

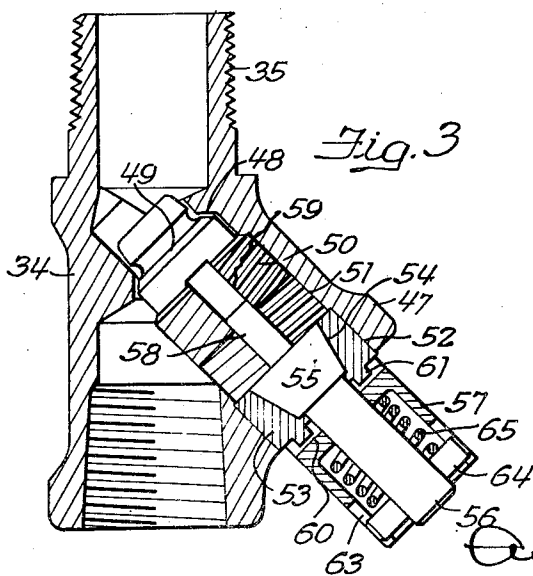
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VALVE FOR PNEUMATIC RIVETING HAMMERS

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VALVE FOR PNEUMATIC RIVETING
HAMMERS

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This invention relates to improvements in pneumatic riveting hammers and has for its principal object the provision of a slow-hitting hammer having such fine control of air delivery that a single light rap may be given the rivet set, thus better adapting the tool to use in airplane manufacturing plants where the light rap serves as a signal from the operator on the outside of an airplane fuselage to his or her helper inside who backs up the rivets which rivet will next be hammered, thus reducing to a minimum any likelihood of the relatively frail aluminum wall that is being riveted being dented, or even punctured, and requiring removal of a large panel as a result of the failure on the part of the helper to back up the proper rivet.

Successful riveting, whether done by skilled or semi-skilled workers, depends to a very large extent on the operator's ability to control the movement of the throttle valve. Small riveting hammers naturally require only a small volume of air. It is, therefore, necessary for the operator of such a hammer to be able to control the movement of the trigger so that the valve may be opened at a uniform rate.

An improvement in trigger control over the existing and conventional types is especially desirable in the offset handle type of hammers to which this invention refers. The reason is that in this type of hammer the movement of the trigger is in the opposite direction to the pressure applied by the operator's hand for holding the rivet set on the rivet.

By using the novel feature of a double guide the trigger in the hammer of my invention can be made wide enough to provide a comfortable grip for two or three fingers. This enables the operator to effect uniform movement of the trigger by the squeezing of his or her hand around the handle.

Another feature of this construction is that the comfortable two or three finger grip reduces finger fatigue or cramp, which is greatly appreciated, especially by female operators.

The invention is illustrated in the accompanying drawing, in which—

Fig. 1 is a longitudinal section through a pneumatic riveting hammer embodying my invention;

Fig. 2 is an enlarged sectional detail of the throttle valve, and

Fig. 3 is a section through the air regulator on an enlarged scale.

The same reference numerals are applied to corresponding parts throughout the views.

The hammer comprises a barrel portion 4 in which a bore 5 is provided for the reciprocable piston 6, adapted to strike the inner end of the shank 7 of the rivet set 8 entered in the outer end of the bore. The rivet set is retained by

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a bee-hive spring 9 mounted on the outer end of the barrel. The throttle valve of my invention, indicated generally by the reference numeral 10, controls the delivery of air to the valve mechanism 11 which fits inside the counter-bore 12 in the rear end portion 13 of the barrel and is arranged to direct the air alternately to the opposite ends of the bore 5 so as to propel the piston 6 back and forth. The valve mechanism 11 is of a well known form and no invention is claimed in any of the details thereof. The rear end portion 13 of the barrel is externally threaded for connection to the upper end portion 14 of the handle 15, the latter being internally threaded as indicated at 16 for such connection. 17 is the air inlet opening to the valve mechanism 11 provided in the handle 15, and 18 is the exhaust opening provided in the rear end portion of the barrel, and 19 is a split sheet metal deflector ring to direct the exhausting air downwardly in the operation of the hammer.

The throttle valve 10, in accordance with my invention, comprises a tapered but nearly cylindrical head 20 on a stem 21, reciprocable in a guide 22 provided therefor in a valve bushing 23. The latter is threaded as indicated at 24, for assembly in a bore 25 provided in the handle 15 and is locked in place by a pin 23' driven into registering holes in the handle and bushing. The bushing is counterbored and radially ported at its inner end, there being a series of radial ports 26 in a smaller counterbore on one side of the valve seat 27 communicating with the inlet passage 17 leading to the valve mechanism 11. On the other side of the seat 27 the valve bushing has a cylindrical counterbore 28 that is only slightly larger in diameter than the large end of the tapered head 20 of the valve, whereby to provide a small tapered clearance between these parts for fine air metering and accordingly make it possible for the operator to give signal raps with the hammer when the throttle valve 10 is opened slightly. For example, the counterbore 28 in one hammer made in accordance with my invention is reamed to the dimension .3437 in., plus .0005 in., and the head 20 is .3420 in. at the small end next to the bevel portion 29 that cooperates with the seat 27, and is .3437 in., minus .0005 in. at the large end, and the head 20 is of such length in relation to the bore 28, as indicated in Fig. 2, that the large end projects only slightly from the counterbore when the throttle valve is closed. The parts, in other words, are shown exaggerated in Fig. 2, in order better to illustrate the tapered clearance but in actual manufacture there is only a very small clearance between the large end of the head 20 and the counterbore 28 when the valve is closed. A coiled compression spring 30 engages at one end in a socket 31 provided therefor in

the back wall of the handle 15 and at its other end fits over a reduced pilot portion 32 provided on the back of the head 20, and tends normally to hold the valve closed. The valve is arranged to be opened by depression of the trigger 33 whereupon air under pressure is delivered past the throttle valve 10 through the inlet passage 17 to the valve mechanism 11 for operation of the hammer. The tapered clearance provides not only fine air metering to enable giving signal raps but it also permits fine control of the speed. In fact, this throttle valve 10 gives such sensitivity in regard to speed governing, that an air regulator is usually not necessary, although one is shown at 34 connected, as at 35, to the lower end of the handle between the air hose (not shown) and the handle, to control the flow of air into the hammer. In most cases the air hose will be connected directly to the handle at 35.

The trigger 33, in accordance with my invention, is of elongated curved form and adapted to be operated by the index finger A and second finger B while the handle is grasped in the hand with the other two fingers C and D closed around the lower curved portion of the handle. In some instances, the operator may place three fingers on the trigger. The trigger has parallel side flanges 36 projecting rearwardly therefrom toward the handle to minimize likelihood of the fleshy portions of the fingers on the trigger getting pinched between the trigger and handle when the trigger is depressed. The forward and upward curvature of the front of the trigger, indicated at 37, is found to make for a comfortable grip and is particularly suited to a woman operator, enabling the operation of the hammer for long intervals without fatigue. A cylindrical stem 37 is cast integral with the lower portion of the trigger 33 and has an easy working fit in a bushing 38, which has a press fit in a hole 39 in the front wall of the handle. The inner end portion of the bushing has a similar press fit in a socket 40 provided in the rear wall of the handle. A pin 41 is driven into a transverse hole 42 in the handle and through a registering hole 43 in the lower portion of the bushing 38 to retain the bushing, and the middle upper portion of this pin cooperates with an elongated groove 44 cut in the bottom of the stem 37, to hold the trigger against turning about the stem 37 as a center, and retain the trigger against displacement from the bushing 38, and also limit depression of the trigger. The drive fit of the bushing 38 in the handle prevents air leakage but the vertical passage 45 provided in the middle portion of the handle between the front and back walls is wide enough for unrestricted flow of air around the bushing to the throttle valve 10. The outer end of the stem 21 of the throttle valve 10 has a working fit in a socket 46 provided therefor in the back of the upper portion of the trigger 33. The throttle valve is therefore operated directly by the trigger, as distinguished from the usual arrangement of intermediate linkage or an intermediate pivoted bell crank member arranged to transmit movement from the trigger to the valve, such arrangements invariably resulting in too much friction and consequently causing fatigue for the operator ultimately. So far as I am aware this double guide for the trigger in which the valve stem 21 is disposed parallel to the trigger stem 37 for operation in a direction substantially parallel to the barrel 4 of the hammer, the trigger being gripped by two or

three fingers and operated uniformly by closing the hand more or less tightly on the handle, is novel. The two or three finger trigger is particularly important in the offset handle type of hammer because in this type the trigger movement is in the opposite direction to the pressure applied by the operator's hand for holding the rivet set on the rivet. The comfort obtained by this novel two or three finger grip reduces finger fatigue and cramp, and, of course, that is greatly appreciated by all operators, and especially women operators.

The air regulator 34 comprises an elongated, tubular body with an angular branch portion 47 cast integral therewith. A valve seat 48 is formed intermediate the ends of the body inclined with respect to the longitudinal axis thereof and normal to the longitudinal axis of the branch 47, to cooperate with the beveled valve portion 49 of a thread restriction plug 50 which threads in the bore 51 of the branch 47. A smooth counter-bore 52 is provided in the branch 47 to receive with a press fit a cylindrical plug 53 having an inwardly flared center tapered hole 54 snugly receiving the tapered end portion 55 of an adjusting stem 56. The stem 56 is adapted to be turned by means of a knurled knob 57 to adjust the plug 50 toward or away from the seat 48, and a screw-driver bit extension 58 is provided on the tapered end 55 of the stem to work in a diametrical screw-driver slot 59 in the plug 50 to provide a slidable driving connection between the stem 56 and the plug 50. The inner end of the knob 57 is castellated, as shown at 60, to cooperate with key projections 61 on the plug 53, whereby to lock the knob 57 in adjusted position. The knob 57 is hollow and is slidably guided on the stem 56 at its inner end, on the stem 56 and is slotted at its outer end, as at 63, slidably to receive the end portions of a cross pin 64 entered in a hole in the outer end of the stem 56. A coiled compression spring 65 is assembled inside the knob 57 around the stem 56 and is compressed between the inner end of the knob and the cross pin 64 whereby normally to urge the knob toward locking engagement with the projections 61 on the plug 53. However, when it is desired to increase or decrease the flow of air into the hammer the operator can pull out the knob 57 enough to unlock it and then turn it in the desired direction to screw the plug 50 outwardly or inwardly, as the case may be, after which the knob 57 is returned to its locked position and will remain in such position under action of spring 65. The air pressure acting on the tapered portion 55 of the stem 56 eliminates likelihood of air leakage and no packing is necessary. As a result, I obtain an air regulator which is operable with much less resistance to turning. The positive locking feature eliminates any likelihood of any accidental change in the air adjustment by reason of vibration of the hammer in operation.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims have been drawn to cover all legitimate modifications and adaptations.

I claim:

1. In a fluid actuated tool, a body having a handle portion in which there is a passage for conveying motive fluid under pressure from a source to the fluid actuated port of the tool, two bushings in said handle in transverse relation to said passage disposed in substantially parallel relation to one another, one of said bushings

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serving as a valve stem guide and having a counterbored and ported end opening into the passage and providing a valve seat on the end thereof, the other bushing being out of communication with said passage and serving as a trigger guide bushing, a valve reciprocable in the valve stem guide bushing having a head arranged to engage the aforesaid valve seat to close the ported end of said bushing to stop fluid flow from said passage and having an operating stem slidable in said guide and projecting therethrough for operation by the trigger, a trigger abutting the outer end of said stem having a guide stem reciprocable in the trigger guide bushing, and spring means normally closing said valve and holding the trigger in an extreme position relative to said handle.

2. A structure as set forth in claim 1, including a pin entered in a hole in the handle in transverse relation to the trigger guide bushing and entering a registering hole in said bushing to hold the same against endwise displacement from said handle, said pin having at least a portion thereof projecting inside the bushing in transverse relation to the bore thereof and entered transversely in a longitudinally extending slot provided in said trigger stem, whereby to hold the trigger against turning relative to said handle about said stem as a center and also to retain said stem and limit endwise movement thereof and accordingly limit movement of the trigger.

3. In a fluid actuated tool, a body having a handle portion in which there is a passage for conveying motive fluid under pressure from a source to the fluid actuated part of the tool, a valve stem guide bushing in said handle in transverse relation to said passage, said bushing having a counterbored and ported end opening into the passage and providing a valve seat on the end thereof, a trigger guide in said handle portion in substantially parallel relation to said valve bushing, a valve reciprocable in the valve bushing having a head arranged to engage the aforesaid valve seat to close the ported end of said bushing to stop fluid flow from said passage and having an operating stem slidable in said guide and projecting therethrough for operation by the trigger, a trigger disposed in transverse relation to the valve bushing and trigger guide and abutting the outer end of said stem and having a guide stem reciprocable in the trigger guide for a parallel sliding relationship between said valve and said guide stem regardless of the location of the point of application of pressure on said trigger, and spring means normally closing said valve and holding the trigger in an extreme position relative to said handle.

4. A structure as set forth in claim 3, including a pin entered in a hole in the handle in transverse relation to the trigger guide and entered transversely in a longitudinally extending slot provided in said trigger stem, whereby to hold the trigger against turning relative to said handle about said stem as a center and also to retain said stem and limit endwise movement thereof and accordingly limit movement of the trigger.

5. In a fluid actuated tool, a body having a handle portion in which there is a passage for conveying motive fluid under pressure from a source to the fluid actuated part of the tool, a valve stem guide bushing in said handle in trans-

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verse relation to said passage, said bushing having a counterbored and ported end opening into the passage and providing a valve seat on the end thereof, a trigger guide in said handle portion in substantially parallel relation to said valve bushing, a valve reciprocable in the valve bushing having a head arranged to engage the aforesaid valve seat to close the ported end of said bushing to stop fluid flow from said passage and having an operating stem slidable in said guide and projecting therethrough for operation by the trigger, an elongated trigger disposed in transverse relation to the valve bushing and trigger guide and abutting near its one end the outer end of said stem and having a guide stem near its other end reciprocable in the trigger guide, the trigger guide and valve stem guide being mounted for parallel sliding movement regardless of the location of the point or points of application of finger pressure on said trigger, and spring means normally tending to close the valve and return the trigger to retracted position.

6. In a trigger controlled portable pneumatic tool of the character described, comprising a body having a passage provided therein for conveying motive fluid under pressure, a reciprocable valve in said body controlling fluid flow in said passage having an operating stem projecting outwardly through a guide in the body for operation externally thereof, a single spring holding the valve normally closed, the motive fluid pressure being active in the same direction on the valve, an elongated trigger disposed in transverse relation to and abutting the outer end of said valve stem to open the valve against the spring and motive fluid pressure by finger pressure on the trigger, and a trigger guide stem in rigid transverse relation to and projecting from the trigger in the same direction as the valve stem and in spaced parallel relation to the latter and slidably and non-rotatably received for limited reciprocatory movement in a guide provided therefor in said body so as to slide in unison and parallelism with the valve stem in the manual operation of the trigger.

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