Feb. 25, 1958 J. F. SHERRILL 2,824,547

PORTABLE SPINNING RIVET HAMMER

Filed Dec. 10, 1953

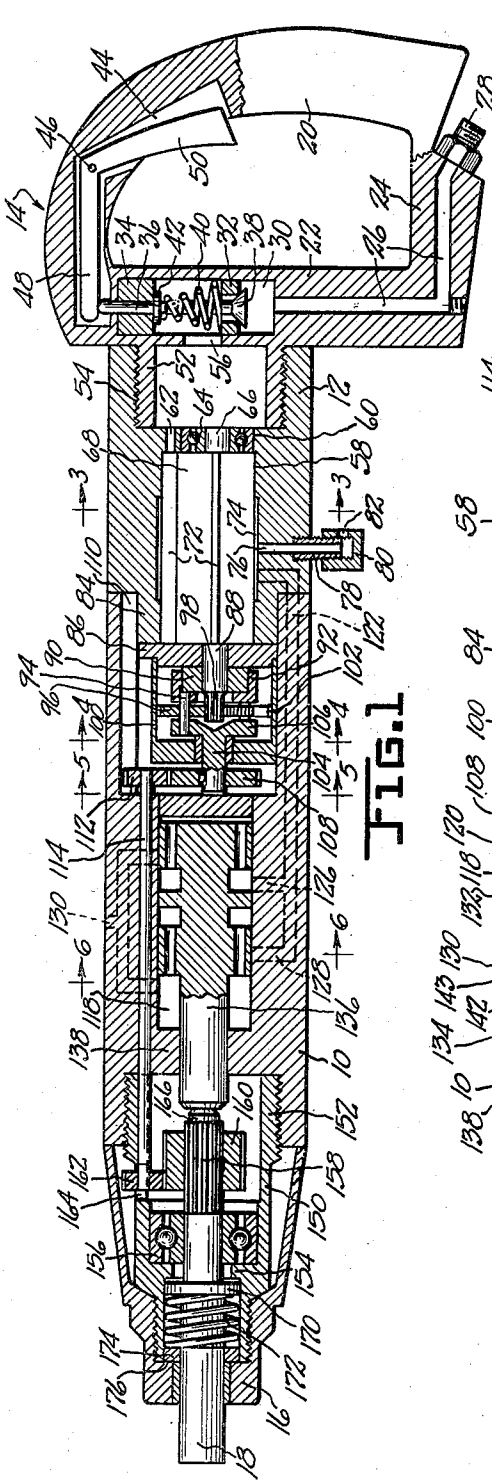


FIG. 1

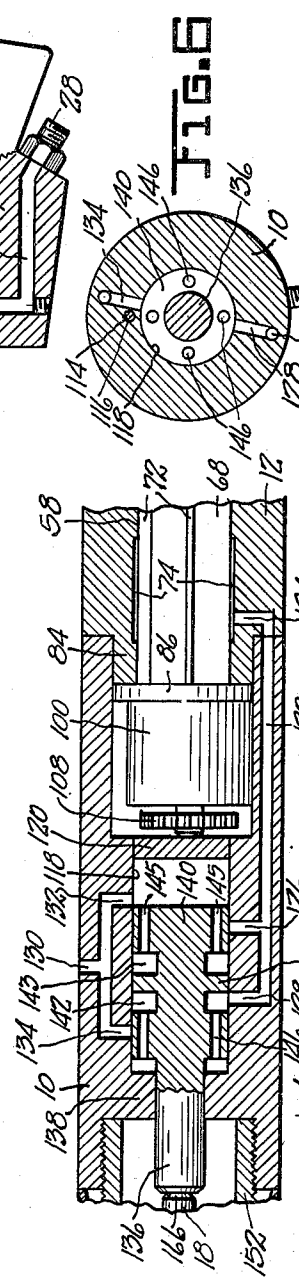


FIG. 2

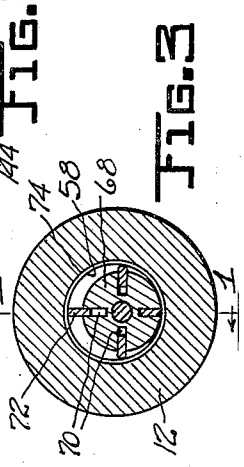


FIG. 3

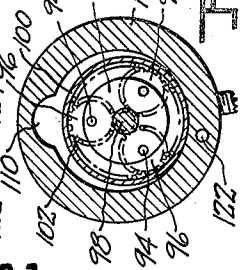


FIG. 4

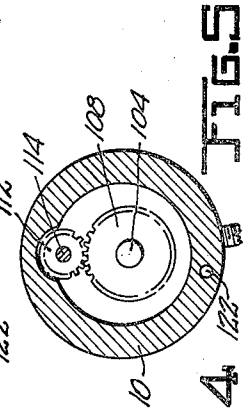


FIG. 5

FIG. 6

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PORTABLE SPINNING RIVET HAMMER

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Application December 10, 1953, Serial No. 397,460

11 Claims. (Cl. 121—7)

This invention relates to portable spinning rivet hammers.

Spinning rivet hammers have been produced heretofore in stationary models, that is, in units mounted upon a stationary frame to which work pieces may be carried and applied for riveting operations. Such hammers have commonly been characterized by a compressed air hammer actuating mechanism and by electrical means for effecting rotation or spinning of the peen. A typical example of such hammers is illustrated in my co-pending patent application, Ser. No. 220,053, filed April 9, 1951, now abandoned. Such devices are very effective for their purpose within the range of work for which they are suited, but they are distinctly limited in utility because of their stationary character. Portable riveting hammers of various types have also been known heretofore, but such mechanisms have commonly been of a construction in which the peen element remained in a predetermined rotative orientation and lacked any means by which it could be positively rotated or spun incident to vibration or rotation thereof. There are many instances in which a portable spinning rivet hammer could be used to advantage but no practical and operative hammer of this character has heretofore been available to the trade.

It is the primary object of this invention to provide a small, light weight, hand-held riveting hammer with means for rotating or spinning the peen element thereof incident to impact and vibration.

A further object is to provide a device of this character which is simple in construction, which has a minimum number of parts, which is light in weight, is rugged and has a long life.

A further object is to provide a device of this character in which a straight line pneumatic hammer strikes against a rotating peen to distribute the impact upon a work piece rotatively and at different angles.

A further object is to provide a device of this character which is operated pneumatically to both rotate and impart impacts to a peen element, and in which the force and speed of blows and also the speed of spinning action can be adjusted through a wide range.

Other objects will be apparent from the following specification.

In the drawing:

Fig. 1 is a longitudinal sectional view taken on line 1—1 of Fig. 3;

Fig. 2 is a fragmentary sectional view similar to Fig. 1 but illustrating the impact hammer in a different operative position;

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a transverse sectional view taken on line 4—4 of Fig. 1;

Fig. 5 is a transverse sectional view taken on line 5—5 of Fig. 1; and

Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 1.

Referring to the drawing which illustrates the preferred embodiment of the invention, the numerals 10 and 12 designate axially aligned interconnected sections of a riveter body having a hollow bore. A hand grip 14 is mounted upon the end of the body part 12. A nose cap 16 projects from the end of the body part 10 and has a bore through which the peen member 18 extends.

The handle member 14 is preferably of the pistol-grip type having a grip portion 20, a frame portion 22, and preferably a bottom portion 24. The frame portion 22 and the bottom portion 24 have an air supply passage 26 extending therethrough from a fitting 28 at which an air line (not shown) is adapted to be connected. The passage 26 extends to and communicates with an enlarged passage 30 which is spanned intermediate its ends by an apertured partition 32. A bearing 34 is also seated in the chamber 30 to guide longitudinal sliding movement of the stem 36 of a valve element mounting a valve head 38 adapted to seat against the partition 32 around the opening through which the stem 36 extends. A coil spring 40 encircles the valve stem 36 and bears against a shoulder 42 on said stem to urge the stem in a direction to seat the valve head 38 at the apertured partition 32. A recess 44 is formed in the hand grip member 20 and has pivoted therein at 46 a bellcrank lever or trigger member having a portion 48 which extends into engagement with the end of the valve stem 36 and which has a trigger portion 50 projecting from the inner surface of the hand grip 20 in a position to be actuated by tightening the grip of a user upon the hand grip 20. Squeezing of the hand grip 20 to trip the trigger 50 depresses the valve stem 36 against the spring 40 to open the valve 38 and permit compressed air from a source to pass through the passage and into and through the chamber 30 and the aperture in the chamber partition 32. A cylindrical externally screw-threaded tubular portion 52 projects from the handle part 22 and is anchored in the screw-threaded portion of a bore 54 of the cylindrical body part 12. An aperture 56 is formed in the wall defining the chamber 30 at a point remote from the valve 38 and discharges air in an axial direction into the part 52 and the housing part 12.

The housing part 12 serves as a means to mount an impeller. The housing part 12 has a cylindrical bore 58 substantially concentric with the threaded bore portion 54 receiving the tubular part 52 of the handle. This bore is separated from the part 54 by a reduced dimension bore portion 60 which is eccentric of the bore 58. A passage 62 is formed in the eccentric reduced wall portion 60 and serves to establish communication between the bore 58 and the interior of the tubular portion 52 on the handle. A bearing 64 is mounted in the eccentric portion 60 and serves to journal the stub shaft 66 upon one end of a rotor 68. The rotor 68 is located eccentrically in the bore 58, as best seen in Fig. 3, and is characterized by a plurality of substantially equally spaced substantially radially extending longitudinal grooves 70, each of which slidably receives an outwardly spring-pressed vane 72 of an impeller. The parts are arranged as illustrated in Fig. 1 so that the intake 62 is located clear of the outer periphery of the rotor 68 so as to enable delivery of compressed air to the impeller to act against the vanes 72 and effect rotation of the member 68.

The bore 58 is preferably slightly enlarged intermediate its ends at 74 substantially concentrically thereof, and a passage 76 extends from the enlarged portion 74 adjacent the point at which the rotor 68 most closely approaches the bore 58. A tube 78 is screw-threaded in a counter bore for communication with the passage 76 and has an external screw-thread upon which is mounted adjustably a cap 80 having a lateral bore 82 intermediate its length. The arrangement is such that all or a selected part of the bore 82 may be open to atmosphere, depending upon

the adjustment of the cap 80 lengthwise upon the tube 78.

The body part 12 has a reduced diameter end portion 84 upon which is mounted, either by a screw-threaded fit or by a press fit, one end portion of the tubular body 10. An end plate 86 fits within the body 10 and bears against the outer end of the part 84 of the body tube 12 and has an aperture therein axially aligned with the impeller shaft 66 for journalling the impeller stub shaft 88 in a position eccentric of the member 10. A bushing ring 90 encircles the shaft portion 88 and is in turn encircled by a rotatable substantially cup-shaped member 92 which mounts one end of each of a plurality of equispaced and equiangularly related shafts 94, each mounting a pinion 96 which meshes with a reduced dimension pinion 98 on the end of the shaft 88. A cup-shaped member having a cylindrical wall portion 100 mounts a planet or ring gear 102 with which each of the pinions 96 mesh, said member being centered by a shoulder upon the plate 86 and having an end wall provided with an aperture to receive the shaft portion 104 of a carrier having a flange 106 which mounts the end of each pin 94 opposite that which is mounted by the cup-shaped member 92. A gear 108 is mounted on the carrier shaft 104. The portion of the bore of the member 10 within which the aforementioned gearing is located has communicating therewith a longitudinal groove or enlargement 110 to receive a gear 112 which meshes with the gear 108 and which is mounted upon a shaft 114. The shaft 114 is journalled in a longitudinal passage 116 in the wall of the part 10 spaced laterally from a reduced bore portion 118 spaced from the gear housing portion of the part 10 and preferably accurately centered relative to the member 10 and eccentric with relation to the axis of the impeller and of the gearing.

As best illustrated in Fig. 2, the chamber or bore portion 118 is separated from the gear-receiving chamber by a partition 120. A longitudinal passage 122 extends through the wall of the part 10, having communication with a passage 124 formed in the part 12 and providing an outlet or discharge from the impeller chamber 58. The passage 122 has a pair of longitudinally spaced lateral branches 126 and 128 which communicate with the chamber 118. In substantially diametrically opposed relation to the passages 126 and 128 is formed an outlet 130 from which branch longitudinally extending passages 132 and 134 which communicate with the chamber 118 at longitudinally spaced points separated a distance greater than the space between the inlet ports 126 and 128.

An impact hammer member 136 is guided in an aperture in a transverse wall portion 138 of the body part 10. The hammer member 136 has a piston 140 formed integrally therewith and mounted at its inner end and reciprocable within the passage 118. The piston 140 has a pair of spaced circumferential grooves 142 and 143 formed in the central portion thereof and defining a circumferential rib 144 therebetween. A plurality of passages 145 extend through the right-hand end of the piston, as viewed in Fig. 2, to establish communication between the right-hand end of the bore 18 and the groove 143. A plurality of similar passages 146 are formed in the left-hand end of the piston 140 to establish communication between the groove 142 and the left-hand end of the chamber 118.

The piston and its grooves 142 and 143 are so proportioned to the ports 126, 128, 132 and 134 that the relationship as shown in Figs. 1 and 2 is secured. Specifically, when the groove 142 communicates with the intake passage 128, the right-hand end of the piston 140 closes the intake 126. Likewise, when the outlet passage 132 communicates with the bore 118, the outlet passage 134 will be closed by the left-hand end of the piston. Thus, as air is supplied through the passage 122, the piston is caused to reciprocate between the position shown in Fig. 1 and Fig. 2. The advanced or outermost position of the hammer is shown in Fig. 2, in which instance compressed air from passage 122 passes through 128 and into the groove 142 for passage through the apertures 146 into the left-hand end of the chamber 118 to act against the piston in a direction to move it toward the right. At that time any air which has previously been trapped in the right-hand end of the chamber 148 is permitted to evacuate to atmosphere through the passage 132 and the outlet 130. As the piston moves toward the right from the Fig. 2 position toward the Fig. 1 position, the inlet 128 is closed and the inlet 126 is open into communication with the groove 143 at the same time that the movement of the piston closes the outlet passage 132 and opens the outlet passage 134. As soon as air can pass from port 126 through groove 143 and passages 145 into the right-hand end of the chamber 118, air pressure is exerted against the right-hand end of the piston 140 to move it towards the left while air previously trapped within the left-hand end of the chamber is evacuated through the passage 134 and the outlet 130. Thus the valve serves to continually reverse the direction of the hammer element 136; or stated differently, the piston 140 is a self-acting valve for effecting reciprocating or longitudinally vibrating motion of itself and of the hammer member 136.

A tubular member 150 has an enlarged portion 152 screw-threaded within an enlarged bore portion in the outer end of the member 10 outwardly of the part 138. The tube 150 has a circumferential internal rib 154 providing a shoulder against which a bearing 156 within that tube seats. The bearing 156 serves to journal the peen 18 at its inner end portion adjacent to a splined part 158 upon which is mounted a gear 160 which meshes with a gear or pinion 162 upon the forward end of the shaft 114 which passes through a groove in the inner surface of the part 152 of the tube and projects into an opening 164 within which the gear 162 is located. The rear terminus 166 of the peen 18 engages the outer end of the hammer 136. The peen has a circumferential shoulder 170 against which a coil spring presses, which coil spring encircles the peen 18 and bears at its opposite end against a ring 174 confined within the nose cap 16 and bearing against a shoulder 176 within that nose cap. The nose cap 16 is screw-threaded on the member 150 and hence is adjustable to vary the compression of the spring 172 and the stroke of the peen 18.

In operation of the device, assuming that the fitting 28 is connected with a compressed air line, depression of the trigger 50 will unseat the valve 38 and permit compressed air from the passage 26 to pass through the apertured partition 32 in the chamber 30 for exhaust through opening 56 and passage 62 into the impeller chamber 58. The air acts against the impeller blades 72, causing rotation of the impeller rotor 68 and of the rotor shaft 88. This rotation is transmitted through the planetary speed reduction gearing housed within the cup-shaped member 100 to cause rotation of the gear 108 which meshes with the pinion 112 upon the shaft 114. Rotation of the shaft 114 is transmitted through the pinion 162 and the gear 160 to the peen 18 independent of and without effecting rotation of the hammer 136. Thus, as long as air is supplied to the device, the peen 18 will rotate.

If the cap 80 is completely closed so that air cannot be discharged through the port 82 to atmosphere, all of the air which has passed the impeller is discharged from the impeller housing through the passage 124 into the passage 122 and one or the other of the branches 126 and 128 for entry into the piston chamber 118 to effect reciprocating action of the piston in the manner described above. This action causes longitudinal movement of the hammer member 136 to impart hammer blows to the end 166 of the peen 18 against the action of the spring member 172 which serves normally to maintain the peen in end contact with the hammer member 136.

By means of this construction the compressed air which is fed to the device serves the dual function of effecting rotation of the peen and effecting longitudinal reciprocation or hammering impact of the hammer mem-

ber **136**. It will be observed that the gear **160** is longer than the pinion **162** and, consequently, accommodates the longitudinal or axial movement of the peen **18** as it is hammered by the hammer element **136** without disengaging the driving connection between the peen and the impeller through the shaft **114** and associated gears and pinions. By this arrangement the shaft **114** may remain in a predetermined longitudinal position, and only the parts carried by the peen, and specifically the gear **160**, need to shift longitudinally.

When it is desired to regulate the force of the blow and also the speed of the impact and the force of the impact of the hammer, such control can be effected by varying the amount of air admitted to the device, that is, by either further depressing or releasing the depressing action upon the trigger **50**, or by adjusting the cap **80** to vary the amount of the port **82** which is open to the passages **76** and **78**. Essentially, speed of impact is determined by the degree of depression of the trigger **50** and force of impact is determined by the extent to which the port **82** is in a venting position relative to the passages **76** and **78**. However, impeller speed is usually increased as the bleed port **82** is opened.

It will be apparent that the device is compact and also that, when formed of non-ferrous metals, it can be made of light weight construction. The device is small in size so that it can be handled easily by a workman, and so that it can be used in places which ordinarily would be difficult to reach. One of the advantages of the device is that it is well suited for use on air frames and fuselages in the aircraft industry where it is customary to set many rivets in the construction of components and in the assembly of frames and many of such parts are at locations which are difficult of access. The device can avoid the splitting and crumbling of rivet heads by regulating the impact force and also by distributing the impact upon the work incident to its rotation, that is, incident to the rotation of the peen **18**. The shape of the peen may vary and it is possible to use peens which will work with either solid head rivets or hollow rivets. One characteristic of the device is that it can be used by simply applying a slight steady pressure through the handle against the peen, and, when so held, acts to feed itself to the work with the spinning of the peen eliminating violent jumping which sometimes characterizes a non-spinning impact riveting hammer.

Further regulation of the impact force of the device is possible by changing the setting of cap **16** to vary the compression of spring **172** and thereby vary the throw or stroke of the peen. An increase of the throw reduces the speed and a reduction of the throw of the peen increases the speed. It will be noted that the adjustment shown in Fig. 1 provides minimum throw and minimum speed, so that the only adjustment possible from this setting is to reduce the pressure exerted on spring **172** by cap **16**. Also, variation of the throw of the peen varies the force of impact, with a light blow occurring with a short stroke and a heavy blow occurring with a long stroke.

Another important advantage of the device is that it can be disassembled quickly, thus rendering the various constituent parts readily accessible for repair and replacement in the event of failure of parts.

While the preferred embodiment of the invention has been illustrated and described, it will be understood that changes in the construction may be made within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for applying compressed air sequentially to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means journaled in said housing alongside and independent of said hammer and actuated by said impeller for rotating said peen.

2. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for applying compressed air sequentially to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means journaled in said housing spaced from said hammer and actuated by said impeller for rotating said peen, said housing including a hand grip, and a valve having a trigger carried by said hand grip for controlling said air supply means.

3. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for applying compressed air sequentially to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means in said housing actuated by said impeller for rotating said peen, said housing being of cylindrical form and having said impeller and hammer spaced longitudinally therein, said drive means including a longitudinal shaft journaled in said housing in laterally spaced relation to said hammer.

4. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for applying compressed air to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means journaled in said housing spaced from said hammer and actuated by said impeller for rotating said peen, said impeller including a rotor journaled eccentrically in said housing and having spring-urged outwardly slidable vanes and an air outlet leading to said hammer.

5. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for supplying compressed air sequentially to said impeller and hammer, a peen member rotatable and axially slidably carried by said housing and spring-urged against said hammer, and drive means in said housing actuated by said impeller for rotating said peen, said housing being elongated and said impeller being rotatable on an axis extending longitudinally of said housing, said drive means including a longitudinal rotatable member laterally offset from said hammer.

6. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for supplying compressed air sequentially to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, drive means journaled in said housing spaced from said hammer and actuated by said impeller for rotating said peen, and a valved bleed port in said housing adjacent said impeller for adjustably bleeding air after reaction thereof with said impeller.

7. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for supplying compressed air to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means journaled in said housing spaced from said hammer and actuated by said impeller for rotating said peen, said housing having an air passage between the outlet of said impeller

and the inlet of said hammer and an outlet passage communicating with said hammer.

8. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for supplying compressed air sequentially to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means journaled in said housing spaced from said hammer and actuated by said impeller for rotating said peen, said drive means including a speed reduction gearing.

9. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for supplying compressed air sequentially to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means journaled in said housing spaced from said hammer and actuated by said impeller for rotating said peen, said drive means including a planetary speed reducing gear system.

10. A portable spinning rivet hammer comprising a portable housing, an air actuated impeller rotatable in said housing, an air actuated hammer reciprocating longitudinally in said housing, means for supplying compressed air sequentially to said impeller and hammer, a peen member rotatably and axially slidably carried by said housing and spring-urged against said hammer, and drive means in said housing actuated by said impeller for rotating said peen, said impeller having a longitudinal axis of rotation, said drive means including planetary speed reducing gearing driven by said impeller and positioned between said impeller and hammer and a longitudinal drive shaft journaled in said housing alongside said hammer and having drive connections at its opposite ends with said gearing and said peen, respectively.

11. A portable spinning rivet hammer comprising a portable housing, having a hand grip, an air actuated hammer in said housing, a peen member journaled and axially shiftable in said housing and spring-urged against said hammer, air actuated means for rotating said peen incident to reciprocation thereof, means for varying the stroke of said peen, means connecting said rotating means and said hammer for air flow therethrough in series, and adjustable means for discharging air from said rotating means.

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CERTIFICATE OF CORRECTION

Patent No. 2,824,547

February 25, 1958

John F. Sherrill

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 2, 3 and 4, for "assignor, by mesne assignments, to Indianapolis Bond and Share Corporation, of Indianapolis, Indiana, a corporation of Indiana," read -- assignor, by direct and mesne assignments, of three-fourths to Eva R. Lemert, of Plymouth, Indiana, and one-fourth to Indianapolis Bond and Share Corporation, of Indianapolis, Indiana, a corporation of Indiana, --; line 13, for "Indianapolis Bond and Share Corporation, its successors" read -- Eva R. Lemert, her heirs or assigns, and Indianapolis Bond and Share Corporation, its successors --; in the heading to the printed specification, lines 3, 4 and 5, for "assignor, by mesne assignments, to Indianapolis Bond and Share Corporation, Indianapolis, Ind., a corporation of Indiana" read -- assignor, by direct and mesne assignments, of three-fourths to Eva R. Lemert, Plymouth, Ind., and one-fourth to Indianapolis Bond and Share Corporation, Indianapolis, Ind., a corporation of Indiana --.

Signed and sealed this 6th day of May 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents