

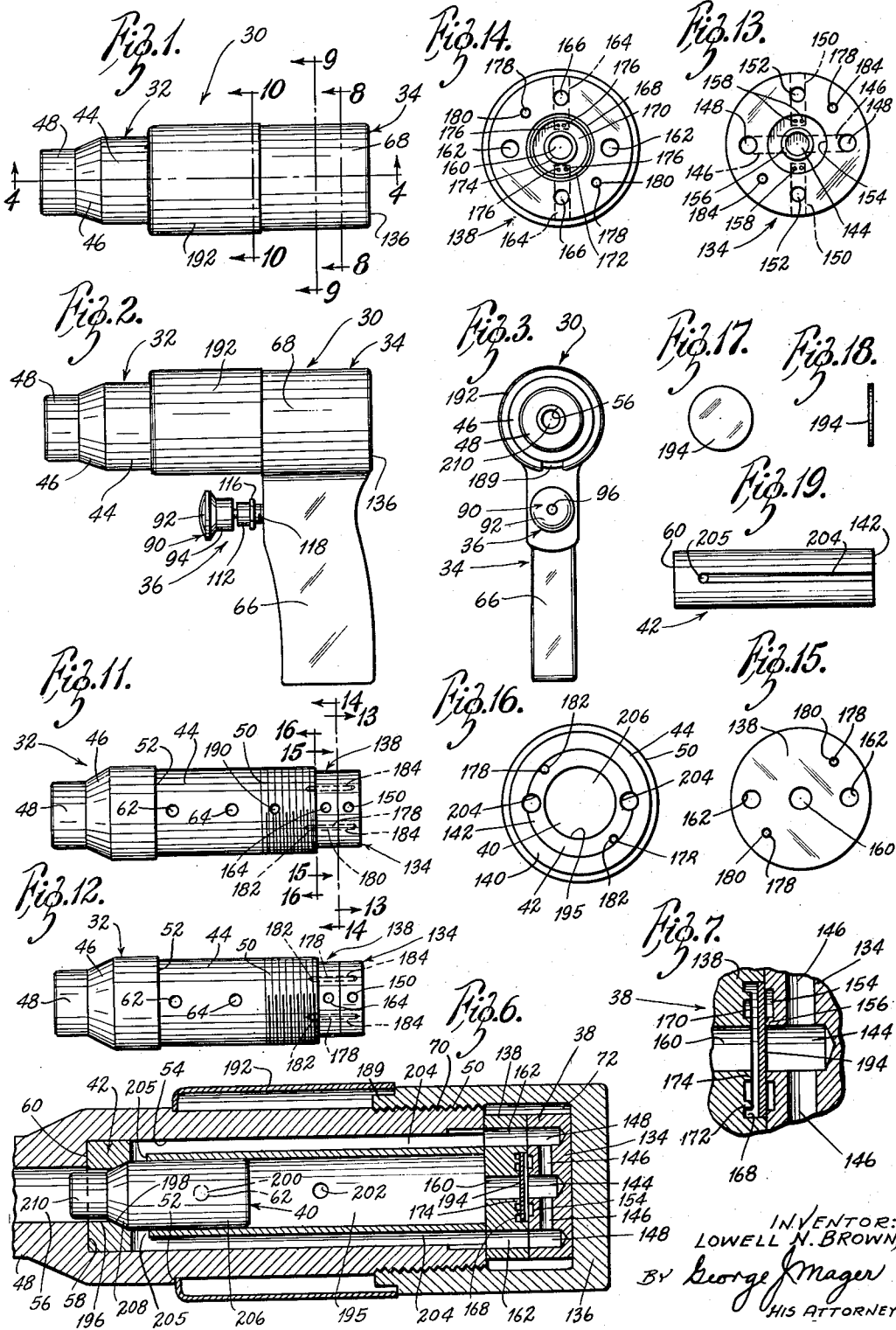
Oct. 20, 1953

L. N. BROWN
PNEUMATIC HAMMER

2,655,901

Filed May 12, 1951

2 Sheets-Sheet 1



INVENTOR:
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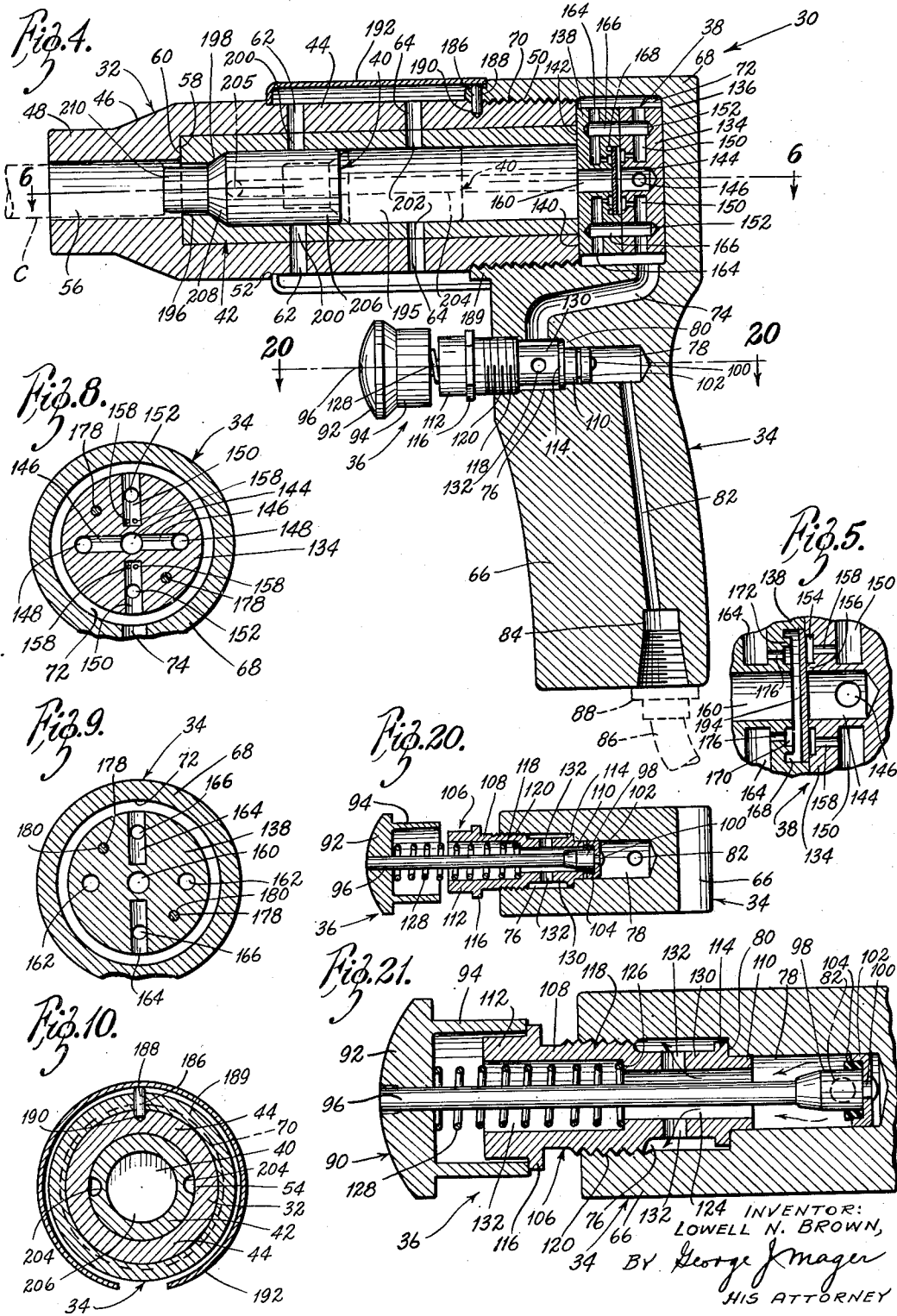
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UNITED STATES PATENT OFFICE

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PNEUMATIC HAMMER

Lowell N. Brown, Overland, Mo.

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1 Claim. (Cl. 121—18)

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The present invention relates generally to new and useful improvements in the construction of portable tools which are operable by means of air under pressure.

More particularly, this invention relates to an improved pneumatic hammer construction primarily, though not at all exclusively, designed for use in the automotive and like industries.

In a mechanism of this type, intermittent hammer blows are delivered to the shank or handle end portions of rivet setting tools, chisels and the like, the blows being delivered at a high rate of speed, and continuing so long as the operator maintains an incorporated pressure control device in open position, as is understood.

As a general rule, devices of this type are of a configuration resembling a pistol, and are thus also commonly known as pneumatic guns, rivet guns and so on.

That is to say, they include a handle portion associated with a barrel portion substantially normal thereto, so that the gun may be, so to speak, directed at any selected angle, as is well understood.

As will appear, the primary object of my invention is to provide a pneumatic hammer which is more efficient, more powerful, and at the same time lighter in weight than those heretofore in use.

Features include simplicity of design; mounting of the air control valve assembly in a portion of the handle to facilitate operation thereof, and also removal thereof as a unit for cleaning purposes when necessary; a replaceable cylinder member in the form of a case hardened metallic sleeve adapted to be pressfitted into the barrel portion, as a consequence of which the latter may be formed of light weight metal without weakening the construction; and novel means responsive to the control valve assembly for effecting the intermittent reciprocations of the hammer blow delivery member.

There are other features and advantages inherent in the invention which will be set forth in the description to follow, reference being had also to the accompanying drawings which illustrate in detail, the preferred construction of my invention.

In said drawings:

Fig. 1 is a top plan view of a pneumatic hammer comprising the present invention;

Fig. 2 is a side elevational view thereof;

Fig. 3 is a front elevational view thereof;

Fig. 4 is a central vertical sectional view thereof on an enlarged scale, the view being taken along line 4—4 of Fig. 1;

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Fig. 5 is a further enlarged reproduction of a fragmentary portion of Fig. 4, an included disk or wafer member occupying an alternate position;

Fig. 6 is a horizontal sectional view taken on line 6—6 of Fig. 4;

Fig. 7 is an enlarged reproduction of a fragmentary portion of Fig. 6, an included disk or wafer member being shown in an alternate position corresponding to Fig. 5;

Figs. 8, 9 and 10 are vertical sectional views taken respectively on lines 8—8, 9—9, and 10—10 in Fig. 1, the scale of said views corresponding to that of Figs. 4 and 6;

Fig. 11 is a top plan view of the barrel portion of the device and certain elements associated therewith;

Fig. 12 is a bottom plan view of Fig. 11;

Fig. 13 is an elevational view, with a pair of dowel pins in section, taken on line 13—13 of Fig. 11, the scale corresponding to that of Figs. 4 and 6;

Figs. 14, 15 and 16 are similar views taken respectively on lines 14—14, 15—15, and 16—16 of Fig. 11;

Fig. 17 is an elevational view of a thin metallic disk or wafer adapted to fluctuate when the invention is in operation;

Fig. 18 is an edge view thereof;

Fig. 19 is a side elevational view of a hollow cylinder adapted to be pressfitted into the bore of the barrel member included in the invention;

Fig. 20 is a horizontal sectional view taken through the handle portion of the gun on line 20—20 of Fig. 4, an incorporated air control valve assembly being portrayed in closed position; and

Fig. 21 is a reproduction on an enlarged scale, of the major portion of Fig. 20, said control valve assembly being portrayed in open position.

In Figs. 1 through 4, the pneumatic hammer comprising my invention is designated as a whole, by numeral 30.

It includes a barrel portion generally designated 32; a handle portion generally designated 34; a manually operable air pressure control assembly 36; a composite assembly generally designated 38 responsive to assembly 36 for automatically effecting intermittent reciprocatory movements of a blow delivery piston member generally designated 40; an insert cylinder 42; and other associated and incorporated parts as will appear.

Barrel portion 32 consists of a body portion 44 the forward end of which is preferably tapered as at 46 to terminate in a concentric extremity 48 of reduced peripheral diameter as shown.

The rear end of said barrel is externally threaded as at 50, and the barrel has formed

therein intermediate its ends, an annular shoulder 52, as seen to best advantage in Figs. 4 and 6.

The body of the barrel has formed therein a longitudinal socket 54, the internal diameter of which is of a size to accommodate a pressfit insertion of cylinder 42. A counterbore 56 of smaller diameter is formed in the forward end portion of said barrel, thus providing a shoulder 58 against which the forward end face 60 of said cylinder is situated.

As shown particularly in Fig. 4, the body portion of the barrel has also formed therein a first or forward pair of diametrically opposite exhaust ports 62, and a second or rearward pair of diametrically opposite exhaust ports 64.

The internal configuration of handle portion 34 is seen to best advantage in Fig. 4. Said handle includes a lower hand grip portion 66 integral with an upper hollow cylindrical portion 68, the latter being internally threaded as at 70, whereby to engage the externally threaded end portion 50 of barrel member 32.

Rearwardly beyond threaded portion 70, an annular air pressure chamber 72 is provided as shown, said chamber being in fluid communication with a passageway 74 leading therefrom and to a smaller annular air chamber 76, the latter being located in handle portion 66.

As shown in the drawings, said chamber 76 is in horizontal alinement with an air pressure intake chamber 78 the diameter of which is reduced, whereby to provide an annular shoulder 80 for a purpose to appear.

Air under pressure from a source (not shown), is continuously supplied to chamber 78 via passageway 82, inlet 84, and a flexible air line 86, the latter being shown by broken lines in Fig. 4, and inlet 84 being threaded internally for the reception of a suitable fitting, such as suggested in broken lines at 88.

The manually operable air control valve assembly 36 is illustrated in detail particularly in Figs. 20 and 21. This valve assembly controls the flow of air pressure from intake chamber 78 into chamber 76, as will now be described.

Included in the assembly 36 is a finger piece 90 which is cupshaped as shown, and preferably provided with a rounded bottom wall portion 92 and an annular flange portion 94. Rigidly secured by welding, peening, or otherwise, to the finger piece 90 centrally thereof, is one end of a valve stem 96. The other end of said stem has an enlarged head portion 98 terminating in a reduced portion 100, which after passing through a central aperture provided in an annular cupshaped washer 102, is peened over to rigidly secure the latter to said head portion as shown in Fig. 21.

Interposed about the head portion 96 in the cavity provided in the washer, is a ring 104 of semi-rigid rubber or the like, the preferable material being neoprene. As shown in the drawings, the exposed portion of said ring projects laterally to the left beyond the washer 102, for a reason to appear.

Numeral 106 indicates generally a hollow valve plug member of assembly 36. It includes a body portion 108 terminating at its right end in a cylindrical portion 110 the external diameter of which is slightly smaller than the internal diameter of chamber 78, and at its left end in a cylindrical portion 112 the external diameter of which is considerably smaller than the internal diameter of annular flange 94.

Adjacent the right end 110, body 108 is provided with an abutment flange 114 adapted, when the

plug is in position, to engage against shoulder 80. Adjacent its left end 112, body 108 is provided with an abutment flange 116, adapted to be engaged by the flange 94 when the valve assembly is in fully open position, as will appear. The peripheral configuration of flange 116 is noncircular, it preferably being hexagonal as shown.

Intermediate its ends, plug 106 is provided with a threaded portion 118 engageable with an internally threaded bore 120 provided in handle portion 66.

Numeral 122 designates a longitudinal bore in plug 106; numeral 124 is a similar counterbore; numeral 126 a shoulder or seat thus formed to accommodate one end of a compression spring 128, the other end of which bears against the bottom wall 92 of member 36, whereby the valve stem 96 is normally biased to the left to force said projecting portion of ring 104 to seat itself against portion 110 of plug 106, as illustrated in Fig. 20.

A cylindrical segment 130 of the hollow plug body, which segment extends through chamber 76, is provided with a pair of diametrically opposite ports 132 whereby fluid communication obtains between passage 124 and said chamber.

From the foregoing, it should be obvious that the air control valve assembly 36 comprises a composite unit which may be quickly removed and replaced with ease, by the application of a wrench, or similar tool, to noncircular flange portion 116 of plug 106.

The composite assembly 38, responsive to air pressure under control of valve assembly 36 whereby to effect the intermittent reciprocations of piston-hammer member 40, will now be described with particular reference to Figs. 4 through 9, and Figs. 13 through 16.

Said assembly comprises a pair of disk members, maintained in peripherally alined relation by means of dowel pins, and disposed concentrically with the pressure chamber 72 in portion 68 of the handle, as reference to the drawings will demonstrate.

Thus, it is seen particularly in Figs. 4 and 6, that the right hand face of first or rear disk member 134 is in intimate contact with a solid vertical wall 136 partly defining chamber 72; that the left hand face is in intimate contact with the right hand face of the second, or forward disk member 138; that the left hand face of the latter is in intimate contact with end face 140 of barrel member 32, and end face 142 of the insert sleeve or cylinder 42; and that the peripheral diameters of said disks 134 and 138 are identical, and less than the internal diameter of chamber 72.

As illustrated in the several views of the drawings, member 134 has formed therein a central longitudinal bore 144, in fluid communication with a pair of diametrically opposite transverse passageways 146, the latter in turn being in fluid communication with a pair of longitudinal bores 148 on a radius concentric with bore 144.

At right angles to passageways 146, member 134 is provided with a pair of diametrically opposite passageways 150 opening into chamber 72. Intersecting each passageway 150 is a longitudinal bore 152 also on a radius concentric with bore 144 aforesaid.

The left hand face of disk member 134 has a circular recess 154 formed therein, and said member is also provided with a circular flange 156 which surrounds bore 144.

A pair of short longitudinal ports 158 lead from

each passageway 150 into the recess 154. It is noted that although one such port would seem to be sufficient, it has been found that a better distribution of air pressure is afforded by the dual port arrangement.

Complementary disk member 138 has formed therein a central longitudinal through bore or passageway 160; a pair of longitudinal through bores 162 on a radius concentric with bore 160; a pair of diametrically opposite bores 164 each opening into chamber 72; a pair of longitudinal bores 166 intersecting bores 164, and on a radius concentric with bore 160; a first circular recess 168 formed in the right hand end face of said disk member; a second smaller recess 170 concentric therewith; a first circular flange 172 surrounding recess 170; a second circular flange 174 surrounding passageway 160; and a pair of short longitudinal ports 176 leading from each of the bores 164 to recess 170.

It is not deemed requisite to describe in detail the alinement and registry of these ports and passageways at this time, since the arrangement should be clear from the drawings and the description of operation to follow later.

Obviously however, it is important that the disposition of disk 138 relative to disk 134 and to adjacent insert cylinder 42 be definitely and precisely maintained.

To this end, a pair of diametrically opposite dowel pins 178 pass through holes 180 in member 138, and project on either side thereof to enter sockets 182 and 184 provided respectively in the end of cylinder 42 and member 134. In this connection, attention is also directed to Figs. 11 and 12.

The complementary disk members, thus positioned, are rigidly clamped between wall 136 and the rear end faces 140 and 142 respectively, of the cylinder 42 and barrel member 32. Rigidity is assured by means of a pin 186 which extends through a hole 188 in a reduced flange portion 189 of the handle member, as shown in Figs. 4 and 9, and into a socket 190 provided in body portion 44 of the barrel member.

Pin 186 is of such size that when in place, the upper rounded end thereof projects upwardly beyond the periphery of said annular flange, whereby it is retained against fortuitous displacement by means of a removable semi-rigid split collar 192, the forward intumed end portion of which engages against annular shoulder 52, as Fig. 4 demonstrates.

Shown per se in Figs. 17 and 18, is a metallic wafer 194, the periphery of which is slightly smaller than circular recess 168 of disk 138. Thus, as a comparison of Figs. 4 through 7 will demonstrate, said wafer is free to vibrate or fluctuate from a position sealing bore 144 to a position sealing the rear end of passage 160, and vice versa.

The longitudinal bore 195 of cylinder 42 is counterbored as at 196 to provide a tapered or frusto-conical shoulder portion 198 adjacent the forward end of said cylinder.

In alinement with exhaust ports 62, cylinder 42 has formed therein a pair of diametrically opposite ports 200; and in alinement with exhaust ports 64, said cylinder has formed therein a similar pair of ports 202.

Formed in the periphery of said cylinder, are a pair of longitudinal air passageways 204, which as best seen in Fig. 6, form continuations of aligned bores 162 and 148. Adjacent shoulder 198, cylinder 42 has formed therein a pair of

openings 205, each of which establishes fluid communication between one of said passageways 204, and bore 195.

Piston member 40 is of solid construction, and includes a body portion 206 slideable in cylinder 42, a frusto-conical portion 208 adapted to strike against shoulder 198 as will appear, and a cylindrical hammer portion 210 the periphery of which is slightly smaller than the diameter of counterbores 56 and 196.

Operation

The manner in which a mechanic would employ this pneumatic hammer is believed to be apparent. Guiding the shank or handle portion of a selected tool with one hand, and gripping the handle 34 with the other, finger manipulation of the control valve assembly 36 will effect the delivery of rapidly successive intermittent blows to the said tool, as will be explained.

The shank portion of a chisel C is suggested by broken lines in Figs. 2 and 4, it being of course understood that other selected tools may be employed, the only requisite being that the shanks of such tools are of a diameter smaller than that of counterbore 56.

It will be assumed that air under pressure is constantly supplied to intake chamber 78 from a source not shown, delivery being via flexible line 86, inlet 84, and passage 82.

It will also be assumed that valve assembly 36 is in its normal or closed position illustrated in Figs. 4 and 20. In this position, flange 114 is seated against shoulder 80, and ring 104 is maintained in sealing position against the end 110 of plug 166 by means of spring 128, so that the air under pressure is confined in said chamber 78.

Release of said pressure, for delivery via chamber 76 and passage 74 to air chamber 72, is effected by pressure applied to finger piece 90 whereby to compress spring 128 and propel the assembly composed of elements 98, 100, 102 and 104 to the right and away from plug end 110, as portrayed in Fig. 21.

As a result, so long as the valve assembly is maintained open, a constant flow of pneumatic pressure is directed into chamber 72 via counterbore 124, ports 132, air chamber 76, and passage 74.

It is noted at this time, that the provision of hexagonal flange 116, serves a dual purpose. That is to say, it provides for easy removal of the entire assembly 36, and in addition, provides an abutment for flange 94, whereby, regardless of pressure unconsciously or otherwise applied by the fingers of the operator, the flow of air power continues until removal of finger pressure automatically and positively shuts off the air supply as spring 128 expands.

Assuming now that the air control assembly 36 is open, and that the blow delivery piston 40 is in the broken line rearward position thereof portrayed in Fig. 4, wafer 194 will be momentarily in the position portrayed in Figs. 5 and 7, thus sealing port 144.

Consequently, the air pressure passes from chamber 72 through bores 164 and ports 176 into recesses 170 and 168, thence through passage 160 into cylinder 42, thus driving piston 40 forwardly to strike against the shank of chisel C, as portrayed by the full line position of said piston in Fig. 4.

It is noted that the position of the piston there illustrated is likewise a momentary one, and that it represents the maximum forward

stroke thereof, the impact being absorbed by shoulder 198 at such time.

That is to say, should the resistance to the cutting action of tool C be normal, then piston 40 will strike shoulder 198 as the hammer portion 210 of said piston drives the tool forwardly, as is understood. However, should the resistance offered be great, the piston stroke may be arrested short of its maximum travel, as should also be understood.

In either case, piston 40 after having been driven forwardly past exhaust ports 202—64, continues to advance by momentum, and after striking a blow against the end of tool C, automatically rebounds rearwardly a sufficient distance for the frusto-conical portion 208 to pass beyond pressure intake openings 205.

Immediately following the instant when body portion 206 of the piston uncovers openings 205, the air pressure, now reversed as will be explained, forces said piston rearwardly until portion 208 thereof passes exhaust ports 200—62, the piston continuing to advance thereafter by momentum to the momentary broken line position thereof portrayed in Fig. 4, whence it is again driven forwardly.

The reciprocatory movements of piston 42 are so rapid that the hammer blows are struck with what may be termed machine-gun velocity, but on the other hand, manual release of finger piece 90 will automatically effect the cessation of said movements, as should be clear from the earlier description of valve assembly 36.

The confined but otherwise unsupported wafer 194 controls the reversal of pressure application to alternate ends of the piston 42.

In other words, as pressure enters cylinder 42 via passage 160 as described, wafer 194 is automatically maintained in the position thereof illustrated in Figs. 5 and 7.

However, as the rear end of piston 40 passes exhaust ports 202—64, the pressure supply in chamber 72 is exerted against the right hand face of said wafer via passages 150 and ports 158, whereby to force said wafer leftwardly to the position thereof illustrated in Figs. 4 and 6.

As a result, passageway 160 becomes sealed, and simultaneously pressure is supplied to passageways 204 via recess 154, bore 144, transverse ports 146, longitudinal bores 148, and passages 162, as particularly apparent from an inspection of Fig. 6.

This reversal of pressure flow is coincidental with the rebounding action of piston 42, so that instantaneously after body portion 206 uncovers openings 205, pressure entering cylinder 42 by way of said openings is directed against the forward end of the piston to force it rearwardly.

Instantaneously after the forward end of piston body 206 passes rearwardly beyond exhaust ports 200—62, the further movement of said piston by momentum again causes wafer 194 to move to the right for a repetition of the cycle, as should be manifest.

From the foregoing description and reference to the drawings, it should be clear that the invention provides a compact, highly efficient mechanism adapted to achieve its objectives.

What I claim is:

In a device of the character described, said device including a reciprocable hammer blow delivery piston member: means for intermittently and automatically reversing the application of pneumatic air pressure from the front to the rear end of said piston, and vice versa; said means comprising a composite assembly including a pair of disk members maintained in peripherally aligned relation by means of dowel pins with a metallic wafer therebetween; the first or right disk member having formed therein a central longitudinal bore, a first pair of diametrically opposite transverse passageways in fluid communication therewith, a pair of longitudinal bores on a radius concentric with said central bore each in fluid communication with one of the transverse passageways, a second pair of diametrically opposite passageways at right angles to said first pair, a pair of longitudinal bores also on a radius concentric with said central bore and each intersecting one of said second pair of passageways, a circular recess in the left hand face portion, an annular flange surrounding the left end of said central bore, and at least one short longitudinal port leading from each of the second pair of passageways to said recess; the second or left hand disk member having formed therein a central longitudinal through passageway, a pair of longitudinal through bores on a radius concentric with the central bore, a pair of diametrically opposite bores, a pair of longitudinal bores on a radius concentric with said central bore each intersecting one of said diametrically opposite bores, a first circular recess in the right hand face portion, a second smaller recess concentric therewith, a first circular flange surrounding the latter recess, a second circular flange surrounding the right end of said central through bore, and at least one short longitudinal port leading from each diametrically opposite bore to said second recess; the metallic wafer being of a size slightly smaller than the first circular recess in the right hand face portion of the second disk member, and larger than the circular recess in the left hand face portion of the first disk member aforesaid.

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