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R. W. FUNK.

PNEUMATIC TOOL.

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NO MODEL.

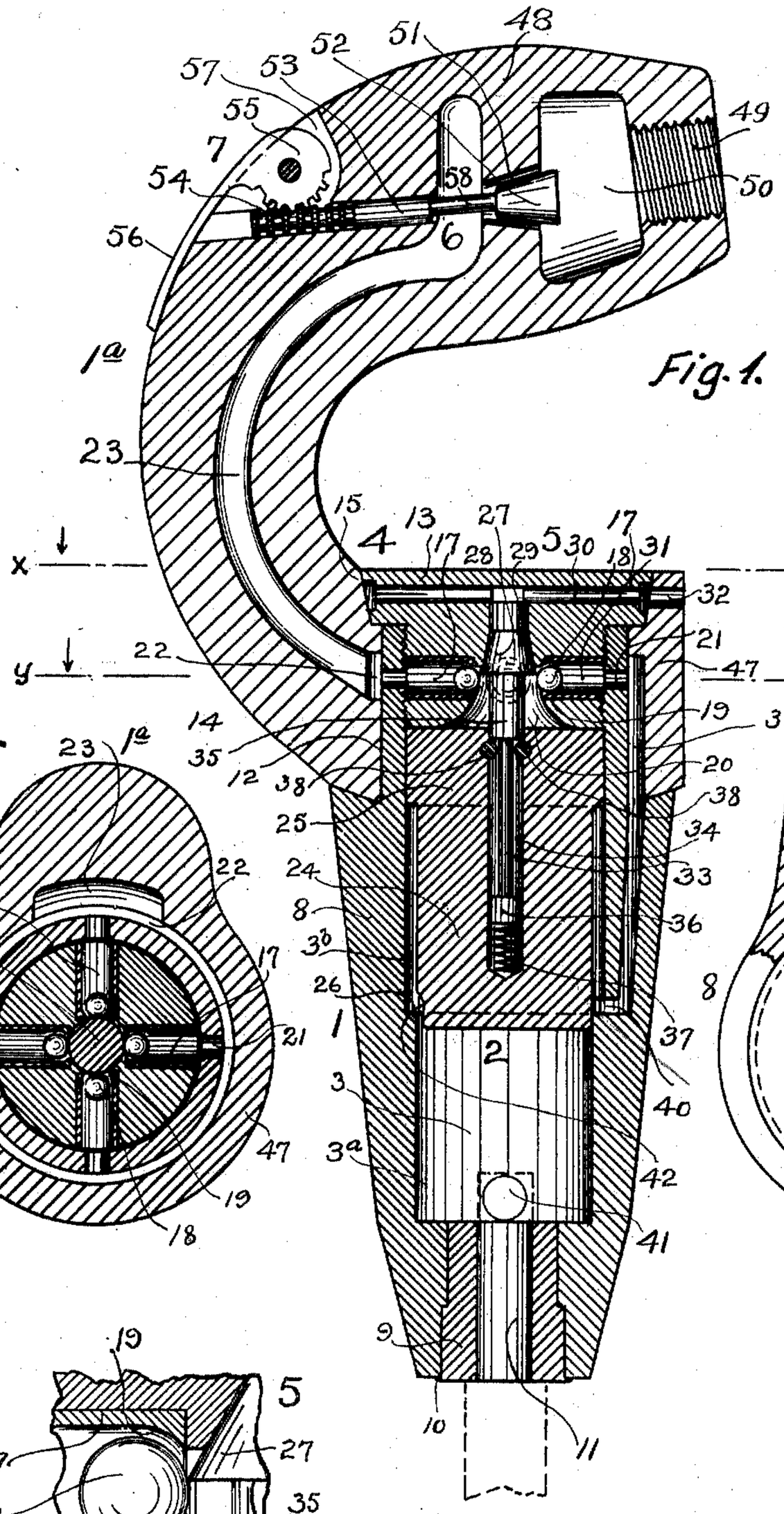

Fig. 1.

Fig. 3.

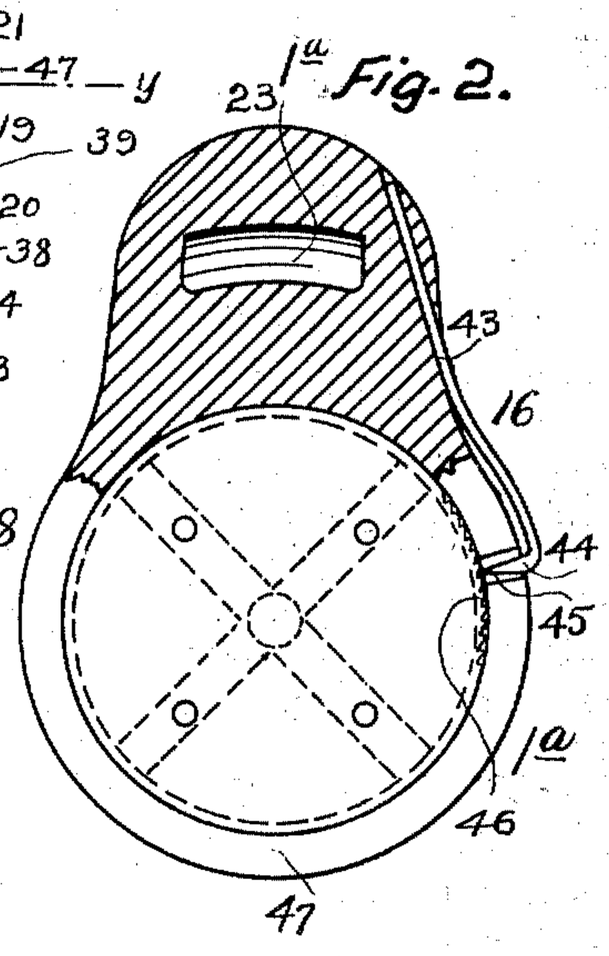

Fig. 2.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 760,329, dated May 17, 1904.

Application filed June 12, 1902. Renewed April 6, 1904. Serial No. 201,913. (No model.)

To all whom it may concern:

Be it known that I, RICHARD W. FUNK, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Pneumatic Tools, of which the following is a specification.

This invention relates to pneumatic tools; and it has for its object to provide an improved device of this class which will be positive and rapid in operation, light in weight, relatively simple in construction, and not likely to get out of repair and which will be generally superior in point of efficiency.

A further particular object of this invention consists in the provision of means whereby the supply and exhaust of the operating or pressure medium are jointly controlled, preferably under the control of the driven or operated element.

In the drawings, Figure 1 is a longitudinal sectional view of a pneumatic tool embodying my invention, several of the parts being shown in full. Fig. 2 is a transverse sectional view taken upon the line X X, Fig. 1, and looking in the direction of the appended arrow. Fig. 3 is a similar view taken upon the line Y Y, Fig. 1, and looking in the direction of the appended arrow. Fig. 4 is a detail longitudinal sectional view of several of the particular features of improvement.

Corresponding parts in all the figures are denoted by the same reference characters.

Referring with particularity to the drawings, my improved pneumatic tool, which in the present disclosure consists of a pneumatic hand riveter or hammer, embodies a tubular barrel member 1, a hammer member 2, which plays longitudinally thereof and within a bore or chamber 3 therein, a handle member 1^a, air-inlet means 4, air-outlet means 5, air-supply means 6, and controlling means 7 for said air-supply means 6. The air-inlet means 4 and air-outlet means 5 are preferably associated with the barrel member 1, and the air-supply means 6 and controlling means 7 are preferably associated with the handle member 1^a. Suitable ports and passages are provided for the admission, circulation, and discharge of the compressed air in the operation of the tool to cause the reciprocation of the hammer member 2 within the chamber 3, all of which will be hereinafter described.

In the preferred form of construction the barrel member 1 consists of a metallic tube 8 of the required diameter and within which is formed the bore or chamber 3. The outer end of the tube 8 is closed by a metallic bushing 9, the extreme end of the tube being crimped about the bushing, as at 10. The tool proper, 11, fits within the bushing 9 and extends into the chamber 3 in position to be engaged by the hammer member 2. The handle member 1^a is connected with the inner end of the tube 8, as at 12, being preferably forced over the same.

The air-inlet means 4 are embodied in a plug 13, which is screwed into the inner end of the tube 8, as at 14, and the annular periphery of said plug, at the rear end of the same, is slightly coned, as at 15, to fit within a surface of similar formation in the handle member 1^a. When the plug 13 is screwed firmly into place, it locks the handle member firmly in connection with the barrel member, and supplemental locking means 16 are provided, which lock the handle member firmly in connection with the plug 13 and prevent unscrewing of the latter. The plug 13 is plurally bored radially to receive a plurality of radial tubular valve-casings 17, within which are mounted, respectively, a plurality of ball-valves 18. The inner ends of said valve-casings 17 are slightly reduced in inner diameter to form valve-seats 19. Said valve-casings 17 communicate at their inner ends with an outwardly-flaring air-chamber 20, formed in the plug 13, and communicate, respectively, at their outer ends with a plurality of inlet-ports 21, formed radially in the inner end of the tube 8, and also communicating with an annular channel 22, formed in the handle member 1^a.

The air-supply means 6 embodies an air-passage 23, formed within the handle member

1ª and communicating with the annular channel 22. By this formation and arrangement of parts air will always be supplied to the valve-casings 17 when the plug is screwed into position to bring the same into communication with the inlet-ports 21.

The hammer member 2 is preferably of cylindrical formation, fitting the formation of the chamber 2, and embodies a body portion 24 and an enlarged head portion 25. The outer end portion 3ª of the chamber 3 is formed to exactly fit the body portion 24 of the hammer member, and the inner end portion of the chamber 3ᵇ is formed to exactly fit the enlarged head portion 25 of the hammer member. An annular shoulder 26 is thus formed in the chamber 3 at the line of connection of the portions 3ª and 3ᵇ of the chamber 3.

The air-outlet means 5 embody an outlet-valve 27, loosely connected with the hammer member 2, and an outlet-valve seat 28, formed centrally in the plug 13 and communicating with the air-chamber 20 and with an exhaust-port 29, which in turn communicates with a plurality of radial exhaust-passages 30, formed in the plug 13 and communicating at their outer ends with an annular channel 31, which at all times communicates with an outlet-port 32, formed in the handle member 1ª at the lower side of the same. By this formation of parts the exhaust-port 29 is always in communication with the outlet-port 32 when the plug 13 is screwed home in the barrel member. The outlet-valve 27 is carried upon a valve-stem 33, which is slidably mounted within a longitudinal chamber 34, formed in the hammer member 2. The inner end of the valve-stem 33 is enlarged, as at 35, to exactly fit the inner dimensions of the chamber 34, and the outer end of the valve-stem 33 is similarly enlarged, as at 36. A coil-spring 37 is interposed between the enlarged outer end of the valve-stem 33 and the outer end of the chamber 34. Two rollers 38 are mounted in suitable bearings formed by slightly recessing the walls of the chamber 34 at opposite points adjacent to the inner end of said chamber 34, the peripheries of said rollers extending into the chamber 34, and the valve-stem 33 plays between said rollers 38 in its movement. The sliding movement of the valve-stem 33 is limited by the contact of the enlarged end portions 35 and 36 of the valve-stem 33 with the rollers 38. The valve-seat 28 and the valve-casings 17 are so relatively arranged and proportioned and the outlet-valve 27 is so proportioned that when said valve 27 is seated the outer end portion or larger end of the same, said outlet-valve 27 being of truncated conical formation, will be engaged with said ball-valves 18 slightly inwardly of a plane passing through the centers of the same and in such manner as to unseat said ball-valves. The pressure of the air upon the ball-valves will operate to hold the outlet-valve 27 in seated position until the latter is positively unseated in the manner hereinafter described.

A return air-supply channel 39 is formed in the outer surface of the inner end of the tube 8 within the portion of the handle member 1ª which encircles the barrel member, and said channel 39 communicates at its inner end with the annular channel 22 in the handle member and extends longitudinally through the wall of the tube 8 to a point slightly inwardly of the shoulder 26 in the chamber 3, at which point, as at 40, it communicates with the inner end portion 3ᵇ of the chamber 3.

A supplemental exhaust-port 41 is formed in the barrel member 1, whereby the chamber 3 communicates at its outer end with the outer air, and the hammer member 2 is slightly cut away at the outer end of the body member 24, as at 42, to permit of communication of the inner end portion 3ᵇ of the chamber 3 with the outer end portion 3ª of said chamber when said hammer member is in extreme inward position, as illustrated in Fig. 1.

The supplemental locking means 16 may consist of a spring-catch 43, carried by the handle member 1ª and embodying a pointed head 44, arranged within an opening 45 in the handle member 1ª in position for engagement with a series of serrations 46, formed upon the periphery of the plug 13.

The handle member 1ª in the preferred form of construction is of curved formation, as illustrated in Fig. 1, embodying an annular inner end portion 47 and an enlarged outer end portion or grip 48. At the extreme end of the grip 48 is formed a threaded compressed-air connection 49, which communicates with an inner air-chamber 50, which in turn communicates with the air-passage 23 by means of a valve-seat 51, which is embodied in the controlling means 7. The latter further embodies a conical controlling-valve 52, which fits the valve-seat 51, the latter being also of conical formation, and said controlling-valve 52 is mounted upon a sliding valve-stem 53, housed within the handle member 1ª and provided at its upper end with a rack 54, with which is engaged a pivoted toothed head 55, operated by a thumb-lever 56 to reciprocate the valve-stem 53 and unseat the controlling-valve 52. The controlling-valve 52 is normally seated by the air-pressure in the air-chamber 50. The racked end of the valve-stem 53 and the toothed head 55 are all housed within a suitable chamber 57, formed in the handle member 1ª. The valve-stem 53 is reduced in diameter adjacent the valve 52, as at 58, to permit the admission of air when the valve is unseated.

The operation and advantages of my improvements in pneumatic tools will be readily understood. Compressed air or any other

suitable actuating or pressure medium is continuously admitted through the connection at 49 into the chamber 50, and the controlling-valve 52 is normally seated cutting off the air from the working parts of the tool. When the thumb-lever 56 is depressed by the operator, who grasps the handle member 1^a firmly, the valve 52 is unseated, and the air passes through the passage 23 and into the annular channel 22, whence it passes to the valve-casings 17 through the inlet-ports 21. The ball-valves 18 are normally seated by the pressure of the air in the valve-casings 17; but when the parts are in the position shown in Fig. 1, which is the position immediately previous to the outward actuation of the hammer member 2, the outlet-valve 29 being seated maintains the ball-valves 18 away from their seats 19, and the air passes into the air-chamber 20 in the plug 13 and forces the hammer member 2 outwardly into engagement with the tool proper, 11. At a predetermined phase of this outward movement of the hammer member the enlarged outer end portion 39 of the valve-stem 33 is engaged with the rollers 38, which project into the chamber 34, and the valve 27 is positively unseated. Previous to such unseating the pressure of the air upon the ball-valves 18 retains said valve 27 in seated position, the outer or larger end of said valve 27 lying in a plane slightly inwardly of a plane passing through the centers of said ball-valves, as above described. As soon as the outlet-valve 27 is unseated the same passes into the chamber 20, opening up the exhaust-port 29 and allowing the ball-valves 18 to seat and cut off the air-supply for the outward actuation of the hammer member. The air in the inner end portion 3^b of the chamber 3 and in the chamber 20 is thus exhausted through the outlet-port 32, this exhaustion continuing during the inward movement of the hammer member 2 under actuation of the air supplied by the return air-supply through the channel 39. Although air is continuously admitted to the inner end portion 3^b of the chamber 3 through the return air-supply channel 39, the surface areas of the shoulder 26 in the chamber 3 and of the inner surface of the enlarged head 25 of the hammer member 2, between which parts the air thus supplied is received, are relatively so small that the outward actuation of the hammer proper is not interfered with. The air in this space is, however, intermittently exhausted when the parts are in the position shown in Fig. 1 by passing around the shoulder 26 at 42 and outwardly through the supplemental exhaust-port 41. The impact of seating the valve 27 is taken up by the coil-spring 37 in the chamber 34. The outwardly-flaring formation of the chamber 20 provides for the housing of the valve 27 when the same is unseated without obstructing the exhaust.

It will be noted that the outlet-valve controls the inlet-valves and is in turn actuated and controlled by the hammer member, which operative association of parts causes a perfect and harmonious sequence of operations of the several parts.

The arrangement of the outlet-port 32 at the bottom of the tool enables the draft occasioned thereby to be utilized in blowing away chips and dust from the work.

The entire tool is relatively simple in construction and of exceeding rapidity in operation and is not liable to get out of order under continual usage.

It is manifest that the air-inlet means 4 and the air-outlet means 5 and the valve mechanism wherein the same are embodied may be employed in connection with the use of power or pressure mediums other than air, such as steam or gases, and may control the actuation of and be associated with driven or operated elements other than the hammer member 2, the essential features of the present invention consisting in the provision of a valve mechanism embodying jointly-controlled inlet means, such as 4, and outlet means, such as 5, for a power or pressure medium.

I do not desire to be understood as limiting myself to the particular construction and relative arrangement of parts as described and shown, but reserve the right to vary the same in adapting my improvements to varying conditions of usage without departing from the spirit of my invention or the terms of the following claims.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. In an improved device of the class described, a barrel member, a hammer member slidable therein, an air-inlet in the barrel member, an inlet-valve for the air-inlet, an air-outlet in the barrel member, and an outlet-valve for the air-outlet actuated by the hammer member and controlling said inlet-valve.

2. In an improved device of the class described, a barrel member, a hammer member slidable therein, an air-inlet in the barrel member, an inlet-valve for said air-inlet, an air-outlet in the barrel member, and an outlet-valve for the air-outlet loosely connected with the hammer member and controlling said inlet-valve.

3. In an improved device of the class described, a barrel member, a hammer member slidable therein, an air-inlet in the barrel member, an inlet-valve for the air-inlet normally seated by the pressure of the air, an air-outlet in the barrel member, and an outlet-valve for the air-outlet actuated by the hammer member and controlling said inlet-valve.

4. In an improved device of the class described, a barrel member, a hammer member slidable therein, an air-inlet in the barrel member inward of the hammer member, an inlet-valve for said air-inlet, an air-outlet inward of the hammer member, an outlet-valve for

said air-outlet controlled by said hammer member and controlling said inlet-valve, and an air-supply in said barrel member outward of a portion of said hammer member.

5. An improved device of the class described, comprising a barrel member, a hammer member slidable therein, air-inlet means arranged at the inner end of said barrel member, and air-outlet means arranged at the inner end of said barrel member; said air-inlet means embodying a plurality of ball-valves, a plurality of valve-casings for said ball-valves arranged radially of said barrel member and provided each at its inner end with a seat, and means for supplying air to said valve-casings; and said air-outlet means embodying an exhaust-port, and a conical valve for said exhaust-port provided with a stem loosely connected with said hammer member and arranged to maintain said ball-valves in unseated position when said conical valve is in seated position.

6. In an improved device of the class described, a barrel member, a hammer member slidable therein, pressure-inlet means in the barrel member, and pressure-outlet means in the barrel member; said pressure-inlet means embodying a ball-valve, a valve-casing for said ball-valve arranged radially of the barrel member and provided at its inner end with a seat, and means for supplying pressure to said valve-casing; and said pressure-outlet means embodying an exhaust-port, and a conical valve for said exhaust-port connected with said hammer member and arranged to maintain said ball-valve in unseated position when said conical valve is in seated position.

In testimony whereof I have signed my name in the presence of the subscribing witnesses.

RICHARD W. FUNK.

Witnesses:
CHARLY WOLF,
RAYMOND I. BLAKESLEE.