May 10, 1955 G. W. HARDY 2,707,941

FLUID OPERATED RECIPROCATING HAND TOOL

Filed Nov. 5, 1951

2 Sheets-Sheet 1

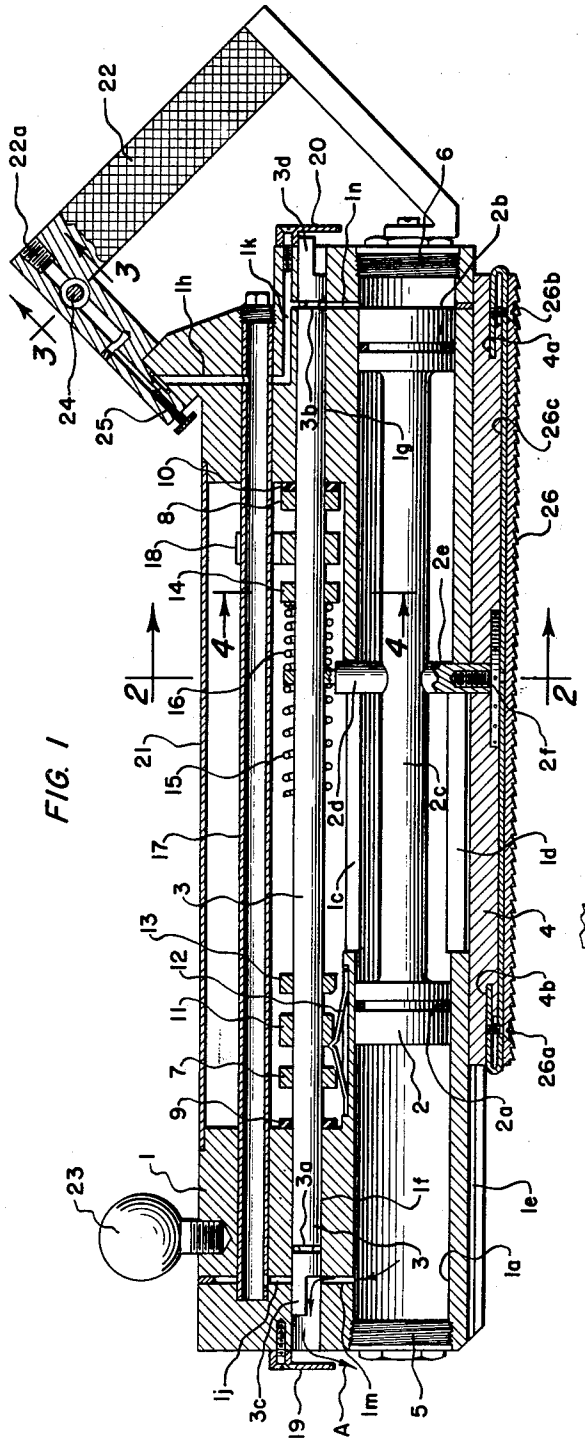


FIG. 1

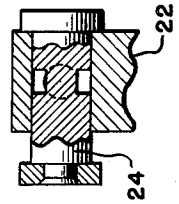


FIG. 3

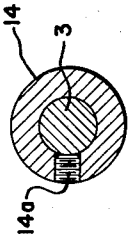


FIG. 4

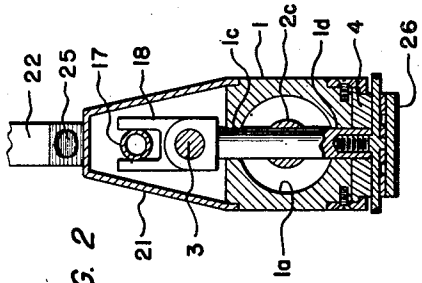


FIG. 2

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FIG. 7

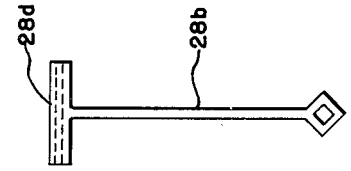


FIG. 5

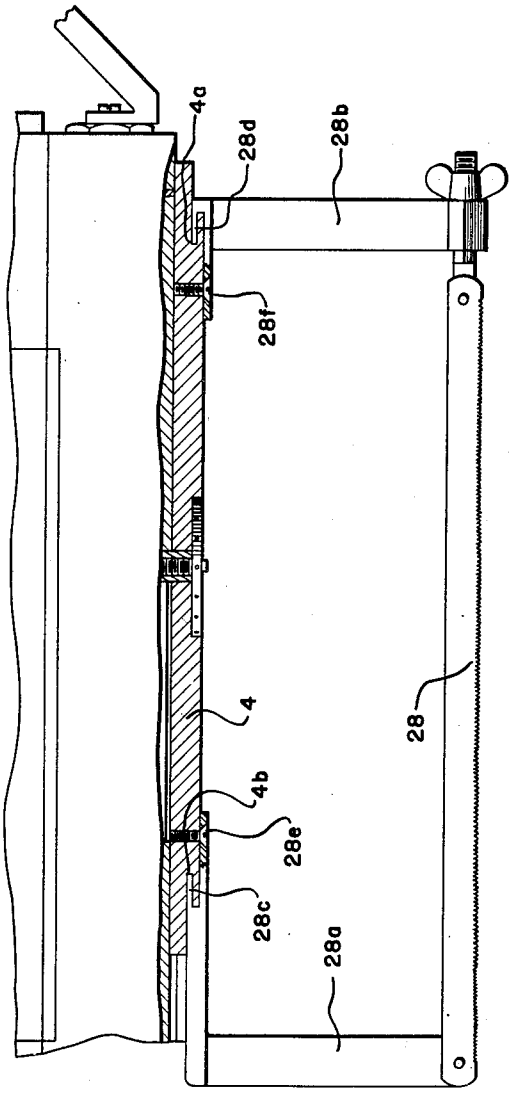


FIG. 8

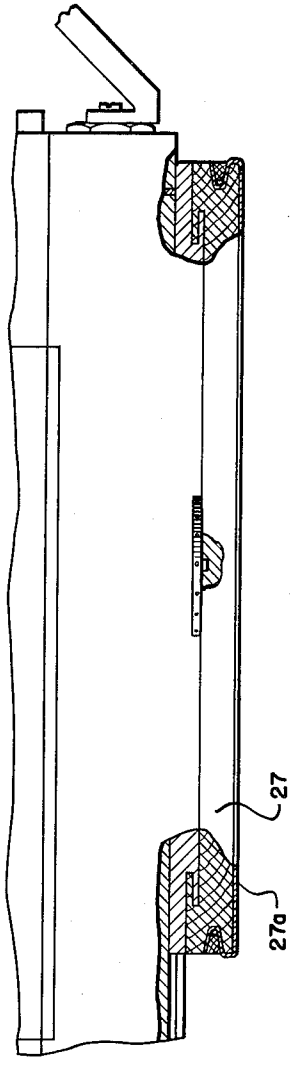
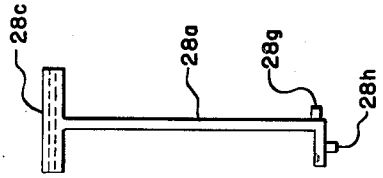


FIG. 6



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United States Patent Office

2,707,941

Patented May 10, 1955

2,707,941

FLUID OPERATED RECIPROCATING HAND TOOL

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Application November 5, 1951, Serial No. 254,963

3 Claims. (Cl. 121—164)

My invention relates to a fluid operated reciprocated hand tool and the objects of my invention are:

First, to provide a tool of this class which is adapted to save considerable manual effort in various hand tool operations.

Second, to provide a tool of this class which may be used to operate a file, a hack-saw or any type of abrading tool as desired.

Third, to provide a tool of this class having a novel combination of reciprocating mechanism and corresponding valve structure which promotes rapid acceleration of the reciprocating mechanism of the tool in both reciprocal directions.

Fourth, to provide a tool of this class which is very light in weight in proportion to its utility.

Fifth, to provide a tool of this class which may be particularly adapted for use in body and fender work for repairing and rebuilding automobile bodies and the like.

Sixth, to provide a tool of this class which is very efficient in its consumption of compressed air, proportional to the work done.

Seventh, to provide a tool of this class having novel means for adjusting the longitudinal stroke of the reciprocating mechanism of the tool and:

Eighth, to provide a tool of this class which is very simple and economical of construction, efficient in operation and which will not readily deteriorate or get out of order.

With these and other objects in view as will appear hereinafter my invention consists of certain novel features of construction, combination and arrangement of parts and portions as will be hereinafter described in detail and particularly set forth in the appended claims, reference being had to the accompanying drawings and to the characters of reference thereon forming a part of this application in which:

Figure 1 is a longitudinal vertical sectional view of my fluid operated reciprocating hand tool, showing parts and portions in elevation to facilitate the illustration.

Figure 2 is a transverse sectional view taken from the line 2—2 of Fig. 1 showing the handle structure fragmentarily.

Figure 3 is an enlarged fragmentary sectional view taken from the line 3—3 of Fig. 1.

Figure 4 is an enlarged sectional view of the valve bar and one of the spring stops taken from the line 4—4 of Fig. 1.

Figure 5 is a fragmentary side elevational view of my fluid operated reciprocating hand tool showing means for operating a saw in connection therewith.

Figure 6 is an end view of one of the saw fixtures shown in Fig. 5.

Figure 7 is an end view of the other saw fixture shown in Fig. 5.

Figure 8 is a fragmentary side elevational view of my fluid operated reciprocating hand tool showing an abrading pad in connection therewith.

Similar characters of reference refer to similar parts and portions throughout the several views of the drawings.

The frame 1, piston 2, valve bar 3, tool shoe 4, cylinder plugs 5 and 6, valve stops 7 and 8, cushion 9 and 10, detent stop 11, detent spring 12, spring stops 13 and 14, springs 15 and 16, air tube 17, valve guide 18, muffler 19 and 20, frame cover 21, handles 22 and 23, control valve 24, speed control valve 25, file 26, abrading shoe 27, and saw 28 constitute the principal parts and portions of my fluid operated reciprocating hand tool.

The frame 1 is preferably a light weight aluminum casting or this frame may be made of any other suitable material as desired. In the lower portion of the frame 1, I have provided a hollow cylindrical bore 1*a* in which the piston 2 is reciprocally mounted. This piston 2 is provided with O-ring seals 2*a* and 2*b* at opposite ends thereof and fixed to the reduced intermediate shank 2*c* are lateral arms 2*d* and 2*e* connected to the valve bar 3 and the tool shoe 4 respectively. The cylinder bore 1*a* is provided with opposed slots 1*c* and 1*d* in which the arms 2*d* and 2*e* are reciprocally mounted. Fixed to the tool shoe 4, is the file 26, all as shown best in Fig. 1 of the drawings. The tool shoe 4 is fixed to the arm 2*e* by means of the screw 2*f* while the file 26 is fixed to the shoe 4 by means of screws 26*a* and 26*b* extending through the mount clip 26*c*. This mount clip 26*c* is provided with U-shaped portions at opposite ends which extend into the slots 4*a* and 4*b* in the tool shoe 4. These slots 4*a* and 4*b* are arranged in opposed relationship to each other and extend toward opposite ends of said tool shoe 4. It will be noted that the tool shoe 4 is under cut at each end on the lower side so that the slots 4*a* and 4*b* terminate at their open ends a short distance from each end of the tool shoe 4. Opposite edges of the tool shoe 4 are retained between guide tracks 1*e* of the frame 1 which provides for rectilinear guidance of the tool shoe 4 as the piston 2 actuates the same. The plugs 5 and 6 provide closures for the ends of the cylinder bore 1*a*. The valve bar 3 fixed to the arm 2*d* reciprocates in bore portions 1*f* and 1*g* of the frame 1 near opposite ends thereof. The air tube 17 is fixed in the frame 1 above the valve bar 3 and receives air from the shut off valve 24 through the passage 1*h* and this air tube 17 delivers air to the bore portions 1*f* and 1*g* through the orifices 1*j* and 1*k*, respectively. The valve bar 3 is provided with annular grooves 3*a* and 3*b* which are adapted to index with the orifices 1*j* and 1*k* and also the orifices 1*m* and 1*n*, respectively, which communicate with opposite ends of the bore 1*a* in which the piston 2 is reciprocally mounted, all as shown best in Fig. 1 of the drawings. Fixed at the outer open end of the bore 1*f* is the downwardly directed muffler 19 and fixed at the outer open end of the bore 1*g* is the downwardly directed muffler 20. These mufflers 19 and 20 are arranged to muffle the exhaust passing outwardly of the bores 1*f* and 1*g* as indicated by the arrow A in Fig. 1 of the drawings. Fixed on the valve bar 3 are the valve stops 7 and 8 adapted to engage the cushions 9 and 10 respectively. These valve stops 7 and 8 are spaced on the valve bar 3 to accomplish indexing of the annular grooves 3*a* and 3*b* of the valve bar 3 with the orifices 1*j* and 1*m* and 1*k* and 1*n* respectively. It will be noted that opposite ends of the valve bar 3 are provided with shelf portions 3*c* and 3*d* which permit by-pass of the orifices 1*n* and 1*m* for exhaust of air from the cylinder 1*a* during stroking of the pistons 2. These shelves 3*c* and 3*d* provide for the closure of the orifices 1*j* and 1*k* during exhaust through either of the orifices 1*m* or 1*n*. Thus the spacing of the valve stops 7 and 8 from the cushions 9 and 10 substantially equals the distance between the annular groove portions 3*a* and 3*b* and the inner ends of the shelves 3*c* and 3*d*, respec-

tively. The detent stop **11** is fixed to the valve bar **3** and it engages the spring detent **12**. This spring detent **12** is vertically resilient permitting the detent stop **11** to depress the same and slide thereover. The detent spacing of the detent stop **11** is substantially equal to the distance between the annular groove **3***a* and the inner end of the shelf **3***c* which also corresponds with the spacing between the annular groove **3***b* and the inner ends of the shelf **3***d*. The spring stops **13** and **14** are fixed on the valve bar **3** and are arranged to be engaged by the springs **15** and **16** respectively for resiliently reciprocating the valve bar **3** in accordance with pressure exerted by the arm **2***d* of the piston **2** on either of the springs **15** or **16**. These springs **15** and **16** are freely mounted on the valve bar **3** while the valve guide **18** is fixed thereto and engages opposite sides of the air tube **17** in order to prevent rotation of the valve bar **3** and consequent displacement of the semicircular in cross-section shelf portion **3***c* which are adapted to cover the ports **1***j* and **1***k* when the valve bar **3** is in either position for exhausting air from the ports **1***m* or **1***n*. The valve **25** is a seat control valve adapted to control the flow of air through the ports **1***h*. The control valve **24** is a reciprocal valve for turning on or shutting off the air supply to the passage **1***h*. The cover **21** is removably mounted on the frame **1** and covers the reciprocating valve mechanism hereinbefore described. The handles **22** and **23** provide for manual control of the entire tool so that both hands of the operator may be employed for guiding or steadying the tool during its varied operation. As shown in Fig. 5 of the drawings, I have provided a saw **28** which is composed of a conventional hack saw blade and for the purpose of mounting this hack saw blade **28** on the tool shoe **4** I have provided brackets **28***a* and **28***b* having lip portions **28***c* and **28***d* respectively engageable with the slots **4***b* and **4***a* respectively of the tool shoe **4**. The brackets **28***a* and **28***b* are secure in engagement with the slotted portions **4***a* and **4***b* by means of the screws **28***e* and **28***f* which are screw threaded into the tool shoe **4**. It will be noted that the brackets **28***a* and **28***b* are substantially conventional and are adapted to hold the blade **28** alternatively in two different positions at right angles to each other which positioning may be accommodated by the engaging pins **28***g* and **28***h* on the bracket **28***a*, which pins are adapted to engage the conventional hack saw blade opening. The abrading shoe **27** is secured to the tool shoe **4** and it is adapted to support a sheet of sand paper **27***a* on its lower surface and when such abrading operations are performed, the spring stops **13** and **14** are adjusted into close proximity with the springs **15** and **16** causing very short stroke of the piston **2** and resultant high frequency motion thereof simulating high frequency vibration which is ideal for sanding operations. Attention is called to Fig. 4 of the drawing wherein the stop **14** is fixed to the valve rod **3** by means of a set screw **14***a*. The valve stops **7** and **8** are secured to the valve bar by similar set screws while the detent stop **11** and the valve guide **18** are also fixed to the valve bar **3** by screws similar to the set screws **14***a*.

The operation of my fluid operated reciprocating hand tool is substantially as follows:

When air is conducted into the internally screw threaded fitting **22***a* of the handle **22** and when the valve **24** is in the open position as shown in Fig. 3 of the drawings compressed air travels downwardly through the speed control valve **25** and into the passage **1***h* from which it passes into the air tube **17** which communicates with the passages **1***j* and **1***k* with which the grooves **3***a* and **3***b* of the valve bar **3** index. In the position as shown in Fig. 1 of the drawings compressed air is conducted through the passage **1***k* into annular groove **3***b* of the valve bar **3** and the passage **1***n* into the bore **1***a* of the frame **1** adjacent the plug **6**. The compressed air forces the piston **2** toward the orifice **1***m* and when the piston **2** approaches the orifice **1***m* in close proximity thereto the spring **15** engages the spring stop **13**. The spring compresses progressively until it overcomes the tension of the detent spring **12** at which time it very rapidly moves the valve bar **3** toward the muffler **19** causing the valve stop **7** to engage the cushion **9** which indexes the groove **3***a* with the orifices **1***j* and **1***m*. In this position the piston **2** is very close to the orifice **1***m* and compressed air entering the orifice **1***m* reacts against the plug **5** and starts the pistons **2** moving in the opposite direction. It will be noted that when the valve bar **3** travels in the direction toward the muffler **19** and the stop **7** is against the cushion **9** that the shelf **3***d* at its inner end is past the orifice thus permitting the piston to exhaust air underneath the shelf and outwardly under the muffler **20**. Thus each reciprocal movement of the piston **2** in the cylinder bore **1***a* is cushioned by the inlet of compressed air which starts it rapidly moving in the opposite direction due to the open exhaust at the opposite end of the cylinder. The detent spring **12** causes the valve bar **3** to remain stationary until one of the springs **15** or **16** is sufficiently compressed to cause very rapid shifting of the valve bar **3** so that it opens one of the orifices **1***m* or **1***n* and closes the other. Thus the reciprocating action of the tool is very rapid and very smooth and highly efficient. It is very quiet due to the cushioned effect of the piston operation which is caused by the inlet of compressed air at each end of the stroke before the piston reaches the end of the cylinder.

The spring stops **13** and **14** may be adjusted to closer proximity to the springs **15** and **16** in order to control the length of the stroke and the frequency of the stroke of the piston **2** and the tool shoe **4** with which various tools may be connected. If it is desired to use the abrading shoe **27** as hereinbefore described the stroke is shortened and frequency is increased by adjustment of the spring stops **13** and **14** so that a high frequency vibration effect may be attained. In the operation of the file **26** or the saw **28** a long smooth stroke is desirable and the speed thereof may be regulated by the speed control valve **25** which regulates the flow of compressed air into the air tube **17**. The on and off switch **24** is conveniently located at the handle **22** for starting and stopping the operation of my fluid operated reciprocating hand tool.

Though I have shown and described a particular construction combination and arrangement of parts and portions, I do not wish to be limited to this particular combination construction and arrangement but desire to include in the scope of my invention the construction combination and arrangement substantially as set forth in the appended claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a tool of the class described, a frame, a cylinder on said frame, a piston reciprocally mounted in said cylinder and having arm portions extending from a position intermediate the ends and laterally of the axis of the piston, a tool shoe connected to one of said arm portions, a valve connected to the other of said arm portions, whereby movement of said piston longitudinally of said cylinder causes said valve to open an exhaust port at one end of said cylinder and index said valve with an air pressure inlet orifice at the other end of said cylinder, said valve consisting of a reciprocating rod mounted in said frame and having air conductor passages adjacent each opposite end of said cylinder, detent means adapted to detain said valve in each opposite position, stop means on said valve, and springs engaging said other of said arms and engageable with said stop means for reciprocating said valve member against the action of said detent means and rapidly changing the position of said valve during each reciprocal movement of said piston.

2. In a tool of the class described, a frame, a cylinder connected thereto, a piston reciprocally mounted in said

cylinder, slots intermediate opposite ends of said cylinder in the side walls thereof, arms connected to said piston intermediate its end and extending radially outwardly through said slot, a tool shoe secured to one of said arms, a reciprocating valve engaged by the other of said arms adapted to control the inlet and exhaust of compressed air at opposite ends of said cylinder, said valve being reciprocated by the last mentioned arm, springs engaging opposite sides of said arm and mounted on said valve, stops on said valve and engageable by said springs, passages in said valve near each opposite end thereof, and passages in said cylinder near each opposite end thereof adapted to index with the passages in said valve, whereby reciprocal movement of said piston causes said springs to engage said stops and alternately open and close the ports in opposite ends of said cylinder for permitting successive intake and exhaust of compressed air therethrough.

3. In a tool of the class described, a frame, a cylinder, connected thereto, a piston reciprocally mounted in said cylinder, slots intermediate opposite ends of said cylinder in the side walls thereof, arms connected to said piston intermediate its end and extending radially outwardly through said slot, a tool shoe secured to one of said arms, a reciprocating valve engaged by the other of said arms adapted to control the inlet and exhaust of compressed air at opposite ends of said cylinder, said valve being reciprocated by said other of said arms, springs engaging opposite sides of said last mentioned arm and mounted on said valve, stops on said valve and engageable by said springs, passages in said valve

near each opposite end thereof, passages in said cylinder near each opposite end thereof adapted to index with the passages in said valve whereby reciprocal movement of said piston causes said springs to engage said stops and alternately open and close the ports in opposite ends of said cylinder for permitting successive intake and exhaust of compressed air therethrough, detent stops on said valve, detent means engageable by said detent stops for causing compression of said springs upon each movement of said valve past said detent means, a speed control valve arranged to control the inlet of compressed air to said first mentioned valve, a shut-off valve arranged to control the flow of compressed air to said speed control valve, and said tool shoe having means at opposite ends thereof for supporting various tools in connection therewith.

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