Sept. 7, 1943. C. H. LYON 2,328,821

RIVET SETTING MACHINE

Filed March 17, 1941 5 Sheets-Sheet 1

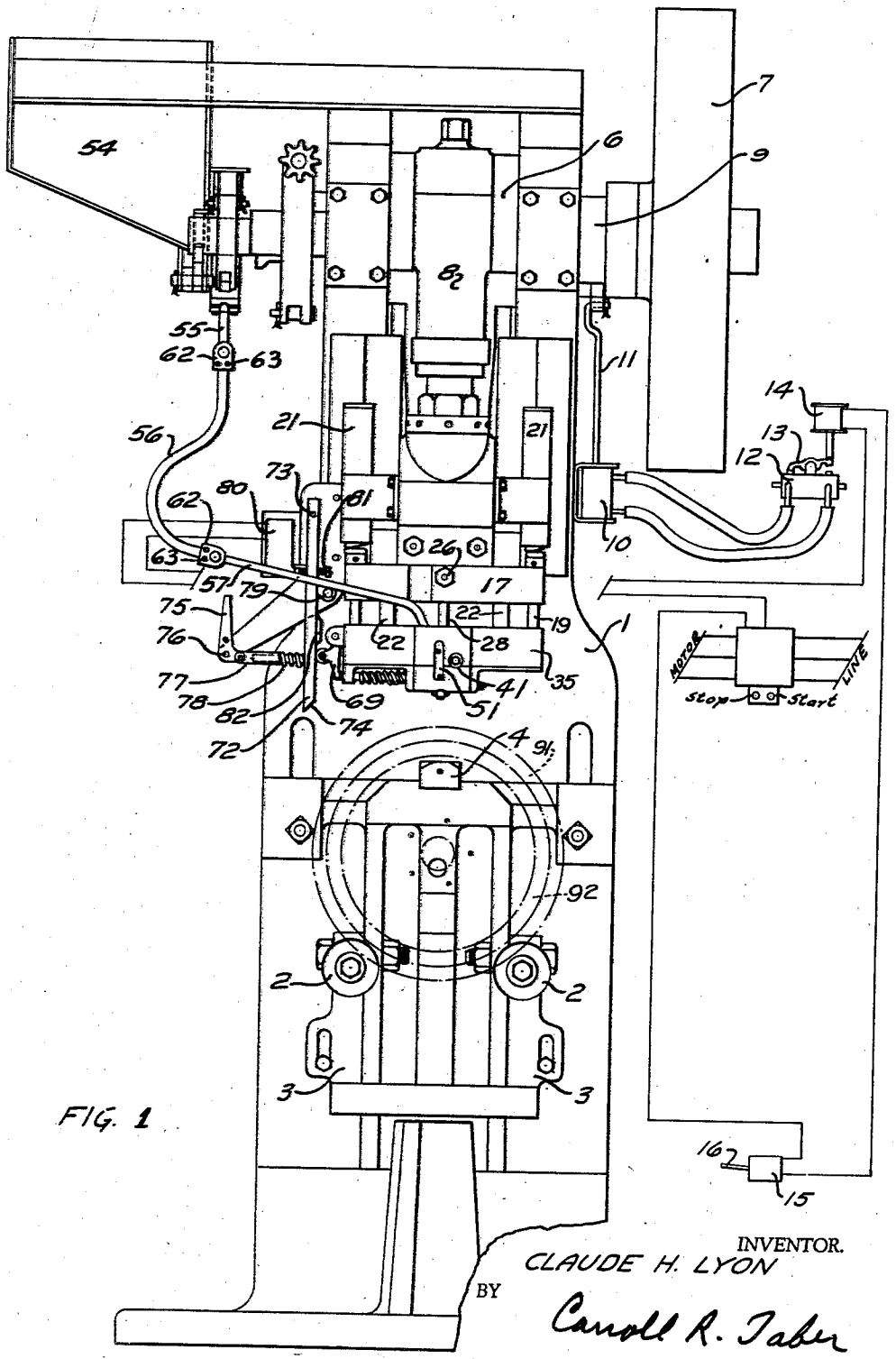


FIG. 1

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RIVET SETTING MACHINE

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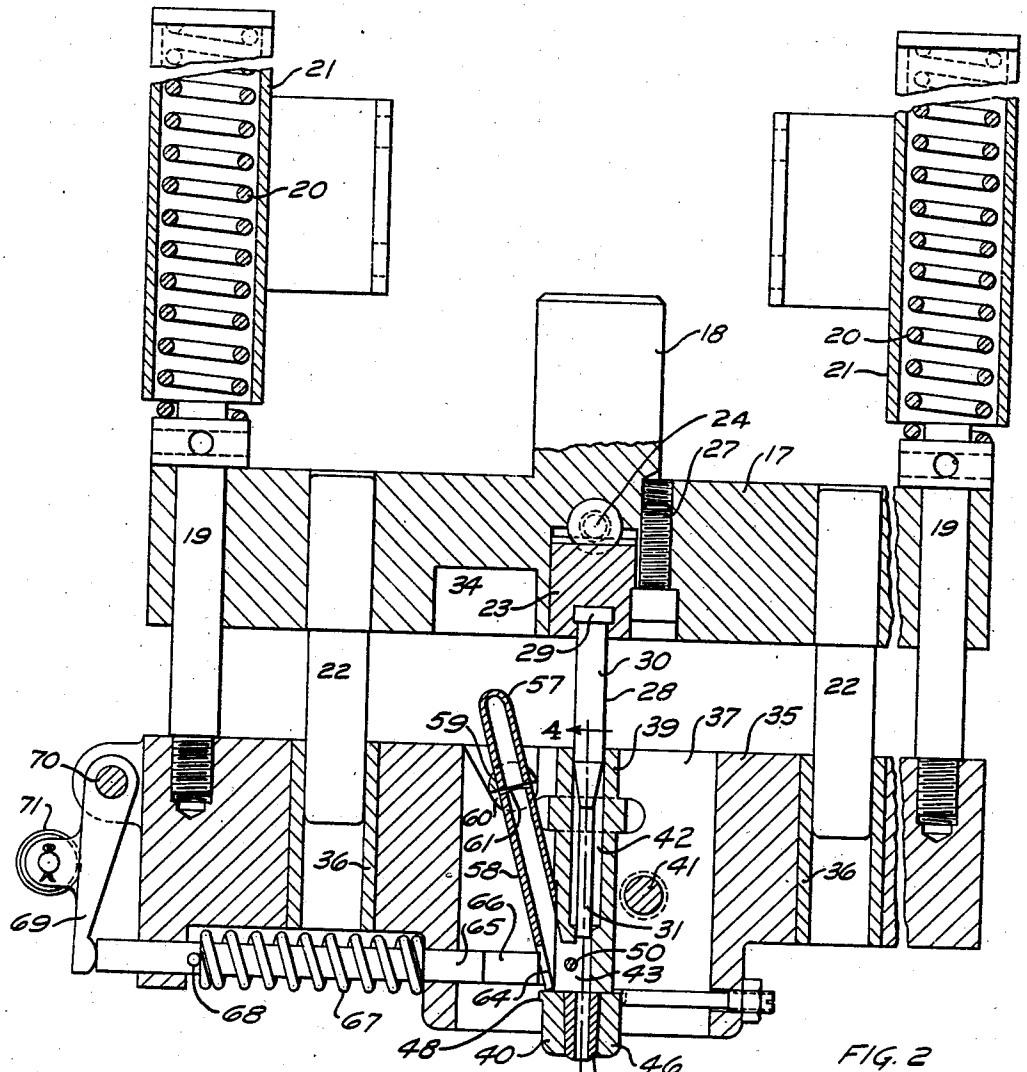


FIG. 2

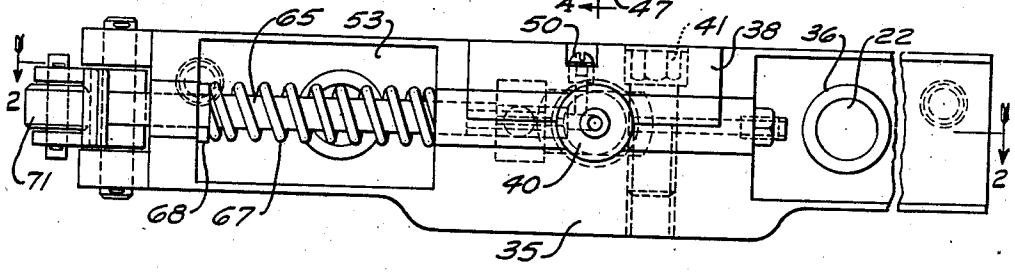


FIG. 3

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RIVET SETTING MACHINE

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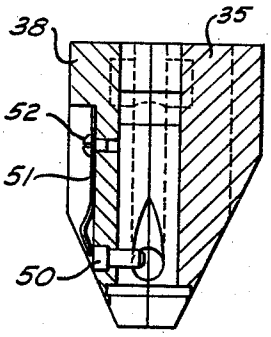


FIG. 4

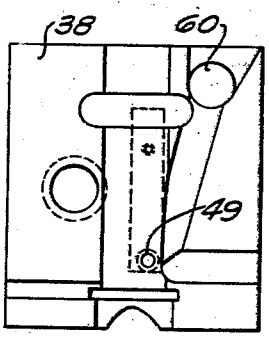


FIG. 5

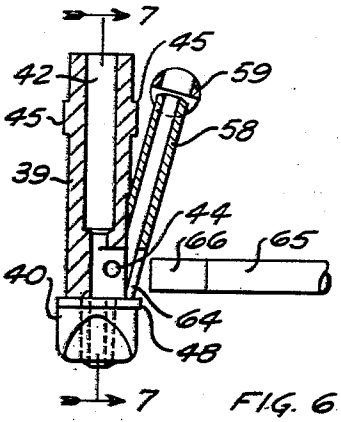


FIG. 6

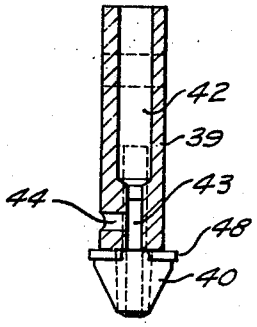


FIG. 7

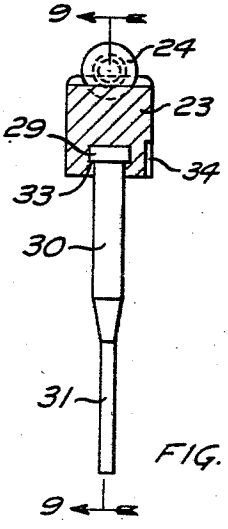


FIG. 8

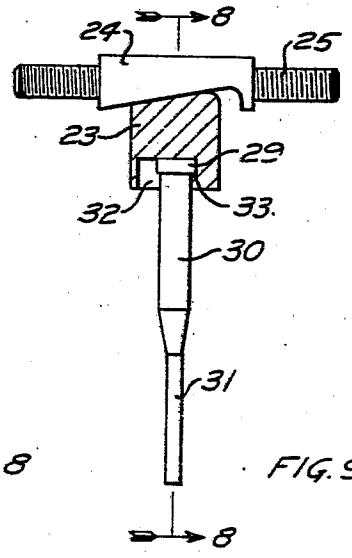


FIG. 9

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RIVET SETTING MACHINE

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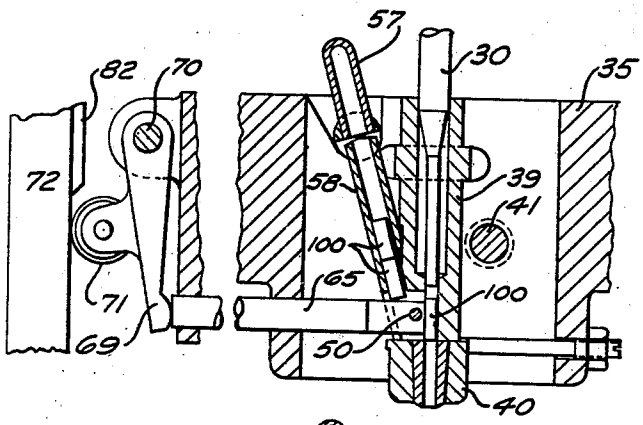


FIG. 10

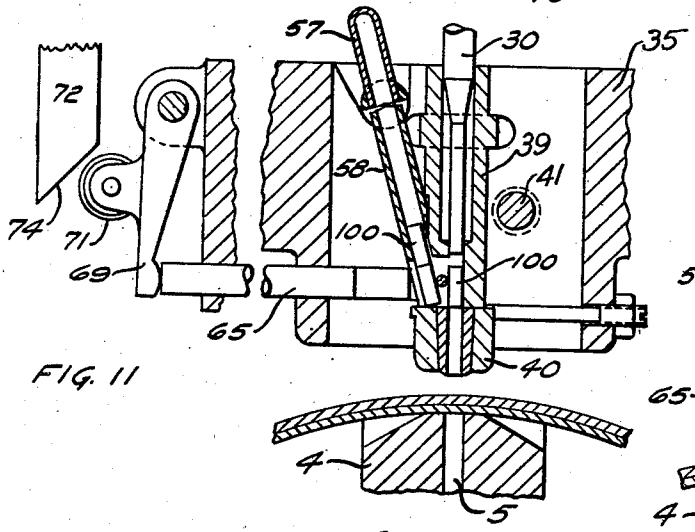


FIG. 11

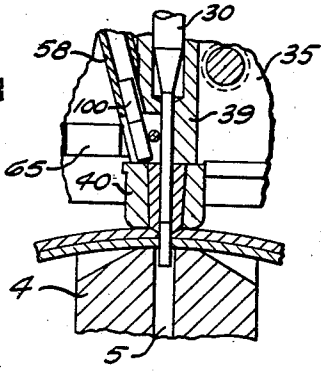


FIG. 13

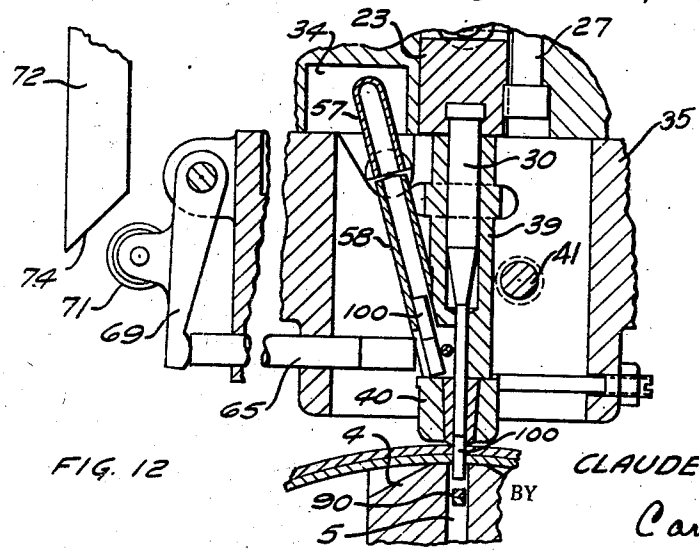


FIG. 12

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RIVET SETTING MACHINE

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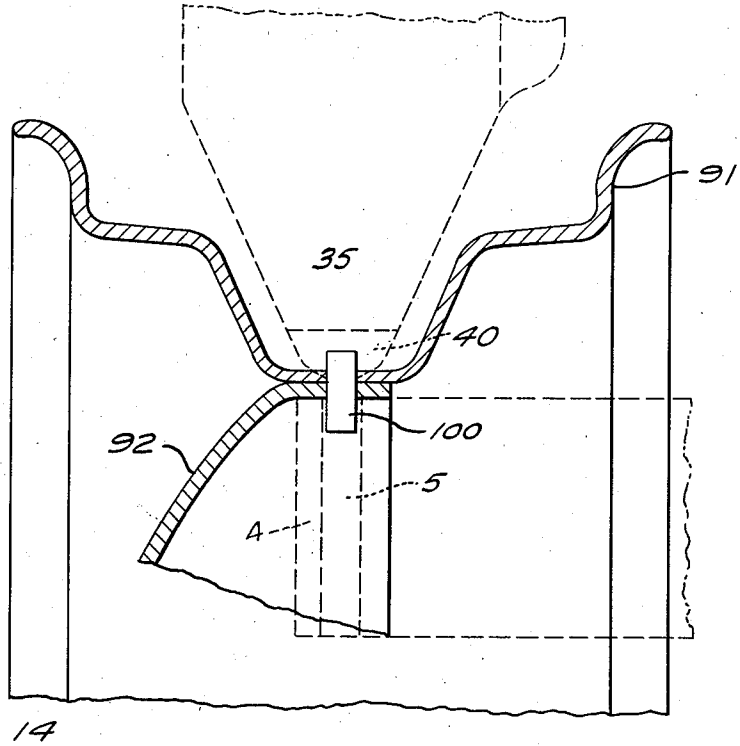


FIG. 14

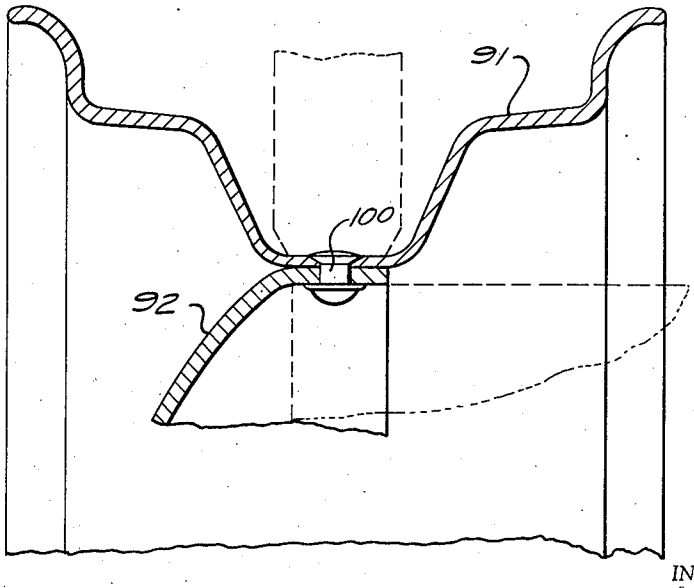


FIG. 15

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Patented Sept. 7, 1943

2,328,821

UNITED STATES PATENT OFFICE

2,328,821

RIVET SETTING MACHINE

Claude H. Lyon, Lansing, Mich., assignor to Motor Wheel Corporation, Lansing, Mich., a corporation of Michigan

Application March 17, 1941, Serial No. 383,762

17 Claims. (Cl. 78—49)

This invention relates to rivet setting machines and more particularly to the rivet feeding and driving mechanisms thereof.

The principal object of the invention is to provide a simple and effective rivet feeding and guiding mechanism for an automatic rivet setting machine adapted to carry out the method described in my copending application Serial No. 236,865, filed October 25, 1938, now Patent No. 2,244,073.

Another object is the provision of mechanism for automatically stopping the machine if the feeding mechanism should for any reason cease to function.

These objects will become more apparent in the following specification when read in connection with the accompanying drawings, wherein—

Figure 1 is a front elevational view of a rivet setting machine embodying the invention;

Figure 2 is a cross-sectional view of the punch assembly taken on substantially the line 2—2 of Figure 3;

Figure 3 is a bottom plan view of the punch assembly;

Figure 4 is a cross-sectional view of the punch guide assembly taken on substantially the line 4—4 of Figure 2;

Figure 5 is a rear elevational view of the removable cap shown in Figure 4;

Figure 6 is a cross-sectional view of the punch guide sleeve, die button, and a portion of the rivet feeding mechanism;

Figure 7 is a cross-sectional view taken on substantially the line 7—7 of Figure 6;

Figure 8 is a cross-sectional view of the punch and punch adjusting mechanism taken on substantially the line 8—8 of Figure 9;

Figure 9 is a cross-sectional view taken on substantially the line 9—9 of Figure 8;

Figures 10, 11, 12 and 13 are fragmentary cross-sectional views similar to Figure 2 showing the parts of the punch assembly in different positions during its cycle of operation;

Figure 14 is a cross-sectional view of a wheel rim showing a rivet in place and the punch assembly in broken lines; and

Figure 15 is a cross-sectional view of the same wheel after the rivet has been headed over.

The machine disclosed herein is designed to drive cylindrical unheaded rivets of the type indicated by the numeral 100 in Figures 10 to 14. The machine is intended especially for riveting wheel rims 91 to wheel bodies 92, but it will be evident that it may be used for riveting other parts, especially if suitably modified.

For the purpose of facilitating the disclosure of the invention, the description will be divided into five parts, relating to the press proper, the punch assembly, the rivet feeding mechanism, the safety mechanism, and the operation of the machine.

The press

The rivet setting machine shown in the drawings comprises a press having a frame 1. A die block 4 is rigidly mounted on the frame 1. (See Figs. 1, 11, 12 and 13.) The die block has a vertically extending bore 5 therethrough for a purpose which will appear presently.

A pair of supports 3 is mounted on the frame 1, below, and on opposite sides of the die block 4. The supports are capable of limited vertical movement and are biased toward their upper positions by springs (not shown). A roller 2 is mounted on each support 3. The rollers seat in the groove of the wheel rim 91, normally supporting the rim in the position shown in broken lines in Figure 1. The wheel is thus permitted to turn freely when so supported, but can be forced downwardly against the die block 4 when the ram (to be described later) contacts the wheel rim.

Journaled in bearings at the top of the frame is a crankshaft 6 on one end of which is a flywheel 7. A ram 8 is connected to the crankshaft for vertical reciprocation as the crankshaft turns. The crankshaft is driven from an electric motor through a driving connection including a clutch 9.

Ordinarily the motor for driving the ram operates continuously, but the ram itself can be started and stopped at will by the operator. The clutch 9 is operated by a pneumatic trip 10. The latter comprises a cylinder having a piston therein and a piston rod 11 connected to the clutch. Opposite ends of the cylinder are connected to an air valve 12 which in turn is connected to a source of air under pressure. Mounted on top of the valve is a rocker arm 13 for moving the valve from one position to the other. The rocker arm is rocked by a solenoid 14 connected to a source of electric current and in series with a switch 15. The switch is actuated by a foot pedal 16 near the machine operator's foot.

When the foot pedal is released the solenoid is deenergized and the valve rocker arm is brought to the position shown in Figure 1. Air is admitted to the upper end of cylinder 10 releasing clutch 9. When the pedal 16 is depressed the solenoid is energized, thereby operating the air valve to admit air to the lower end of the cylinder.

This forces the piston rod 11 upward and engages the clutch.

The punch assembly

Attached to the lower end of the ram 8 and reciprocable therewith is the punch assembly. The punch assembly comprises a punch holder 17 having a projection 18 fitting into a recess in the lower end of the ram 8. Adjacent the ends of the punch holder and slidably mounted therein are two shoulder screws 19. The upper ends of the shoulder screws are enlarged as shown in Figure 2 to form seats for a pair of coil springs 20. The springs 20 are contained in spring housings 21. The housings 21 are rigidly connected to opposite sides of the ram 8 at points above the punch holder. The lower ends of the shoulder screws 19 are threaded for attachment to a punch guide assembly, which will be described later. Intermediate the shoulder screws 19 are two guide pins 22. The guide pins are rigidly mounted in the punch holder and project downwardly therefrom.

In the center of the punch holder is a recess which receives a punch retainer 23 and an adjusting wedge 24. The adjusting wedge 24 is slightly shorter than the recess to permit fore and aft movement of the wedge. The ends 25 of the wedge are threaded. They project through the front and rear walls of the recess and are provided with nuts 26 to provide for adjustment of the wedge.

The punch retainer 23 has an inclined top surface that cooperates with the lower surface of the wedge, whereby fore or aft adjustment of the wedge produces an up or down adjustment of the punch retainer. A screw 27 threaded into the punch holder locks the punch retainer tightly in its adjusted position.

In the lower face of the punch retainer is a bayonet type recess 32. See Figures 8 and 9. At the rear of the slot are shoulders 33 to hold a punch 28.

The punch 28 has a head 29 which fits within the bayonet slot 32 in the bottom of the punch retainer. The central part 30 of the punch is smaller than the head, but of a diameter sufficient to provide the necessary strength. The lower end of the punch 28 is reduced in diameter as at 31. The diameter of this portion is the same as that of the rivets 100.

A recess 34 is provided in the punch holder at one side of the punch retainer 23. The purpose of this recess will appear presently.

Below the punch holder 17 is the punch guide assembly. The punch guide assembly comprises a body portion 35 which is attached to the threaded ends of the shoulder screws 19 and is movable therewith. Intermediate the center and the respective ends of the body portion 35 is a pair of guide pin bushings 36 which receive the guide pins 22 on the punch holder 17. The guide pins 22 are slidably mounted in said bushings.

In the front surface of the body portion 35 is a generally rectangular recess 37 which receives a removable cap 38 (see Figures 3, 4 and 5). The front wall of the recess 37 and the adjacent or rear wall of the cap 38 are hollowed out to receive a punch guide sleeve 39, a die button 40, and certain parts of the rivet feeding mechanism, which will be described later. The cap 38 is held in place within the recess 37 by means of a screw 41 accessible from the front of the assembly.

The punch guide sleeve 39 above mentioned has a bore 42 extending therethorugh to receive the punch 28. The upper part of this bore is large enough to slidably receive the enlarged portion 30 of the punch 28 while the lower end of the bore slidably receives the reduced lower end portion 31 of the punch. Extending radially through the side of the punch guide sleeve 39 adjacent the lower end thereof is a rectangular slot 43. The dimensions of the slot are such as to permit the radial insertion into the bore 42 of the rivets 100. A small hole 44 extends into the punch guide sleeve from the front thereof and intersects the slot 43. The hole 44 is tangent to the left hand side of the bore 42 (see Figures 2, 5 and 7). On the outside of the sleeve 39 are two shoulders 45 which fit corresponding recesses in the body portion 35 and the cap 38 to accurately locate the punch guide sleeve 39.

Directly below the sleeve 39 and aligned therewith is the die button 40. This die button is composed of two parts, a casing 46 of tough stress resisting steel to prevent bursting of the button, and a bushing 47 of very hard steel to minimize wear. These two parts are fitted together with a drive fit. The bushing 47 has a bore extending vertically therethrough, which is aligned with the bore 42 in the punch guide sleeve 39. The lower end of the bushing 47 is in the form of a truncated cone. It projects slightly below the lower end of the casing 46. The casing 46 has a peripheral shoulder 48 which locates and holds the die button in place in the punch guide assembly.

The cap 38 above mentioned is provided with a small hole 49 aligned with the hole 44 in the punch guide sleeve. Received in this hole is a rivet retaining pin 50 which projects nearly half way through the punch guide sleeve 39 (see Figure 4). The inner end of the pin 50 is rounded. The pin 50 is held in place by means of a short leaf spring 51 attached to the front of the cap 38 by a screw 52. The spring 51 permits the pin 50 to be pushed part way out of the hole 44 in the punch guide sleeve 39.

In the lower face of the body portion is a rectangular recess 53, the purpose of which will presently appear.

The rivet feeding mechanism

Mounted on the frame 1 at the upper end thereof is a rivet hopper 54 adapted to contain a quantity of loose unheaded rivets 100. The hopper 54 is connected to a rivet feed tube comprising four sections, 55, 56, 57 and 58. The section 55 is firmly secured to the hopper. Section 56 is hinged to section 55. Section 57 is hinged to section 56 and to the punch guide assembly. Section 58 is immovably mounted in the punch guide assembly between the body portion 35 and the cap 38 (see Figure 2).

The hinges between the various sections of the rivet feed tube are nearly alike and only one will be described in detail. That one is the connection betwen the sections 57 and 58. The lower end of the section 57 has a pair of oppositely extending cylindrical projections 59. These projections fit within circular recesses 60 in the body portion 35 and the cap 38 and are rotatable to a limited extent therein. The upper end of the section 58 is oppositely beveled as at 61 to permit limited rocking movement of the section 57 relative to the section 58.

The other hinged connections between the sections are the same as that just described except that the recesses for receiving the projections on the sections of the feed tube are formed in housings 62. Each housing is made in two halves held together by bolts 63.

The lowermost section 58 of the rivet feed tube

has its lower end cut away at a very acute angle to fit against the side of the punch guide sleeve 39, as shown in Figure 2. The extreme lower end of the section 58 is slotted at 64 to admit the end of the rivet feed bar, which will be described later. The open lower end of the section 58 communicates with the slot 43 in the side of the punch guide sleeve 39.

Slidably mounted in opposite walls of the recess 53 is a rivet feed bar 65. The right hand end (Figure 2) of the rivet feed bar is reduced in section as at 66 to permit it to enter the slot 64 in the section 58 of the rivet feed tube. A spring 67 surrounds the rivet feed bar 65 and is held in compression by a pin 68 extending through the rivet feed bar. This spring urges the feed bar 65 to the left, as shown in Figure 2.

A feed bar operating lever 69 is pivoted at 70 on the left hand end of the body portion 35 of the punch guide assembly. The lower end of the lever 69 bears against the adjacent end of the feed bar 65. A roller 71 is rotatably mounted on the operating lever 65 between the ends of the latter.

A feed cam 72 is pivotally mounted at 73 upon the frame 1 of the press. The lower end of the feed cam 72 is beveled as at 74.

A release lever 75 in the form of a bell crank is pivotally mounted at 76 on the frame 1. A link 77 made up of two telescoping sections is pivotally connected at its opposite ends to the release lever 75 and the feed cam 72. A coil spring 78 surrounds the link 77 and acts to press the feed cam toward the punch assembly. This spring 78 is considerably stiffer than the spring 67 surrounding the feed bar 65. The movement of the feed cam 72 toward the punch assembly due to the spring 78 is limited by an adjustable eccentric 79 mounted on the frame 1. The tension of the spring 78 can be released by swinging the release lever 75 in a counter-clockwise direction.

The safety mechanism

The safety mechanism comprises a safety switch 80 mounted on the frame 1 and connected in series with the solenoid 14 and operating switch 15. Switch 80 normally is closed. Threaded into the feed cam 72 is a bolt 81 which bears against the switch 80 whereby movement of the bolt to the left (Fig. 1) will open the switch. A safety cam 82 is attached to the side of the feed cam adjacent the feed bar operating lever 69.

If the safety switch 80 is opened by pressure of the bolt 81, the clutch is thrown out in the same manner as is the case when the switch 15 is opened.

Operation of the machine

The operating cycle of the machine is shown in Figures 1, 2, 10, 11, 12 and 13. At the start the parts are in the positions shown in Figures 1, 2 and 10. The ram and punch assembly are in their uppermost positions, with the punch holder 17 and punch guide assembly separated by the springs 20 acting on the shoulder screws 19. The rivet feed tube has a plurality of rivets 100 therein and there is one rivet in the bore in the punch guide sleeve 39 (see Figure 10).

A wheel body and its rim are placed in position on the rollers 2 shown in Figure 1.

The operator starts the machine by depressing the foot pedal 16, causing the clutch 9 to engage, whereupon the ram 8 starts downwardly. All of the parts of the punch assembly remain in this position until just before the die button strikes the work, see Figure 11. At that time the roller 71, which has been held in the position shown in Figure 10 by the vertical face of the feed cam 72, is permitted to move to the left along the inclined face 74 of the cam. The spring 67 retracts the rivet feed bar 65 and permits a rivet 100 in the feed tube to drop down into its position shown in Figure 11. It is held in that position by the walls of the feed tube section 58 and the spring pressed rivet retaining pin 50.

The punch assembly in its entirety continues to move down until the hardened bushing 47 in the die button 40 strikes the top surface of the work and thus stops the punch guide assembly. However, the ram 8 and the punch holder 17 continues to move downward against the action of the springs 20. The punch 28 contacts the rivet 100 in the punch guide sleeve forcing the rivet out of the sleeve through the die button and eventually through the work itself (see Figure 12). The lower end of the rivet forms a hole for itself in the work by shearing out slugs 90 and then enters the bore 5 in the die block, pushing the slugs ahead of it. The slugs fall on through the bore 5.

When the punch holder 17 bottoms on the top of the body 35 of the punch guide assembly as shown in Figure 12, the entire punch assembly is pressed down still farther for a short distance, forcing the conical end of the hardened sleeve 47 into the metal of the work. (See Figure 13.) That flows the metal of the work against the sides of the rivet therein, securing the rivet in place. At the same time it forms a cavity in the top surface of the work to receive the metal of the upper end of the rivet when it is later headed over (Figure 15).

The ram 8 now starts its upward movement and the springs 20 separate the punch holder 17 from the body 35 of the punch guide assembly, holding the latter against the work until the punch holder strikes the heads of the shoulder screws. By that time the punch has been withdrawn from the die button up into the guide sleeve to a point above the slot 43. Presently the roller 71 strikes the inclined face 74 of the feed cam 72 causing the feed bar 65 to be brought into contact with the bottom rivet 100 in the feed tube and then push the rivet out of the feed tube past the rivet retaining pin 50 into the punch guide sleeve 39. (See Figure 10). This rivet is held in place by the pin 50 until the ram 8 starts down on its next cycle of operation.

After a suitable number of rivets have been driven into the work the latter is removed and transferred to another machine where the ends of the rivets are headed over. This is a purely conventional pressing operation and is shown in Figure 15. It is more fully described in my aforementioned copending application.

If during the cycle of operation above described the punch holder 17 and body 35 of the punch guide assembly should stick or jam so that they do not separate as described, the safety mechanism comes into play. Assuming that the parts do stick, the feed bar 65 will be prevented from moving completely through the slots 43 and 64 in the feed tube and sleeve 39 by the presence in the latter of the punch 28. The roller will then ordinarily force the feed cam 72 to the left against the action of the spring 67 whereby to cause the screw 81 to trip the switch 80 and stop the machine. If this does not occur when the roller 71 passes cam surface 74 it will certainly

occur when the roller reaches the safety cam 82. Thus, there is no possibility of the machine continuing with the parts jammed.

Occasionally an abnormally short rivet will get into the feed tube. When this occurs the feed bar 65 will strike the rivet next above the bottom rivet in the feed tube and will be prevented from moving the bottom rivet into the sleeve 39. The roller 71 will again be locked against movement and will push the feed cam 72 to the left and stop the machine.

In either case the machine cannot be started again until the jam has been remedied. It is a simple matter to overcome this difficulty. The lever 75 is rotated counter-clockwise to relieve the pressure of the spring 67. Then the single screw 41 is removed permitting the cap 38 to be lifted from the body 35 of the punch assembly. All parts are then exposed for the ready removal of the offending rivet.

From the foregoing it will be apparent that the invention provides a relatively simple rivet feeding and guiding mechanism for a rivet setting machine. It also provides mechanism which prevents damage to the parts of the machine due to failure to operate in the intended manner.

The scope of the invention is indicated in the appended claims.

I claim:

1. A rivet setting machine comprising a ram, a punch secured thereto, a punch guide assembly slidably connected to said ram, said punch guide assembly having a bore therethrough slidably receiving said punch, a rivet feed tube in said assembly having one end communicating with said bore between the extreme positions of punch movement, a rivet feed bar mounted on said assembly for reciprocatory movement transversely of the axis of said bore at the end of said rivet feed tube, a die button having a bore therethrough axially aligned with said first named bore to receive a rivet when such rivet is acted upon by said punch, and means at one side of the bore in the punch assembly frictionally engaging a rivet in said bore to hold said rivet until acted upon by said punch.

2. A rivet setting machine comprising a ram, a punch secured thereto, a punch guide assembly slidably connected to said ram, said punch guide assembly having a bore therethrough slidably receiving said punch, a rivet feed tube in said assembly having one end communicating with said bore between the extreme positions of punch movement, a rivet feed bar mounted on said assembly for reciprocatory movement transversely of the axis of said bore at the end of said rivet feed tube, a die button having a bore therethrough axially aligned with said first named bore to receive a rivet when such rivet is acted upon by said punch, and a spring pressed rivet holder between said bore and the end of the feed tube to hold the rivets against movement therein.

3. A rivet setting machine comprising a ram, a punch secured thereto for movement therewith, a punch guide slidably connected to said ram and having a bore therethrough receiving said punch, a rivet feed tube communicating at one end with said bore, a rivet feed bar mounted on said punch guide for reciprocatory movement transversely of the axis of said bore, cam actuated mechanism engaging an end of said feed bar for moving the latter toward said bore, and means actuatable by said cam actuated mechanism for stopping the operation of said rivet setting machine upon the prevention of movement of said feed bar.

4. A rivet setting machine comprising a frame, a ram mounted thereon for reciprocation relative thereto, a punch mounted on said ram for movement therewith, a punch guide slidably mounted on said ram, said punch guide having a bore therein receiving said punch, mechanism for feeding a rivet into said bore in front of said punch at each stroke of the ram including a rivet feed bar mounted on said punch guide for reciprocation relative thereto, and means on said frame engaging said rivet feeding mechanism for stopping the operation of the rivet setting machine upon jamming of the rivet feed bar.

5. A rivet setting machine comprising a frame, a ram mounted thereon for reciprocation relative thereto, a punch mounted on said ram for movement therewith, a punch guide slidably mounted on said ram, said punch guide having a bore therethrough slidably receiving said punch, mechanism for feeding rivets into the bore ahead of said punch, and means on said frame engageable with means on said punch guide for stopping the operation of the rivet setting machine upon failure of said punch guide to slide relative to said ram.

6. In a rivet setting machine, a punch guide assembly comprising a body portion having a recess in a vertical face thereof, a punch guide sleeve having a bore therethrough mounted in said recess, a rivet feed tube having a portion thereof in said recess and having one end thereof communicating with said bore, a cap seated in said recess cooperating with said body portion for holding said punch guide and feed tube in said punch guide assembly, and means removably securing said cap to said body portion.

7. The combination defined in claim 6 wherein the means for securing the cap to the body portion comprises a single screw accessible from the front of the assembly.

8. A rivet setting machine comprising a ram, a punch secured thereto, a punch guide assembly slidably connected to said ram, said punch guide assembly having a bore therethrough slidably receiving said punch, a rivet feed tube in said assembly having one end communicating with said bore between the extreme positions of punch movement, means in said punch guide assembly at one side of said bore for releasably holding a rivet therein, a rivet feed bar mounted on said assembly for reciprocatory movement transversely of the axis of said bore at the end of said rivet feed tube, and a die button having a bore therethrough axially aligned with said first named bore to receive a rivet when such rivet is acted upon by said punch.

9. In a rivet setting machine: a punch guide assembly comprising a body portion; a removable cap therefor; said body portion and cap being constructed and arranged to receive between them and hold in operative relationship a punch guide sleeve, a portion of a rivet feed tube, and a die button; and means removably securing said cap to said body portion.

10. A rivet setting machine as defined in claim 9 wherein the means for securing the cap to the body portion comprises a single screw accessible from the front of the assembly.

11. A rivet setting machine as defined in claim 9 wherein said body portion and cap are provided with complementary recesses receiving said punch guide sleeve, rivet feed tube, and die button.

12. In a rivet setting machine: a punch guide

assembly comprising a body portion; a removable cap therefor; said body portion and cap being constructed and arranged to receive between them and hold in operative relationship a punch guide sleeve and a portion of a rivet feed tube; and means removably securing said cap to said body portion.

13. A rivet setting machine comprising a frame, a ram reciprocably mounted on the frame, a punch guide assembly reciprocably mounted on the ram, mechanism for feeding rivets into the punch guide assembly comprising a cam movably mounted on the frame and a cam follower on the punch guide assembly, spring means on said frame normally immobilizing said cam but permitting movement thereof when the cam follower is immobilized relative to the punch guide assembly, and means actuated upon a predetermined movement of the cam relative to the frame for stopping the operation of the rivet setting machine.

14. A rivet setting machine comprising a frame, a ram reciprocably mounted thereon, a punch guide assembly reciprocably mounted on said ram, a cam movably mounted on the frame and a cam follower on the punch guide assembly, said cam being out of the normal path of movement of the cam follower and adapted to be engaged by the cam follower when the punch guide assembly is held against movement in one of its positions relative to the ram, and means actuated upon a predetermined movement of the cam for stopping the operation of the rivet setting machine.

15. A rivet setting machine comprising a ram, a punch secured thereto, a punch guide assembly slidably connected to said ram, said punch guide assembly including a die button removably secured thereto, said die button consisting of a stress resistant casing and an abrasion resistant sleeve in said casing, said sleeve having a bore therethrough adapted to receive said punch and being axially aligned therewith.

16. A rivet setting machine as defined in claim 15 wherein the end of said sleeve remote from the ram projects axially beyond the corresponding end of the casing.

17. A rivet setting machine comprising a reciprocable ram, a punch, means on said ram securing said punch thereto, said means holding said punch against movement of the latter in the direction of reciprocation of said ram but permitting release of said punch from the ram by lateral movement of the punch relative to the ram, a punch guide assembly connected to the ram for movement in the direction of reciprocation of the ram, said assembly comprising a body portion and a removable cap receiving said punch between them, snid cap being removable from said body portion in a lateral direction whereby to permit releasing of said punch from the ram when the cap is removed from the body portion of the punch guide assembly.

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