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Gregory

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[54] **AUTOMATIC RIVETING DEVICE**

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[73] Assignee: **Rohr Corporation,** Chula Vista, Calif.

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[52] **U.S. Cl.** **29/243.53,** 29/522, 227/51, 227/152

[51] **Int. Cl.** **B23p 11/00**

[58] **Field of Search** 227/30, 51, 152; 29/522, 243.53, 243.54, 243.55, 233

[56] **References Cited**

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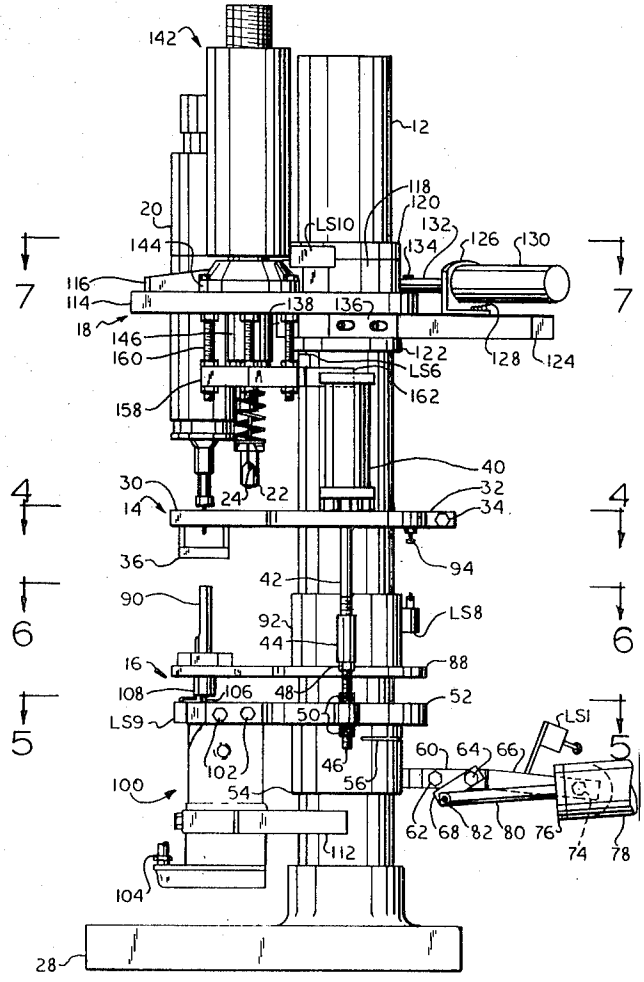
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[57] **ABSTRACT**

An upper pressure foot assembly is fixed to an upright column and mounts rams connected to a lower pressure foot assembly slidable on the column for clamping a workpiece therebetween. A ram operated support, mounted for swinging about the column axis, carries ram operated drilling and rivet holding means for perforating the workpieces and inserting and holding a rivet in the perforation. The lower pressure foot assembly has column gripping means and rivet squeezing means, ram operated in the order named. A system of switches, relays, solenoids and air valves provide interlocking controls for orderly sequential operation of the components of the device.

8 Claims, 8 Drawing Figures



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SHEET 1 OF 5

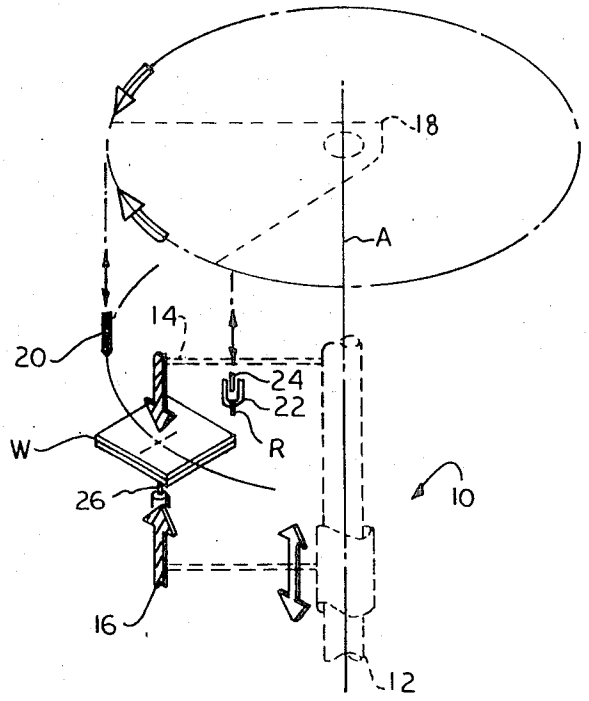


FIG. 1

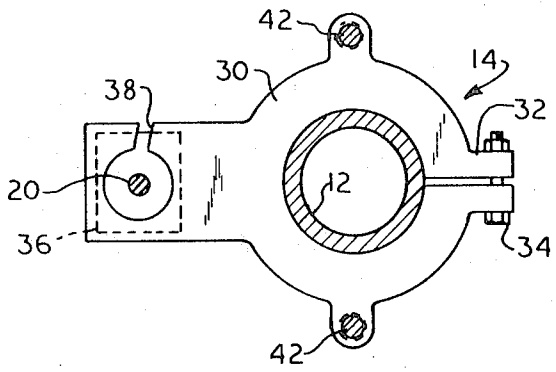


FIG. 4

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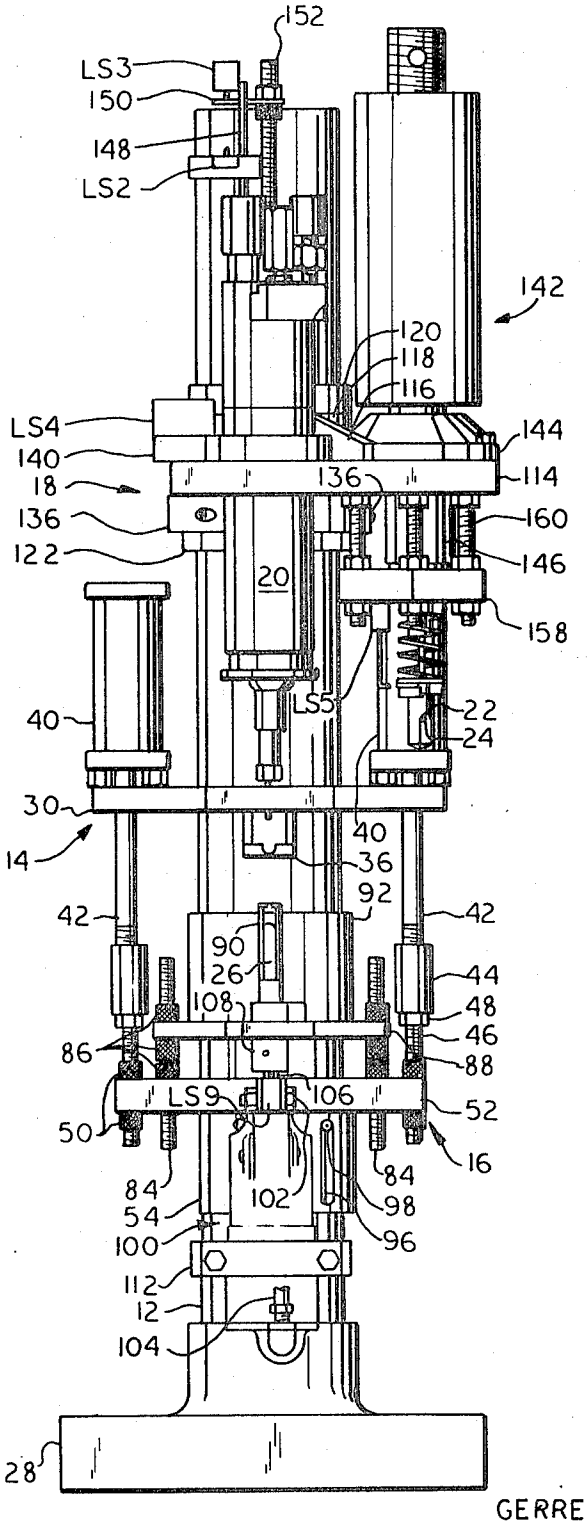


FIG. 2

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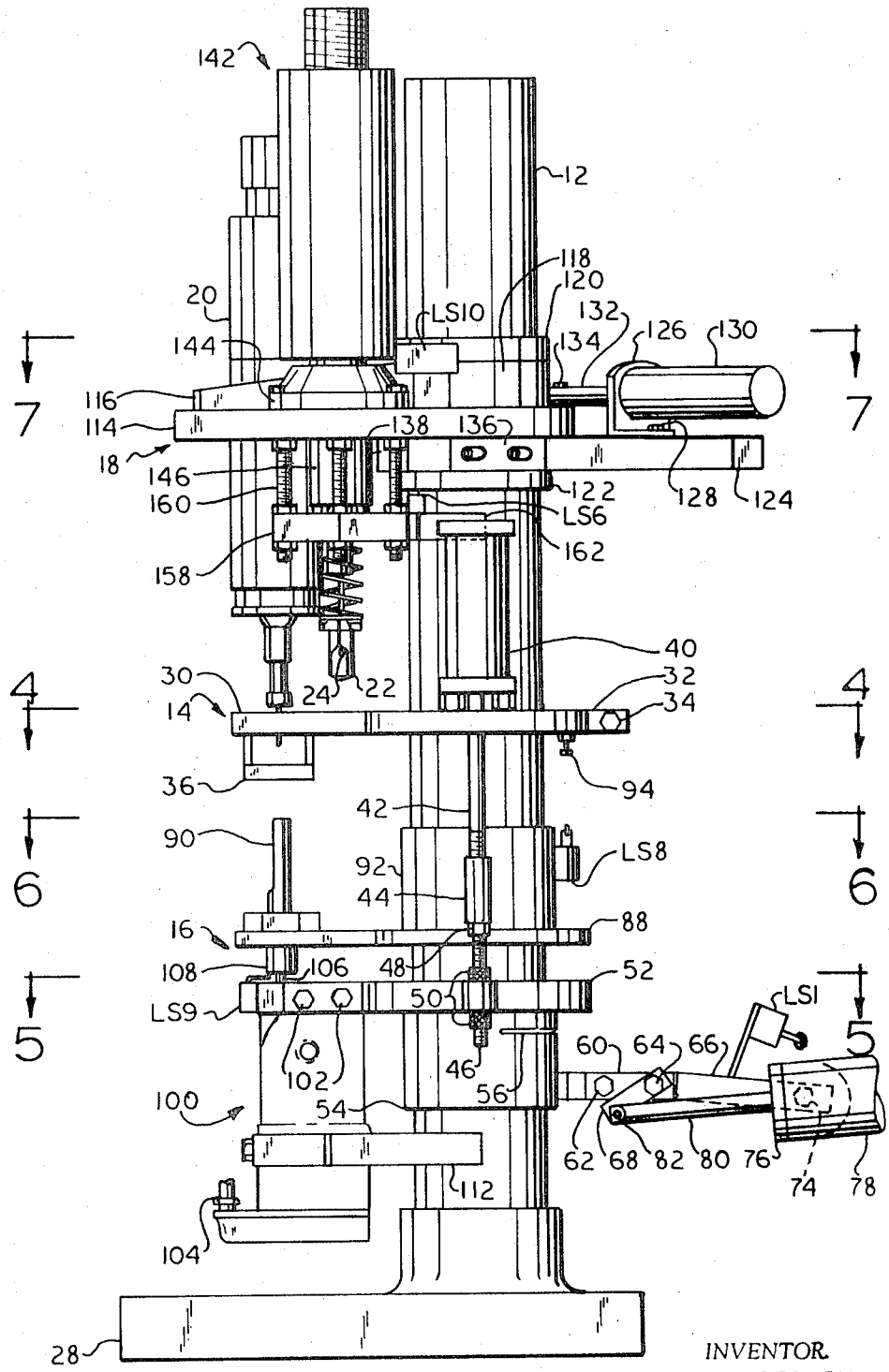


FIG. 3

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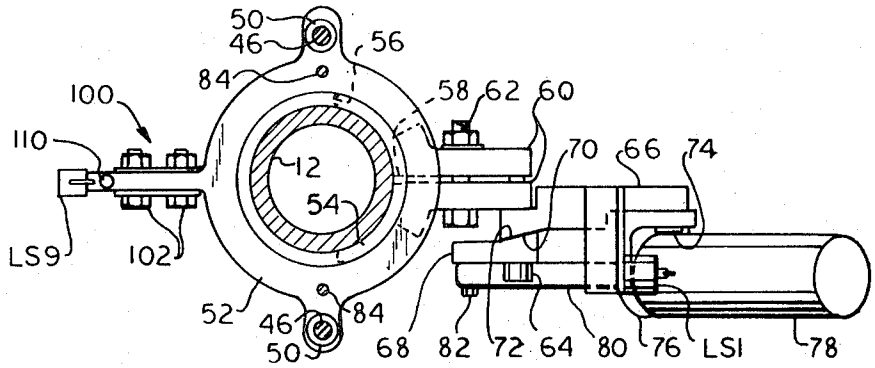


FIG. 5

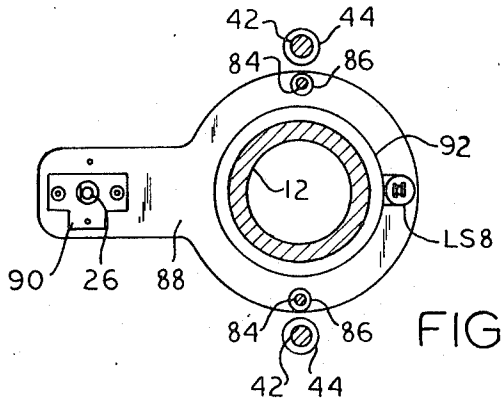


FIG. 6

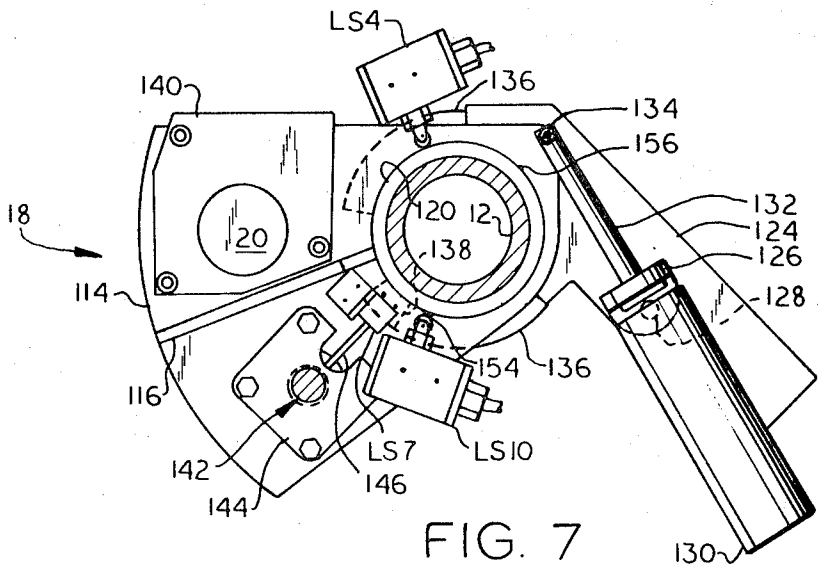


FIG. 7

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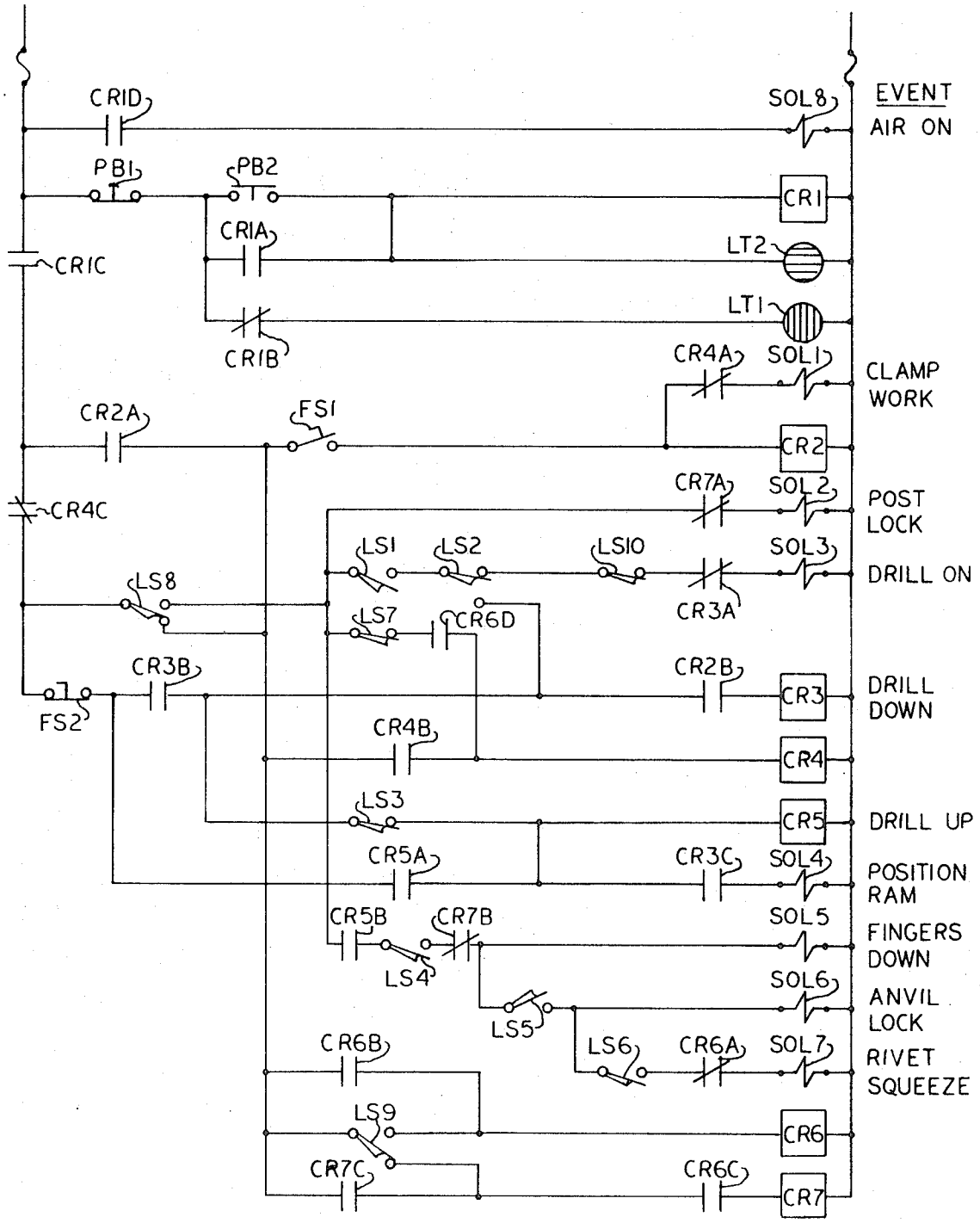


FIG. 8

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AUTOMATIC RIVETING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to riveting machines, and more particularly to a relatively compact bench type riveting device which is readily portable and operates automatically to clamp a workpiece, drill a hole therein, insert and hold a rivet in the hole, and squeeze the rivet.

Conventional riveting machines usually include a C-frame for receiving and clamping the parts and supporting power operated equipment for drilling and riveting. Of necessity, the C-frame is of relatively large rugged construction and the machines are usually so huge and heavy that, for all practical purposes, they are permanently fixed in place. This requires that all work be brought to the machines. Additionally, such machines are complex and costly, and require a considerable amount of space. Since the machines are fixed in place, the use of such space is denied for other purposes, whether or not the machine is being profitably employed.

Obviously a riveting device which is of relatively inexpensive construction, compact and readily portable, yet is capable of performing required work on a competitive economical basis, would be welcome in the fabricating industry.

SUMMARY OF THE INVENTION

The present invention contemplates and is concerned with riveting devices and has as its primary purpose the provision of a device which consists essentially of a supporting column or post on which are mounted workpiece clamping means, a drill and rivet transfer and holding means swingable together about the column axis, and rivet squeezing means. The clamping means include a pressure foot fixed to the column and a movable pressure foot mounted on the column for travel along a path parallel to the column axis, the rivet squeezing means being associated with the movable pressure foot and movable therewith. The drill and rivet transfer and holding means are supported abaxially and are alternately alignable with the clamped workpiece for drilling a hole therein and inserting a rivet in the hole, after which the rivet is squeezed to upset the same and form a headed enlargement thereon.

The present invention has the advantage being of compact rugged construction for use on a bench with access to a source of pressurized air, or on a vehicle which has a motor driven compressor. Being air operated, the components are resiliently urged into operation, thereby minimizing the danger of straining. Also, by mounting the drill and rivet holding means for swinging in an arcuate path, the arc of swinging can be time shared and additional mechanisms can be provided for performing additional operations or duplicating operations on the opposite side of the column.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a highly schematic perspective view of a riveting device embodying the principles of the present invention.

FIG. 2 is a front elevational view of the riveting device.

FIG. 3 is a side elevational view of the device.

FIGS. 4 – 7 are horizontal sectional views generally along lines 4—4, 5—5, 6—6 and 7—7, respectively, of FIG. 3, with parts omitted or broken away for clarity of illustration.

FIG. 8 is a bus bar diagram schematically illustrating the action of the interlocking controls of the device and indicating various operational events.

DESCRIPTION OF EMBODIMENT

Referring to the drawings, there is shown in FIG. 1 a highly schematic perspective view of a riveting device 10 embodying the principles of the present invention which includes an upright column or post 12, an upper pressure foot assembly 14 fixed to the post, and a lower pressure foot assembly 16 mounted for sliding on the post along a path parallel to the column axis A in alignment with the upper pressure foot assembly and adapted to clamp workpiece W therebetween. Also mounted on the column, for swinging about the axis A thereof, is a support member 18 which carries a rotary drill 20 and rivet transfer fingers 22 spaced from the axis so as to be alignable with the pressure feet. The fingers are spring loaded for resiliently holding a rivet R and has associated therewith a vertically movable locking anvil 24 which is adapted to force the rivet from the fingers. As hereinafter described in greater detail, the device is powered with pressurized air and has interlocking electrical and pneumatic controls which operate automatically, after closing an initiating switch, to cause the lower pressure foot assembly 16 to ascend and clamp the workpiece against the upper pressure foot assembly 14, and be locked to the post 12. The drill 20 then starts rotating and descends to drill a rivet hole in the workpiece after which it ascends and stops. This triggers swinging movement of the support member 18 to move the drill away and replace it with the rivet transfer fingers 22 which then descend to insert a rivet in the hole, the anvil 24 being locked against the rivet head. Following this, a rivet squeezing anvil 26 carried by the lower pressure foot assembly rises and forms the free end of the rivet into a headed enlargement, and then descends. When the initiating switch is opened, the device returns to starting condition ready for another riveting operation.

As later made clear, the several components are conditioned or triggered by the action of limit switches LS1 through LS10 and associated multi-contact, circuit relays CR1 through CR7, which are operatively related to solenoids SOL1 through SOL8 for actuating valves for controlling the flow of pressurized air to the components. Other controls include push button switches PB1 and PB2, and foot switches FS1 and FS2. The push button and foot switches, relays, solenoids and valves are not shown but can be conveniently mounted on a board or boards located out of the way but connected electrically an pneumatically to the device, as necessary. The interrelation of the several controls will be made more clear when the operation of the device is hereinafter described.

Inviting attention to FIGS. 2 and 3, the column or post 12 is mounted on a base or pedestal 28 and extends upwardly therefrom. The upper pressure foot assembly 14 includes a cantilever support arm 30 having a split portion 32 and adapted to be fixedly clamped to the column 12 by a bolt 34, as shown in FIG. 4. Mounted below the arm 30 is a pressure foot 36, both of which are suitably apertured to receive the drill 20.

Additionally, a slot 38 is formed in the arm to accommodate swinging of the drill.

The support arm 30 also serves as a mounting base for a pair of clamping rams 40, each having a movable rod 42 adjustably connected to the lower pressure foot assembly 16 by means of coupling sleeves 44, threaded links 46, lock nuts 48 and knurled nuts 50. The rams are powered by pressurized air delivered through lines and solenoid-operated valves, not shown.

The lower pressure foot assembly 16 includes a horizontally disposed support member 52 suitably perforated to receive the links 46 and adjustably secured thereto by the knurled nuts 50. The member 52 is secured to the upper edge of a collar 54 close-fitted to the post 12 for sliding thereon. As best seen in FIGS. 3 and 5, extending substantially half-way around the collar is an arcuate slot 56 from the midportion of which a vertical slot 58 extends downwardly. This provides the collar with a split portion to which are fixed substantially rigid arms 60, slightly spaced apart and interconnected by a bolt 62 passing therethrough.

Threadedly connected to one of the arms 60 is a headed screw bolt 64 which passes loosely through the other arm and pivotally mounts a pair of arms 66 and 68 having cam surfaces 70 and 72 respectively. Pivotally mounted on the arm 66, by means of a pivot pin 74, is an angle bracket 76. The bracket carries a locking ram 78 having a movable rod 80 pivotally connected the free end of the arm 68 by a pivot bolt 82.

The ram 78 is powered by pressurized air delivered thereto through lines and solenoid operated valve, not shown, and is operative to retract its rod 80 for moving the cam surfaces 70, 72 relative to each other to draw the arms 60 toward each other and cause the split portion of the collar 54 to grip the column 12 and lock the lower pressure foot assembly 16 thereto. During operation of the ram 78 to lock the assembly and column together, the ram swings about the axis of the pin 74 and closes a normally open limit switch LS1, the switch being suitably supported on the arm 66.

Adjustably mounted above the support member 52, by means of threaded rods 84 and knurled nuts 86, is a support plate 88 which mounts a lower pressure foot attachment 90. The attachment is hollow and receives the lower anvil 26.

The plate 88 is secured to the lower edge of an upstanding collar 92 slidably fitted to the column 12. Mounted on the collar is a double contact limit switch LS8 normally engaged with one contact in the down position of the lower pressure foot assembly 16 and actuated to engagement with the other contact by a bolt 94 adjustably mounted on the underside of support member 30. The bolt is adjusted so that actuation of the switch occurs when workpieces are clamped between the pressure feet 36 and 90. For maintaining the pressure feet vertically aligned, the collar 54 is formed with a vertical guide slot 96 in which is slidably received a guide pin 98 secured to the column 12, best seen in FIG. 2.

The lower anvil 26 and pressure foot 90 are parts of a rivet squeezing mechanism 100 of suitable type secured to the support member 52 by bolts 102. Typical of such mechanisms is that designated Lower Anvil and Pressure Foot Assembly, TS42–20S, manufactured by Rohr Corporation, Chula Vista, Calif. Such mechanism is powered by pressurized air delivered through a conduit 104 fragmentarily shown and controlled by a solenoid-operated valve, not shown. The pressurized air operates a ram, now shown, which actuates a rod 106 having an adapter 108 secured thereto for driving the anvil 26. The member 52 has a suitable bore 110 for passage of the rod, as shown in FIG. 5, and mounts a limit switch LS9. The switch has two contacts and is actuated by operation of the mechanism 100.

Considerable forces are involved in the squeezing of the rivet. Accordingly, the mechanism 100 has bolted thereto a force-transmitting bracket 112 having an arcuate guide surface, not shown, slidably engaging the column 12. This arrangement provides a movable brace for the lower pressure foot assembly 16 and transmits the reaction forces to the column.

Referring also to FIG. 7, the support member 18 includes a sector plate 114 and a rib 116, both secured to a journal collar 118 fitted to the column 12 for rotation about the axis A thereof and held thereon on a retaining ring 120 fixed to the column above the collar. Fixed to the column, below the sector plate, is an attaching collar 122 to which is secured a laterally extending arm 124. An angle bracket 126 is pivoted to the arm 124 by means of a pivot pin 128 and mounts a positioning ram 130 operated by pressurized air delivered through lines, not shown. The ram has a movable rod 132 pivotally connected to the sector plate 114 by a pivot pin 134 for swinging the sector plate. Adjustably secured to the attaching collar 122 are spaced slotted stops 136 adapted to engage with an abutment member 138 disposed therebetween and dependingly fixed to the underside of the sector plate. Thus, the stops define the limits of swinging of the sector plate and the positioning ram holds the sector plate resiliently in its limit positions.

The drill 20 can be of any suitable type; for example, the Air Feed Drill, 92–D2–45, manufactured by Gardner-Denver Company, Quincy, Ill. This drill is air operated and, once energized, automatically rotates, descends and drills a hole, ascends to its normal up position and stops. The drill is secured in place by a drill mounting plate 140 bolted to the sector plate 114.

The rivet transfer fingers 22 and upper anvil 24 are parts of a mechanism 142 suitable for transfering a rivet and holding it for squeezing, and can be the air operated mechanism designated Rivet Fingers and Transfer Assembly TS 17–775–700, manufactured by Rohr Corporation, Chula Vista, Calif. Such mechanism is mounted on the sector plate 114 by a member 144 and also includes a vertically movable plunger 146 operable to move the spring loaded fingers 22 and anvil 24 vertically. Rivets can be fed to the fingers manually or automatically by rivet feed means, not shown.

Associated with the drill 20 and controlled by the up-and-down movement thereof are limit switches LS2 and LS3 adjustably secured to an upstanding support 148 stationarily mounted with respect to the sector plate 114, best seen in FIG. 2. Switch LS2 has two contacts, one of which is normally engaged when the drill is in its up or starting position, the other contact being engaged when the drill is down, actuation of the switch being accomplished by an actuating finger 150 adjustably supported on a threaded rod 152 which is vertically movable with the drill. Switch LS3 is normally open and is actuated to closed position by the finger 150 when the drill is in its up position.

Returning to FIG. 7, mounted on the sector plate 114 and movable therewith are limit switches LS4 and

LS10, both of the normally open type. Switch LS10 is actuated to closed position by an actuating button 154 on the retaining ring 120, the button being located to actuate the switch when the drill 20 is properly positioned for alignment with the pressure feet 36 and 90. Proper positioning of the drill is obtained by suitable adjustment of the appropriate limit stop 136. Limit switch LS4 is actuated to closed position by a button 156 which is appropriately located for actuation of the switch when the mechanism 142 is properly aligned with the pressure feet, the other limit stop 136 being suitably adjusted for the purpose. Thus, when the drill is properly positioned for drilling a hole in the workpieces, switch LS10 is closed and switch LS4 is open, the situation being reversed when the drill has been replaced with the mechanism 142.

Associated with the mechanism 142 are limit switches LS5, LS6 and LS7, all of the normally open type. Switch LS5 is suitably supported on a block 158 surrounding the lower end of the plunger 146 and is actuated to closed position when the plunger moves the fingers 22 and upper anvil 24 downwardly. The block 158 is adjustably mounted on the sector plate 114 by threaded rods 160. Switch LS7 is supported on the upper side of the sector plate, as shown in FIG. 7, and is actuated to closed position by the plunger when the plunger, fingers and upper anvil are up.

Switch LS6 is supported on the block 158, which also supports an air operated ram 162. The ram is operative to move a blocking bar or bolt, not shown, to lock the upper anvil 24 against the head of the inserted rivet after the anvil has forced the rivet from the spring loaded fingers 22. Simultaneously, the limit switch LS6 is actuated to closed position by operation of the ram.

OPERATION

The operation of the riveting device 10 of the present invention is believed to be clearly apparent and is summarized at this point. Referring to FIG. 8, and with the device connected to electric power and a source of pressurized air, when connection is made to electrical power, a circuit is completed through normally closed OFF push button switch PB1, normally closed contacts CR1B of circuit relay CR1 and red warning light LT1 comes on. When normally open ON push button switch PB2 is closed, circuit relay CR1 is energized and the contacts thereof change state, that is, contacts CR1B open and normally open contacts CR1A, CR1C and CR1D close, the red light goes out and blue light LT2 comes on. When contacts CR1A close, a bypass is provided around the switch PB2 to maintain circuit relay CR1 and the blue light energized. When contact CR1D close, a circuit is completed which energizes solenoid SOL8 and actuates its associated air valve, admitting pressurized air to the device. RESET foot switch FS2 is pushed to insure that all parts are in starting position.

The workpieces to be drilled and riveted together are placed against the underside of the upper pressure foot 36 and the foot switch FS1 is operated to closed position. Electric current then flows through closed contacts CR1C, normally closed contacts CR4C of circuit relay CR4, limit switch LS8 and the closed foot switch FS1, to the circuit relay CR2 to energize the same and cause its contacts CR2A and CR2B to change from normally open to closed. As the same time, current flows through normally closed contacts CR4A of circuit relay CR4 to energize solenoid SOL1 and actuate its air valve to cause pressurized air to be delivered to the clamping rams 40 to cause upward movement of the lower pressure foot assembly 16 for clamping the workpieces between the pressure feet 36 and 90.

Upward movement of the lower pressure foot assembly 16 actuates the limit switch LS8 to its other contact and current flows through closed contact CR1C and CR4C, limit switch LS8, and normally closed contacts CR7A of circuit relay CR7, to energize solenoid SOL2 and actuate its air valve to cause the post locking ram 78 to retract and cause the split collar 54 to grip the post 12. This causes the ram 78 to pivot and actuate normally open limit switch LS1 to closed position.

Closure of switch LS1 completes a circuit through closed contacts CR1C and CR4C, limit switches LS8, LS1, LS2 (through normally engaged contact) and LS10, and normally closed contacts CR3A of circuit relay CR3, to energize solenoid SOL3 and its associated air valve. This causes the drill 20 to start rotating and descend to drill a hole in the workpieces.

At the end of drill descent, limit switch LS3 is open and limit switch LS2 has moved into engagement with its other contact. This energizes circuit relay CR3, causing its contacts CR3A to open and normally open contacts CR3B and CR3C to close, thereby providing a path for power to the circuit relay CR3 through the normally closed RESET foot switch FS2 and closed contacts CR2B. Also, solenoid SOL3 is deenergized and the drill returns to its up position, which closes limit switch LS3 and energizes circuit relay CR5 and solenoid SOL4. With energization of circuit relay CR5, its normally open contacts CR5A are closed and a maintaining circuit is provided which shunts limit switch LS3.

Energization of solenoid SOL4 causes the positioning ram 130 to retract and swing the drill 20 and rivet transfer mechanism 142 so that the fingers 22 are aligned with the drilled hole in the workpieces. This opens limit switch LS10 and closes limit switch LS4.

Closure of switch LS4 provides power to solenoid SOL5 through limit switches LS8 and LS4 and closed contacts CR5B of circuit relay CR5 and CR7B of circuit relay CR7. This energizes the solenoid which causes downward movement of the plunger 146 and the rivet holding fingers 22 for insertion of a rivet into the drilled hole. The upper anvil 24 engages against the rivet head and forces the rivet from the fingers.

Downward movement of the plunger 146 opens limit switch LS7 and closes limit switch LS5, thereby completing a circuit to energize solenoid SOL6. The bolt lock ram 162 then extends and locks the upper anvil 24 and the rivet against upward movement.

Movement of the bolt lock to locking position results in closure of limit switch LS6 and solenoid SOL7 is energized through normally closed contacts CR6A of circuit relay CR6. This causes the rivet squeeze mechanism 100 to operate and drive the lower anvil 26 against the rivet end to squeeze the same. It also causes limit switch LS9 to change contacts and circuit relay CR6 is energized.

Energization of circuit relay CR6 causes contacts CR6A to open and normally open contacts CR6B and CR6C to close. Closure of contacts CR6B provides a circuit around limit switch LS9 for maintaining circuit relay CR6 energized. Opening of contacts CR6A deenergizes solenoid SOL7 and the rivet squeeze mechanism 100 gravitates to its normal down position, limit

switch LS9 changing contacts in the process to cause energization of circuit relay CR7 through closed contacts CR6C.

Energization of circuit relay CR7 causes its normally open contacts CR7C to close and provide an energization maintaining by-pass around limit switch LS9. It also causes normally closed contacts CR7A and CR7B thereof to open and interrupt energization of solenoids SOL7, SOL6, SOL5 and SOL2, so that the bolt lock ram 162 unlocks the anvil 24, the fingers 22 ascend, and the lower pressure foot assembly 16 is unlocked from the column or post 12.

With the fingers 22 up, limit switch LS7 is closed and circuit relay CR4 is energized and normally open contacts CR4B thereof are closed for maintaining energization of the relay. Normally closed contacts CR4A and CR4C of the relay become open with the result that solenoid SOL1 is deenergized and power is cut off to the limit swijch LS8 and RESET foot switch FS2, resulting in the deenergization of solenoid SOL4 and circuit relays CR3 and CR5. Deenergization of solenoid SOL4 causes positioning ram 130 to extend and swing the drill 20 and mechanism 142 back to starting position, limit switch LS4 opening and limit switch LS10 closing in the process. With solenoid SOL1 deenergized, pressurized air is removed from the clamping rams 40 and the lower pressure foot assembly 16 gravitates to its normal starting position, limit switch LS8 changing to its normal starting contact.

When foot switch FS1 is released to open position, circuit relay CR2 is deenergized, resulting in opening of its contacts CR2A and consequent deenergization of circuit relays CR4, CR6 and CR7, the contacts thereof returning to their normal conditions. The device is now ready for another drilling and riveting operation. To insure that all parts are in starting position, RESET foot switch FS2 is momentarily opened and then allowed to return to normally closed position.

Shutdown of the device is accomplished by pushing the OFF push button switch PB1 open to deenergize circuit relay CR1 and allow its contacts to return to normal conditions. This extinguishes blue light LT2, and deenergizes solenoid SOL8, cutting off pressurized air to the device. When the OFF switch is released, red light LT1 comes on. Disconnection of the device from electrical power extinguishes the red light LT1.

Stated more simply, the steps of operation are:

1. Foot switch is depressed. (FS1)
   a. Workpieces are clamped and locked to column.
   b. Drill turns on, descends, drills hole, ascends, stops turning.
   c. Fingers swing over, descend and insert rivet.
   d. Upper anvil forces rivet from fingers.
   e. Upper anvil is locked against upward movement.
   f. Rivet squeeze operates, lower anvil ascends and descends.
      i. Upper anvil is unlocked.
      ii. Column is unlocked.
      iii. Fingers ascend and swing over.
2. Foot switch is released. (FS1)

There has thus been provided a riveting device in accordance with the present invention which is of economical construction, rugged and compact, for operation on a bench or portable vehicle, and operates automatically in a safe and reliable manner at a relatively rapid rate.

Although the present invention has been herein shown and described in considerable detail in what is believed to be the most practical and preferred embodiment thereof, it is to be understood that many variations thereof are possible and that the present invention is not to be limited to such details but is to be considered in its broadest aspects and accorded the full scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be protected by U. S. Letters Patent is:

1. A device for riveting workpieces together comprising:
   an elongated support structure having a longitudinal axis;
   clamping means including a first member fixedly mounted on said elongated support structure and a second member movable with respect to said first member along a path parallel to the axis of said elongated support structure adapted to clamp workpieces together for riveting;
   swingtable support structure for supporting a drill and rivet holding and inserting means mounted abaxially on said elongated support structure for arcuate movement about said axis thereof to a first drill position wherein said drill is aligned with the path of said second movable member and operable to drill a hole in said workpieces and a second rivet inserting position wherein said drill is swung out of alignment with said path of said second movable member and said rivet holding and inserting means is aligned therewith for inserting a rivet in said hole of the workpieces and
   means carried by said second member and operable for squeezing said rivet and forming a head enlargement thereon.

2. The device of claim 1 in which said movable means also includes structure gripping means actuatable to gripping position prior to squeezing of the rivet for locking the movable means to the structure.

3. The device of claim 1 in which said movable means includes a support on which said squeezing means is mounted, said support slidingly engaged the structure and serving to transmit thereto reaction forces imposed on the movable means during squeezing of the rivet.

4. The device of claim 1 in which said structure is an upright post, a laterally extending support plate mounted on the upper end of the post for swinging movement about the axis thereof, said drill and rivet holding means mounted on the support in angularly spaced relation and for movement relative to the post, pressure applying means on said movable means movable therewith along the path of travel thereof, pressure receiving means fixedly mounted on the post below the drill in alignment with the pressure applying means, said workpieces to be riveted being receivable between said pressure means for clamping therebetween, control means responsive to upward movement of the pressure applying means to clamping position for causing the drill to rotate and descend to form a hole in the clamped parts and then ascend and stop, control means responsive to ascension of the drill for causing pivotal movement of the plate to align the rivet holding means with the formed hole, and means responsive to said pivotal movement of the plate for causing the rivet holding means to descend and insert the rivet in the hole.

5. The device of claim 4 in which said movable means includes post gripping means actuable to a position locking the movable means to the post, and control means responsive to movement of the movable means to clamping position for actuating the post gripping means to locking position.

6. The device of claim 4 in which the rivet holding means includes a movable anvil, control means responsive to descent of the rivet holding means for pressing the anvil against the rivet and locking it in place thereagainst, and rivet squeezing means on the movable means for upsetting the rivet.

7. The device of claim 6 in which the movable means includes a plate having a laterally extending arm, a support below said arm fixedly connected thereto, said support slidingly engaging the post and transmitting thereto reaction forces imposed on the movable means as a result of the upsetting of the rivet by the rivet squeezing means.

8. The device of claim 1 in which the structure is a cylindrical column; a sector plate journaled on the column for swinging movement about the axis thereof; drill and rivet holding means on said sector plate having angularly spaced axes of operation parallel to the column axis and at the same radial distance therefrom; ram means interconnecting the sector plate and the column for pivoting the drill and rivet holding means; workpiece clamping means including a pair of pressure foot means, one fixed to the column and the other movably mounted thereon; ram means associated with the fixed pressure foot means operative to move the movable pressure foot means toward the fixed pressure foot means to a position clamping the workpiece at a work station, ram-operated column gripping means associated with the movable pressure foot means and responsive to movement thereof to workpiece clamping position for locking the same to the column; means responsive to operation of the column gripping means operative to cause the drill to descend, drill a hold in the clamped parts and ascend, means responsive to ascension of the drill operative to cause the first-named ram means to operate and swing the drill and rivet holding means to align the latter with the drilled hole; means responsive to such alignment operative to cause the rivet holding means to insert a rivet in the hole and hold it therein; and rivet squeezing means associated with the movable pressure foot means and operative to upset the free end of the rivet and form a headed enlargement thereon.

* * * * *