional view on line 8—8 of Fig. 2.

Fig. 9 is an enlarged face view of the rivet control switch adjusting means.

Fig. 10 is a diagrammatic view showing the electrical connections of the various electric

switches of my structure and the electrically controlled means connected therewith.

Fig. 11 is a longitudinal, sectional view of a modified form of rivet control means.

Fig. 12 is a transverse, sectional view thereof taken on line 12—12 of Fig. 11.

Fig. 13 is an elevation, partly in section, of a portion of another modified form of device.

My device comprises a frame having an upper jaw 21 and a lower jaw 22.

The lower jaw is provided with an axial bore 23 within which is slidably mounted the ram 24 of my device. This ram is reciprocated vertically by means of toggle links 25 and 26, joined together at their adjacent ends in a cylindrical joint 30. The lower end of the link 26 is oscillatably mounted upon a bearing cylinder 31 carried by a stationary part of the frame. The upper end of the link 25 is reciprocally attached to a bearing cylinder 32 carried by the ram 24. The links are held in place against their respective bearing cylinders by means of plates 33 which are secured to the links and which are each engageable with trunnion extensions 35 carried by the bearing cylinders. The upper toggle link 25 is provided with toggle link extension 36 which projects downwardly beyond the joint between the two toggle links and to the lower end of which is pivotally attached the piston rod 40 of the operating cylinder 41 of the device. This operating cylinder is pivotally mounted at its outer end upon a pin 42 which is stationarily arranged within the housing 20 of the device, thereby permitting the cylinder to oscillate as the piston moves forwardly and backwardly in the actuation of the toggle links. The operating cylinder is provided with a pipe connection 43 at the forward end thereof and a pipe connection 44 at the rear end thereof which act as inlet and exhaust passageways for the entrance and exhaust of air under pressure supplied to the operating cylinder during the operation thereof. These pipes are connected to a solenoid valve 45 to be hereinafter described. The lower end of the link extension 36 is provided with a latch surface 46 terminating in an edge 50 for engagement with the latch arm 51 of a toggle latch 52, to be hereinafter described.

Carried by the upper jaw 21 and by the ram 24 is the upper anvil 53 and the lower anvil 54, respectively. The upper and lower anvils are carried by anvil mounting plates 55 and 57, respectively. Shims 34 are preferably provided, and these are located between the upper anvil and the upper mounting plate 55, whereby the relative positions of the anvils may be adjusted to the thickness of the workpieces. The plate 55 is secured to an anvil index plate 58 and is held in rotatable manner against the upper jaw 21 by means of a retaining ring 59. The

plate 57 carrying the lower anvil is secured to an anvil index plate 60 which is rotatably attached to the upper surface of the ram by means of a retaining ring 61. Each of the anvil index plates is formed with a series of equidistantly spaced apertures or recesses 63 with which spring-pressed index detents 64 are engageable. The detents for the upper index plate are carried by the jaw 21 and the detents for the lower index plate are carried by the ram 24. Each of the index plates 58 and 60 is provided with a handle 62 whereby they may be rotated relative to the upper jaw 21 and ram 24 to quickly and conveniently position the anvils so as to register with the rows of rivets carried by the workpieces.

My device is provided with dimensional control means consisting preferably of a pressure rail 65 which is slidably mounted on the lower anvil 54. The upper edge 66 of the pressure rail is held above the upper edge 70 of the lower anvil by means of helical springs 71 which are mounted in recesses 72 formed in the lower anvil. The springs of the two end recesses bear against the lower anvil mounting plate 57 at their lower ends and against the flange 73 of two end spring buttons 74. The center spring bears against the flange 75 of a center spring button 76. At the upper end of each of the recesses 72 there is a lateral recess 80 in which the flanges 73 and 75 of the spring buttons are disposed and from which they extend sufficiently far to engage the lower edge 81 of the pressure rail. The upward movement of the pressure rail is limited by contact of the flanges of the buttons with the top surfaces of the lateral recesses 80.

Carried by the center spring button 76 is a rail motion rod 82 which is slidably guided in the anvil mounting plate 57 of the lower anvil. As the pressure rail is forced downwardly over the lower anvil, as will be more fully described later, relative movement is produced between the lower anvil and the rail motion rod. This motion is transferred to a switch actuating plunger 83 through an adjustable plunger stem 84. The adjustable plunger stem is attached to the plunger 83 by suitable screwthreads, a lock nut 86 being provided on the stem for locking the same in its adjusted position. Flattened surfaces 85 are provided near the upper end of the stem for the reception of a wrench. The switch actuating plunger is slidably mounted within a suitable bore 90 formed within the ram 24. The lower end of this plunger is provided with a flattened portion 91 which is formed at its extreme lower end with an inclined surface 92. The flattened portion 91 fits within a slot 93 formed in a laterally actuating plunger 94. This last mentioned plunger is slidably disposed within a diametrically arranged bore 95 formed in the ram 24. The slot 93 terminates in an inclined surface 96 arranged preferably at the same angle as the inclined surface 92 of the switch actuating plunger. The lateral actuating plunger 94 has a reduced portion 100 to which is secured a switch actuating arm 101. This arm is disposed within a recess 102 formed in the face of the ram 24 and it is movable laterally with the lateral actuating plunger 94, it being obvious that any reciprocating movement of the switch actuating plunger 83 will be transferred to the lateral actuating plunger 94 by the inclined surfaces 92 and 96. Mounted about the reduced por-

tion 100 of the lateral actuating plunger 94 is a helical spring 103, one end of which bears against the shoulder 104 formed by the reduced portion and the other end against a bushing 105. By means of this spring the inclined surface 96 of the lateral actuating plunger is maintained in firm contact with the inclined surface 92 of the switch actuating plunger, and all lost motion is thereby taken up.

In order to arrest the operation of the toggle links 25 and 26, I provide a stop switch 106 which is positioned opposite the switch actuating arm 101 and which is rigidly secured to a switch mounting plate 110. This switch, as will hereinafter be described more in detail, is actuated when the rivet head has been upset to the predetermined height or thickness and serves, through other mechanism to be hereinafter described, to reverse the movement of the ram 24. The switch mounting plate 110 is pivotally secured near its lower end to the housing by means of brackets 111, a pivot pin 112 serving to connect the plate to the bracket.

Means are provided on my device for adjusting the relative position of the contact point of the switch 106 with relation to the switch arm 101. These means comprise an eccentric shaft 113 which is rotatably mounted within a sleeve 114. The sleeve is carried by the housing 20 and by a mounting disc 115 which is suitably secured to the outside of the housing. A groove 116 is formed in the shaft 113 and a retaining ball 120 carried within a bore 121 formed in the mounting disc 115 engages said groove for preventing end motion of said shaft. This ball is pressed inwardly by means of a helical spring 122 mounted within the bore 121 which is held in place by means of a screw 123. At the inner end of the shaft 113 there is provided an operating button 124 which is eccentrically mounted with respect to the shaft. The button bears against an actuating block 125 carried by the switch mounting plate 110. A spring 117, having one end connected to the plate 110 and the other end to the housing, serves to keep the plate pressed against the button 24. By rotating the shaft 113 the button 124 will be moved away from or toward the ram 24, thereby governing the height of the finished rivet, as hereinafter described.

Secured adjacent to the mounting disc 115 is an index disc 126. This index disc is formed with a plurality of recesses 130 arranged preferably equidistantly. Adjacent the outer index surface of the index disc 126 is a regulating knob 131. This knob carries a spring-pressed detent 132 which is engageable with any one of the index recesses 130 of the index disc. This knob is firmly secured to the shaft 113 and provides the means for rotating the shaft. A regulating knob handle 133 is provided on the knob to facilitate its actuation.

The toggle latch 52 hereinbefore referred to is arranged in cooperative relation with the lower end of the toggle link extension 36. This toggle latch is carried by a suitable toggle shaft 134 suitably mounted for oscillation. A spring arm 135 extends backwardly from the shaft and is drawn downwardly by means of a loading spring 140. A stop 136 limits the upward movement of the latch arm 51. In the position shown in full lines in Fig. 2, the latch arm 51 is engaged with the latch surface 46 of the said link extension, said arm being normally held in this position by means of the spring 140, thereby limiting the normal downward working stroke of the ram.

When, however, it is desired to increase the space between the upper and lower anvils beyond the normal working distance in order to permit the insertion of a workpiece, the latch 51 is moved out of contact with the link extension or to the position shown in dotted lines in Fig. 2, thereby allowing the ram to be lowered beyond its normal working stroke. In order to operate the arm 51 of the toggle latch 52, I provide a latch pedal 141 which is mounted upon a pedal shaft 142 and rotatable with said shaft from its inoperative full-line position of Fig. 2 to its operative dotted-line position. The shaft also carries an upstanding latch plate 143 which engages a latch pedal switch 144 when it is in its dotted-line position. The upper end of the latch plate 143 is provided with an eyelet 145 which is connected to the outer end of the spring arm 135 preferably by means of a flexible cable 146 and a latch release spring 150. The latch release spring 150 and the latch loading spring 140 are so proportioned that when the latch pedal is depressed, the tension produced upon the latch release spring 150 will overcome the tension of the latch loading spring 140, placing an upward pull upon the spring arm of the toggle latch, thereby causing the toggle latch shaft 124 to be rotated in counterclockwise direction when the latch arm 51 is released by the forward movement of the link extension 36. The latch arm 51 is stopped in its downward movement by means of an adjustable stop 151. When the latch pedal 141 is depressed to its lowermost position, the latch plate 143 will engage the latch pedal switch 144, closing the circuit to be hereinafter described and causing the link extension to be moved forwardly, thereby releasing the frictional contact between it and the latch arm just above referred to. As the latch arm 51 moves downwardly to its stop 151, an adjusting screw 152 carried by the latch will contact the plunger 153 of a latch switch 154, thus closing a circuit effecting the operation of the operating cylinder 41 to be hereinafter described.

The solenoid valve 45 is a standard article of manufacture and is provided with an intake 155 for connection to a suitable source of air under pressure, and with an exhaust 156 which is preferably connected to a muffler 160 so as to minimize the noise of exhaust from the operating cylinder. In the intake line 43 from the solenoid valve to the cylinder I preferably provide an adjusting valve 161 which controls the flow of the exhaust from the front end of the cylinder when air is leaving it through the pipe 43, and thus controls the speed of operation of the ram 24.

A relay 162 is also provided, by which the various switches and circuits are controlled and synchronized. This is also a standard article of manufacture and will not therefore be further described in detail except to point out the various contacts and operation thereof. The relation of the various contacts and circuits is shown in diagrammatic manner in Fig. 10. All of the electric switches employed in my structure are preferably standard articles of manufacture and are of the type which requires but a very minute movement of the plunger to close and open the contact elements thereof. A foot switch 163 is provided near the front of the machine and is connected to the relay as hereinafter described.

The relay 162 comprises a normally closed contact 164, a normally open contact 165 and a holding coil 166, as clearly shown in Fig. 10, all of which are shown in diagrammatic manner in this figure. The relative arrangement of the

latch switch 154, the stop switch 106, the foot switch 163 and the latch pedal switch 144 is also diagrammatically shown in this figure. A line switch 170 for connecting the relay to the line current leads 167 and the operating coil 171 of the solenoid valve 45 are also shown in this figure.

When my device is to be put into operation, the operator places his foot upon the foot switch 163 which closes the circuit through the normally closed contacts 164 of the relay and the coil 171 of the solenoid valve 45. This causes the solenoid valve to be actuated and air to be directed into the cylinder behind the piston (not shown) for causing the piston rod 40 and the link extension to be forced forwardly, thus moving the toggle links 25 and 26 to their riveting positions and moving the ram 24 upwardly, as shown in dotted lines in Fig. 2.

As shown by Figs. 3, 4 and 5, when the lower anvil 54 with its extended pressure rail 65 is first moved upwardly the pressure rail contacts the workpiece sheets 172 being riveted, there being obviously sufficient rivet shank extending below the lower surface of the bottom sheet to form a rivet head of the desired size and thickness when it is upset or flattened. When the pressure rail has forced the sheets 172 together, the upward movement of the pressure rail will be stopped and the sheets will be held together by the tension of the springs 71. After the upward movement of the pressure rail ceases, the lower anvil 54 will continue its upward movement toward the rivet and move relatively to the pressure rail. The pressure rail, which is bearing on top of the flange 75 of the middle spring button, will therefore force the flange 75 thereof downwardly against the tension of the spring 71, thus moving it relatively to the lower anvil 54 and the ram 24. Such relative movement will be transferred through the plunger stem 84 and switch actuating plunger 83. Since the lower inclined surface 92 of the switch actuating plunger is in contact with the similar surface 95 of the lateral actuating plunger 94, this relative movement will be imparted to such lateral plunger. When the anvil 54 has moved upwardly the predetermined amount or when it has been moved upwardly to a distance from the lower plate equal to the desired and predetermined thickness of the rivet head, the relative movement above referred to will have moved the lateral plunger 94 outwardly, carrying its arm 101 toward the stop switch 106. This switch is a normally open switch as shown in the diagram in Fig. 10 and, since it is of a sensitive nature, very slight movement of the arm will cause it to be closed and thereby establish a circuit through holding coil 166 of the relay and the foot switch 163. When the circuit is closed through this switch 106, the relay will be actuated to open the normally closed contacts 164 and simultaneously close the normally open contacts 165. When the current is interrupted through contacts 164, the coil 171 of the valve 45 will be deenergized, thus allowing closing this valve and terminating the riveting operation. This will allow the ram to move downwardly. When the contacts 165 are simultaneously closed, current will flow through the connected circuit in parallel to the circuit established through the stop switch 106, and when the current is interrupted through the opening of the switch 106 by the initial downward movement of the ram, the flow of current will be maintained through the contacts 165. Since the holding coil 166 is energized by current flowing through the contacts 165, the coil 171 will be kept deenergized

until the operator takes his foot off of the foot switch 163, thereby allowing the ram to continue its movement downwardly to the lower end of its stroke. Were it not for the holding coil 166, the opening of the stop switch by the initial downward movement of the ram would allow the ram to be reversed and again immediately raised, unless the operator instantly removed his foot from the foot pedal. However, by providing the contacts 165 and the holding coil 166, the coil 171 of the solenoid valve is kept deenergized by the opening of the contacts 164 until the operator removes his foot from the switch 163 and again closes the same by depressing the pedal thereof. As shown in this schematic figure the latch pedal switch 144 is connected in parallel with the foot switch 163 and its closing by means of the operation of the foot pedal 141 has the same effect upon the operating cylinder as if the operator closed the foot pedal switch 163. Since it is necessary to release the friction between the latch surface 46 of the link extension 36 and the engaging surface of the latch arm 51 before the latch arm can be moved out of the way of the extension, the switch 144 is provided and one operation of the pedal 141 not only serves to place tension upon the spring 150 but at the same time serves to release the latch arm as just above described. When the latch pedal 141 is depressed, tension is placed upon the toggle latch arm 51, as hereinbefore pointed out and, upon the forward movement of the extension link 36 caused by the closing of the latch pedal switch 144, the latch arm 51 will be moved counterclockwise to its lower position (shown in dotted lines in Fig. 2). Just as soon as the latch is moved downwardly, the latch switch 154 is closed. This switch, which is connected in parallel with the rivet control switch 106, serves to reverse the movement of the ram. This will cause the extension 36 to be moved backwardly over the top of the depressed latch arm 51 to the position shown by the dot-and-dash lines in Fig. 2, thus lowering the lower anvil beyond the normal operating stroke and to a position where work requiring a greater opening between the anvils may be inserted. Just as soon as the link extension has passed backwardly to its backward position, the latch pedal 141 is released which opens the switch 144 and allows the loading spring 140 to bring the toggle latch arm 51 back to its normal position as shown in full lines in Fig. 2. When the operator now places his foot upon the foot switch 163, the operating cylinder 41 is again actuated to force the link extension forwardly. As the lower edge 50 of the extension link contacts with and moves over the latch arm 51 it will cause said arm to be rotated counterclockwise. The parts are so designed that just as the edge 50 passes over the top of the latch arm, the latch arm has been sufficiently depressed so as to close the circuit controlled by the latch switch 154. The operating cylinder is thereby reversed in a manner similar to the reversal brought about by the actuation of the stop switch 106, but before the link has had time to move back again to its rearward position, the latch arm 51 has snapped up in position behind it, thus setting the extension link and the toggle links in normal working positions where they are ready to go through the regular riveting stroke when the foot switch 163 is again depressed.

In the modified form shown in Fig. 11 the stop switch 175 is carried by a slidable switch plunger 176. This plunger is carried by a guide sleeve 180 having an integral annular flange

181 which is secured to a boss 182 carried by the ram housing 183.

In this form of the invention the boss 182 is formed on the exterior of the machine where the parts of the switch controlling mechanism are accessible to direct adjustment. The switch 175 is mounted within a recess 184 formed in the boss and opening up into the bore in the housing for the ram 24. The contact button 185 of the switch extends inwardly toward and in contact with the switch actuating arm 101 as in the other form of the invention. The switch plunger 176 is slidably mounted within a bore 186 formed in the guide sleeve 180. So as to prevent rotation of the plunger 176 a feather screw 190 is provided which is carried by the guide sleeve and extended into the bore 186 where it engages with a keyway 191 formed in the switch plunger. The switch plunger and the switch are kept in their outward positions by means of a helical spring 192 arranged to have one end contacting with the switch 175 and the other end with a switch arm 193 carried by the housing and extending upwardly to a point opposite the switch. The arm carries a retaining pin 194 which passes through the center of the spring to maintain it in position. The guide sleeve 180 is formed in its outer end with interior screwthreads 194 for the reception of an adjusting screw 195. This adjusting screw has a stud 196 engaging the outer face of the switch plunger 176, and at its opposite end it is formed with a guide stud 200. This stud is disposed within a bore 201 formed in an adjusting knob 202. The adjusting screw is held in place within the knob by engagement of the stud 200 with the bore 201 and by means of rivets 203 which pass through the adjusting screw 195 and the outer wall of the knob whereby the screw and knob are made a unitary structure. The knob is thus rotatable relative to the guide sleeve 180 and the position of the plunger 176 at which the switch 175 will make contact is adjusted by rotation of the knob. When turned in one direction the switch plunger 176 will be moved inwardly. When the screw is backed away the spring 192 will force the plunger and switch backwardly against the screw. The adjusting knob 202 is formed with an annular recess 204 in its inner face which provides a flange 205 for concealing the flange 181 of the guide sleeve and also the screws which secure the same in place. Suitable index markings (not shown) are carried on the flange 205 which provide definite indication of the adjustment of the knob. A number of spring-pressed detents 206 are carried by the boss 182 and the flange of the guide sleeve 180 for engagement with suitable recesses 210 formed in the inner face 211 of the adjusting knob. A helical spring 212 is provided for each of the detents.

In the modified form of Fig. 13 I show my invention as applied to a machine for upsetting a single rivet. In this form of invention the lower anvil 215 is suitably carried by the ram 216 of the device. The pressure sleeve 217 in this form of invention is slidably mounted about the anvil 215 and is prevented from relative rotation therewith preferably by means of a keyway 220 formed in the anvil with which a detent ball 221 is engageable. This ball is carried by the pressure sleeve and is maintained in position by means of a screw 222. The pressure sleeve is forced upwardly by means of a helical spring 223 which is mounted about the anvil

and has its upper end preferably disposed within a recess 224 formed in the lower end of the pressure sleeve. The pressure sleeve is provided with a screw arm 225 which carries an adjusting screw 226. The screw is passed through the arm and has a lock nut 230 disposed on one side of the arm. By means of this screw the point at which contact is made with the stop switch 232 is accurately controlled. The contact switch is carried by a bracket 233 secured to and carried by the ram 216.

In this form of invention as the ram is moved upwardly toward the workpiece (not shown) and against the upper anvil (not shown) the pressure sleeve 217 contacts the workpiece and compresses the pieces thereof firmly together, after which further upward movement of the ram will cause the lower anvil 215 to move upwardly relative to the pressure sleeve and cause the rivet to be upset. When the rivet has been upset the predetermined amount, or until the space between the lower anvil and the face of the workpiece is at a predetermined distance, the adjusting screw 226 will contact the switch 232 and close the circuit, thus causing the operating means to be interrupted as hereinbefore described in connection with the other form of invention.

While I have described the use of air in the operation of the operating cylinder, it is obvious that oil or other fluid may be used. Furthermore, while I have described the form of Fig. 13 as applied to a single rivet, it is obvious that this invention is also applicable to a multiple riveter. These and other modifications of the details herein shown and described may be made without departing from the spirit of my invention or the scope of the appended claims and I do not, therefore, wish to be limited to the exact embodiment herein shown and described, the form shown being merely a preferred embodiment thereof.

Having thus described my invention, what I claim is:

1. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle link to a normal operating stroke, and latch release means for releasing the toggle links for movement to their maximum stroke.

2. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle link to a normal operating stroke, latch release means, a latch pedal switch associated with said release means for causing the operating means to travel on its riveting stroke, and a latch switch associated with said latch means for causing said operating means to travel on its non-riveting stroke.

3. A riveting machine, comprising a housing, a stationary anvil carried by said housing, a ram opposite said stationary anvil and slidably mounted in said housing, a movable anvil carried by said ram, means for reciprocating said ram, a pressure rail slidably mounted upon said movable anvil and movable relatively thereto, a

switch actuating plunger slidably carried by said ram, a lateral actuating plunger slidably mounted in said ram, said switch actuating plunger and said lateral plunger being connected so that movement of the switch actuating plunger is transmitted to the lateral actuating plunger, a switch mounting plate pivotally carried by the housing opposite the lateral actuating plunger, an electric switch carried by said plate, means for adjusting the position of the plate and switch, and actuating means connecting said switch with said ram reciprocating means.

4. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle link to a normal operating stroke, latch release means, a latch pedal switch associated with said release means for causing the operating means to travel on its riveting stroke, a latch switch associated with said latch means for causing said operating means to travel on its non-riveting stroke, a loading spring for holding said latch means in its normal position, and a latch release spring for counteracting said loading spring.

5. A riveting machine, comprising a housing, a stationary anvil carried by said housing, a ram opposite said stationary anvil and slidably mounted in said housing, a movable anvil carried by said ram, means for reciprocating said ram, a pressure rail slidably mounted upon said movable anvil and movable relatively thereto, a rail motion rod carried by said movable anvil and actuated by the relative movement between said pressure rail and said movable anvil, a switch actuating plunger slidably carried by said ram, an adjustable plunger stem carried by said actuating plunger and coacting with said rod, and actuating means, including a switch, for connecting said plunger to said ram reciprocating means for terminating the riveting operation.

6. A riveting machine, comprising a housing, a stationary anvil carried by said housing, a ram opposite said stationary anvil and slidably mounted in said housing, a movable anvil carried by said ram, means for reciprocating said ram, a pressure rail slidably mounted upon said movable anvil and movable relatively thereto, a rail motion rod actuated by the relative movement between said pressure rail and said movable anvil, a switch actuating plunger carried by said ram, a lateral actuating plunger slidably mounted in said ram, an adjustable plunger stem carried by said switch actuating plunger and coacting with said rail motion rod, said switch actuating plunger and said lateral plunger being connected so that movement of the switch actuating plunger is transmitted to the lateral actuating plunger, and actuating means connecting said ram reciprocating means with said lateral actuating plunger for terminating the riveting operation.

7. A riveting machine, comprising a housing, a stationary anvil carried by said housing, a ram opposite said stationary anvil and slidably mounted in said housing, a movable anvil carried by said ram, means for reciprocating said ram, a pressure rail slidably mounted upon said movable anvil and movable relatively thereto, a switch actuating plunger slidably carried by said ram, a lateral actuating plunger slidably mounted in said ram, said switch actuating plunger and

said lateral plunger being connected so that movement of the switch actuating plunger is transmitted to the lateral actuating plunger, an adjustably mounted electric switch carried by said housing, and actuating means connecting said switch with said ram reciprocating means.

8. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle link to a normal operating stroke, latch release means for releasing the toggle links for movement to their maximum stroke, a loading spring for holding said latch means in its normal position, and a latch release spring for counteracting said loading spring.

9. A riveting machine, comprising riveting means including a pair of relatively movable anvils, means associated with said anvils for operating said riveting means, dimensional control means associated with said riveting means for limiting the relative movement between said anvils, to determine the thickness of the rivet head being formed, said riveting means being movable relatively to said dimensional control means upon engagement of the surface of the workpiece, said control means including stop means responsive to the relative movement between said riveting means and said dimensional control means as determined by rivet head thickness for arresting the operation of said riveting means.

10. A riveting machine, comprising riveting means including a pair of relatively movable anvils, means for operating said riveting means, a pressure rail slidably carried by one of said anvils and engageable with the workpiece during riveting operation, said rail being movable relatively to the anvil carrying the same to effect riveting operation, an electric control switch, and means connecting said rail to said switch for actuating the latter, said switch and said connecting means being responsive to the relative movement between said rail and the anvil carrying the same as determined by rivet head thickness for arresting the operation of said riveting means.

11. A riveting machine, comprising riveting means including a pair of relatively movable anvils, means for operating said riveting means, a pressure rail slidably carried by one of said anvils and engageable with the workpiece during riveting operation, said rail being movable relatively to the anvil carrying the same to effect riveting operation, an electric control switch, means connecting said rail to said switch for actuating the latter, said switch and said connecting means being responsive to the relative movement between said rail and the anvil carrying the same as determined by rivet head thickness for arresting the operation of said riveting means, and means for adjusting the position of said switch with respect to the relative movement between the rail and the anvil carrying the same.

12. In a riveting machine, the combination with relatively movable riveting anvils, of dimensional control means associated with one of said anvils for limiting the relative movement between said anvils to determine the thickness of the rivet head being formed, said dimensional control means being movable relatively to the one of the anvils upon contact with the surface of the workpiece, said control means including stop

means responsive to the relative movement between said one anvil and said dimensional control means as determined by rivet head thickness for arresting the operation of said riveting means.

13. A riveting machine, comprising a housing, upper and lower fixed jaws carried by the housing, a stationary anvil carried by said upper jaw, a ram slidably carried by said lower jaw, a movable anvil carried by said ram, operating means for said ram for effecting a riveting operation, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member movable relatively to one of said anvils upon contact with the surface of a workpiece, an electric stop switch for arresting said operating means, means carried by said ram for transmitting the relative movement between said movable member and one of said anvils to said switch, and means connecting said switch with said operating means for interrupting said operating means and thereby terminating the riveting operation.

14. A riveting machine, comprising a housing, upper and lower fixed jaws carried by the housing, a stationary anvil carried by said upper jaw, a ram slidably carried by said lower jaw, a movable anvil carried by said ram, operating means for said ram for effecting a riveting operation, dimensional control means carried by said movable anvil to control the thickness of the rivet head being formed, said control means comprising a member movable relatively to such anvil upon contact with the surface of a workpiece, an electric stop switch for arresting said operating means, means carried by said ram for transmitting the relative movement between said movable member and said movable anvil to said switch, and means connecting said switch with said operating means for interrupting said operating means and thereby terminating the riveting operation.

15. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the adjacent surface of a workpiece, one of said anvils having relative movement with said movable member, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle links to a normal operating stroke, and latch release means for releasing the toggle links for movement to their maximum stroke, said control means further comprising stop means including an electric switch coacting with said operating means and actuated by the relative movement between said movable member and said movable anvil for determining the total movement of said movable anvil.

16. A riveting machine, comprising a housing, a stationary anvil carried by said housing, a ram opposite said stationary anvil and slidably mounted in said housing, a movable anvil carried by said ram, means for reciprocating said ram to effect a riveting operation, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the adjacent surface of a workpiece, one of said anvils having relative movement with said mov-

able member and a stop switch carried by said housing and in coacting relation with said movable member, and switch regulating means carried by the housing for controlling the position of said rivet control switch, comprising an eccentric shaft, an eccentric button carried by the shaft and coacting with said rivet control switch, and means for fastening said eccentric shaft in its adjusted position.

17. A riveting machine, comprising a housing, a stationary anvil carried by said housing, a ram opposite said stationary anvil and slidably mounted in said housing, a movable anvil carried by said ram, means for reciprocating said ram, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the surface of a workpiece and a stop switch associated therewith, one of said anvils having relative movement with said movable member, a switch plate pivotally carried by said housing, said stop switch being rigidly carried by said plate, an eccentric shaft carried by said housing, an eccentric button carried by the shaft and coacting with said switch plate, and means for fastening said eccentric shaft in its adjusted position.

18. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the surface of a workpiece, one of said anvils having relative movement with said movable member, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle links to a normal operating stroke, latch release means for releasing the toggle links for movement to their maximum stroke, a loading spring for holding said latch means in its normal position, and a latch release spring for counteracting said loading spring, said control means further comprising actuating means connecting said movable member with said operating means for interrupting said operating means and terminating the riveting operation.

19. A riveting machine, comprising a housing, a stationary anvil carried by said housing, a ram opposite said stationary anvil and slidably mounted in said housing, a movable anvil carried by said ram, means for reciprocating said ram, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the surface of a workpiece, one of said anvils having relative movement with said movable member, a stop switch carried by said housing for cooperation with said dimensional control means, a switch actuating plunger carried by said ram, a lateral actuating plunger slidably mounted in said ram, said switch actuating plunger and said lateral actuating plunger each being formed with inclined coacting surfaces, and actuating means connecting the ram reciprocating means with the lateral actuating plunger for interrupting said operating means and terminating the riveting operation.

20. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable mem-

ber for contact with the surface of a workpiece, one of said anvils having relative movement with said movable member, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle links to a normal operating stroke, and latch release means for releasing the toggle links for movement to their maximum stroke, said control means further comprising actuating means connecting said movable member with said operating means for terminating the riveting operation.

21. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the surface of a workpiece, one of said anvils having relative movement with said movable member, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle links to a normal operating stroke, latch release means, a latch pedal switch associated with said release means for causing the operating means to travel on its riveting stroke, and a latch switch associated with said latch means for causing said operating means to travel on its non-riveting stroke, said control means further comprising actuating means connecting said movable member with said operating means for terminating the riveting operation.

22. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the surface of a workpiece, one of said anvils having relative movement with said movable member, operating means for said movable anvil including an upper toggle link and a lower toggle link, a link extension carried by said upper toggle link, latch means engageable with said link extension to limit the movement of the toggle links to a normal operating stroke, latch release means, a latch pedal switch associated with said release means for causing the operating means to travel on its riveting stroke, a latch switch associated with said latch means for causing said operating means to travel on its non-riveting stroke, a loading spring for holding said latch means in its normal position, and a latch release spring for counteracting said loading spring, said control means further comprising actuating means connecting said movable member with said operating means for terminating the riveting operation.

23. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member for contact with the adjacent surface of a workpiece, one of said anvils having relative movement with said movable member, operating means for said movable anvil including an upper toggle link and a lower toggle link, and a link extension carried by said upper toggle link, said control means further comprising stop means including an electric switch coacting with said operating means and actuated by the rela-

tive movement between said movable member and said movable anvil for determining the total movement of said movable anvil.

24. A riveting machine, comprising a pair of relatively movable anvils, operating means associated with said anvils for effecting a riveting operation, movably mounted dimensional control means to control the thickness of the rivet head being formed, said control means comprising a movable member arranged adjacent one of said anvils and engageable with one of the surfaces of a workpiece, one of said anvils being movable relatively to said movable member, and arresting means actuated by and during the relative movement between said dimensional control means and the anvil associated therewith for interrupting said control means and thereby terminating the riveting operation.

25. A riveting machine, comprising a pair of relatively movable anvils, operating means associated with said anvils for effecting a riveting operation, and dimensional control means associated with said operating means and movable relatively to one of said anvils upon contact with the surface of a workpiece for determining the thickness of the rivet head.

26. A riveting machine, comprising a pair of relatively movable anvils, operating means associated with said anvils for causing a projecting rivet body to be upset and formed into a rivet head against the surface of a workpiece, and dimensional control means engageable with the surface of the workpiece against which the rivet head is formed, said means having relative movement with one of said anvils upon contact with said surface for interrupting said operating means when said formed head has reached its predetermined thickness.

27. A riveting machine, comprising a pair of relatively movable anvils, operating means associated with said anvils for causing a projecting rivet body to be upset and formed into a rivet head against the surface of a workpiece, and dimensional control means for determining the thickness of the rivet head being formed, said control means comprising a movable member engageable with the surface of the workpiece against which the rivet head is formed, said member having relative movement with one of said anvils upon contact with said surface, said dimensional control means including means associated with said movable member and said operating means for interrupting the latter when the rivet head has reached a predetermined thickness.

28. A riveting machine, comprising a pair of relatively movable anvils, operating means associated with said anvils for causing a projecting rivet body to be upset and formed into a rivet head against the surface of a workpiece, and dimensional control means for determining the thickness of the rivet head being formed, said control means being carried by one of said anvils and movable relatively to such anvil, said control means being engageable with the surface of the workpiece against which the rivet head is formed and including means having relative movement with one of said anvils upon contact with said surface for interrupting said operating means when said formed head has reached its predetermined thickness.

29. A riveting machine, comprising a pair of relatively movable anvils, operating means associated with said anvils for causing a projecting rivet body to be upset and formed into a rivet head against the surface of a workpiece, and dimensional control means for determining the thickness of the rivet head being formed, said control means comprising a movable member engageable with the surface of the workpiece against which the rivet head is formed, said member having relative movement with one of said anvils upon contact with said surface, said control means being associated with said movable member and said operating means and including an electric switch connected with said operating means and actuated by the relative movement between said movable member and the anvil relative to which it moves for interrupting the operating means when the rivet head has reached a predetermined thickness.

30. A riveting machine, comprising a stationary anvil, a movable anvil slidable relatively thereto, operating means for said movable anvil for causing a projecting rivet body to be upset and formed into a rivet head against the surface of a workpiece, and dimensional control means for determining the thickness of the rivet head being formed, said control means comprising a movable member carried by said movable anvil and movable relatively to said movable anvil upon contact with the surface of the workpiece against which the rivet head is formed, said control means being associated with said movable member and said operating means for interrupting the latter when the rivet head has reached a predetermined thickness.

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