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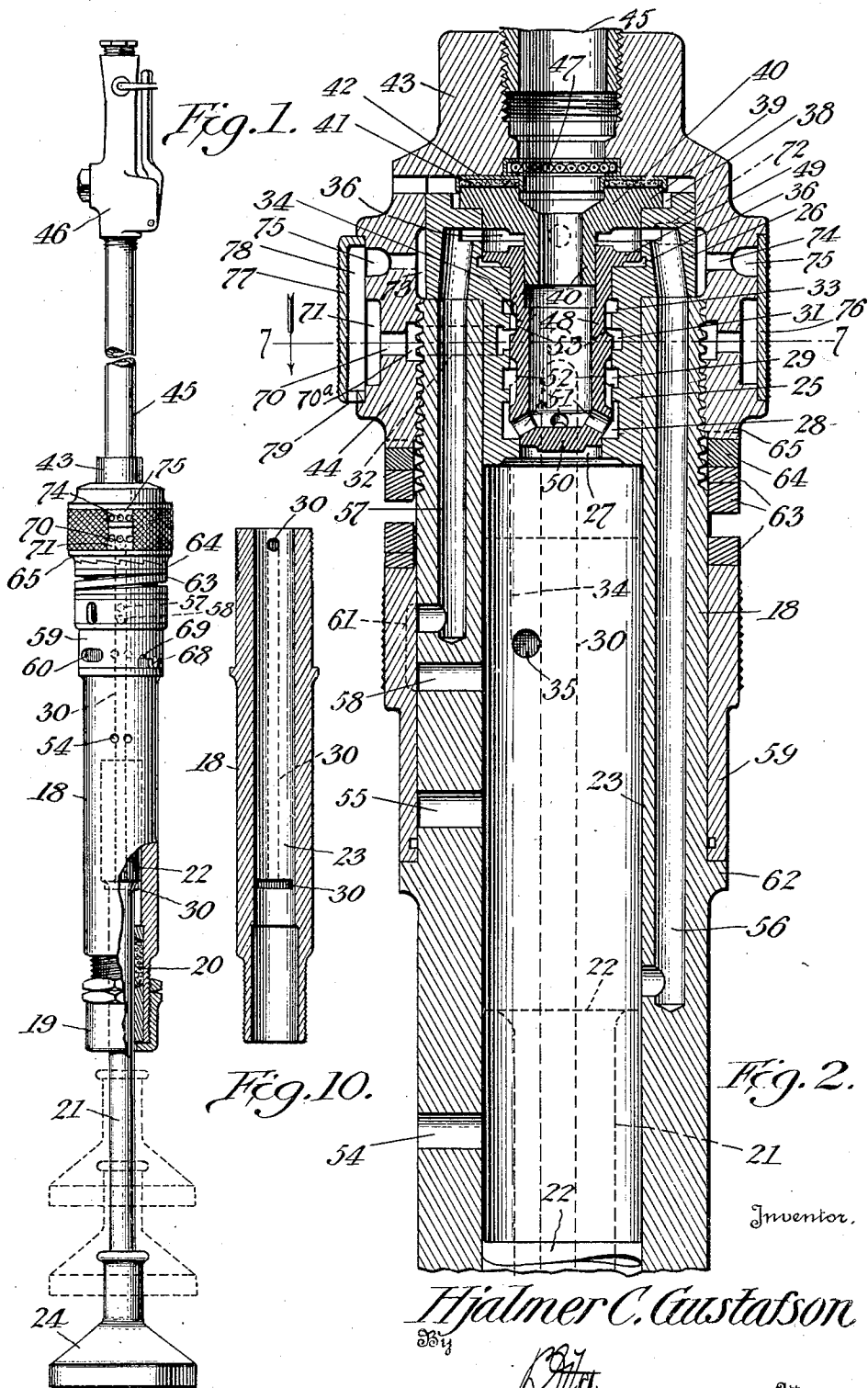
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VARIABLE STROKE TOOL

Filed May 21, 1928

4 Sheets-Sheet 1



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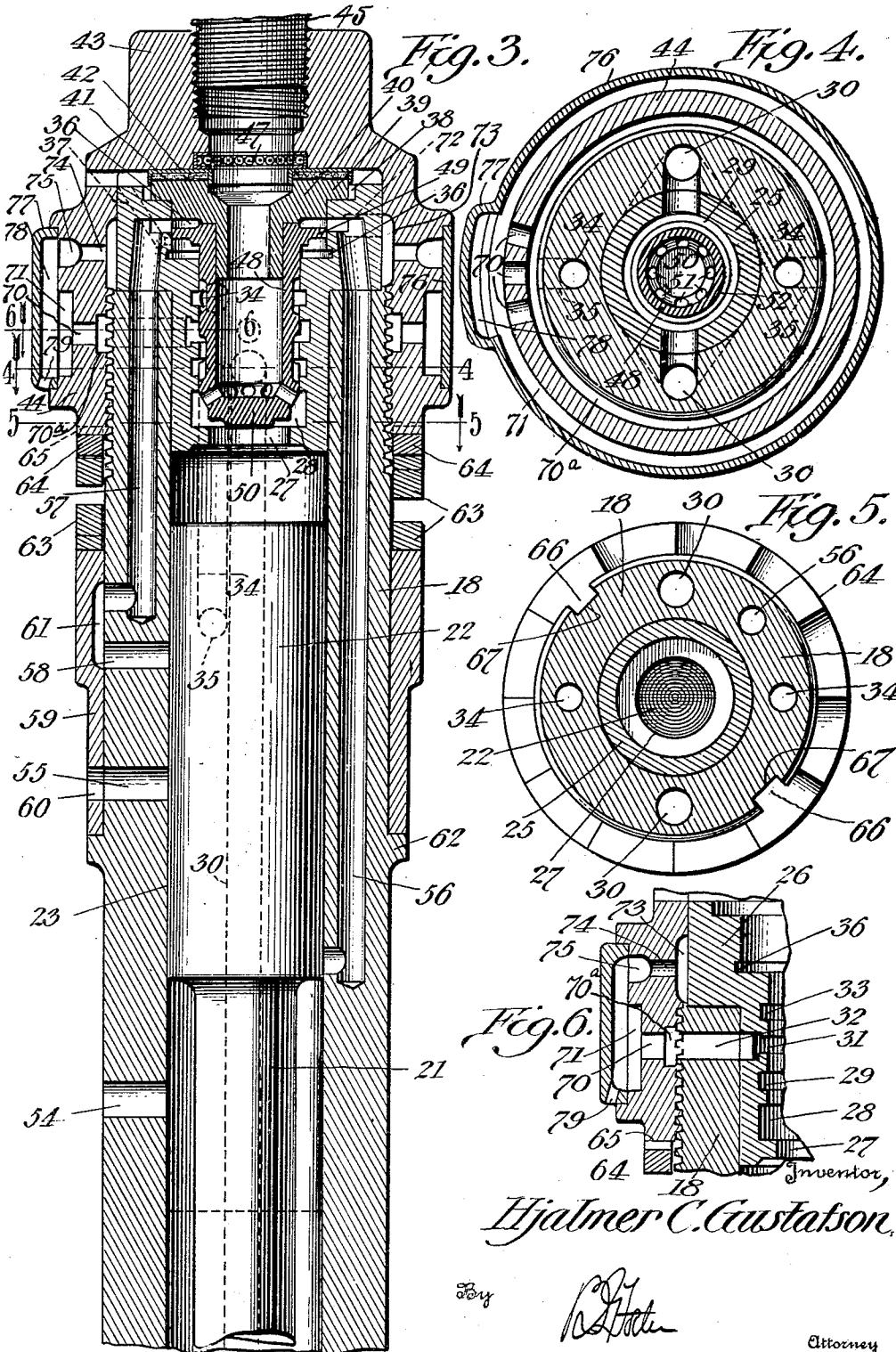
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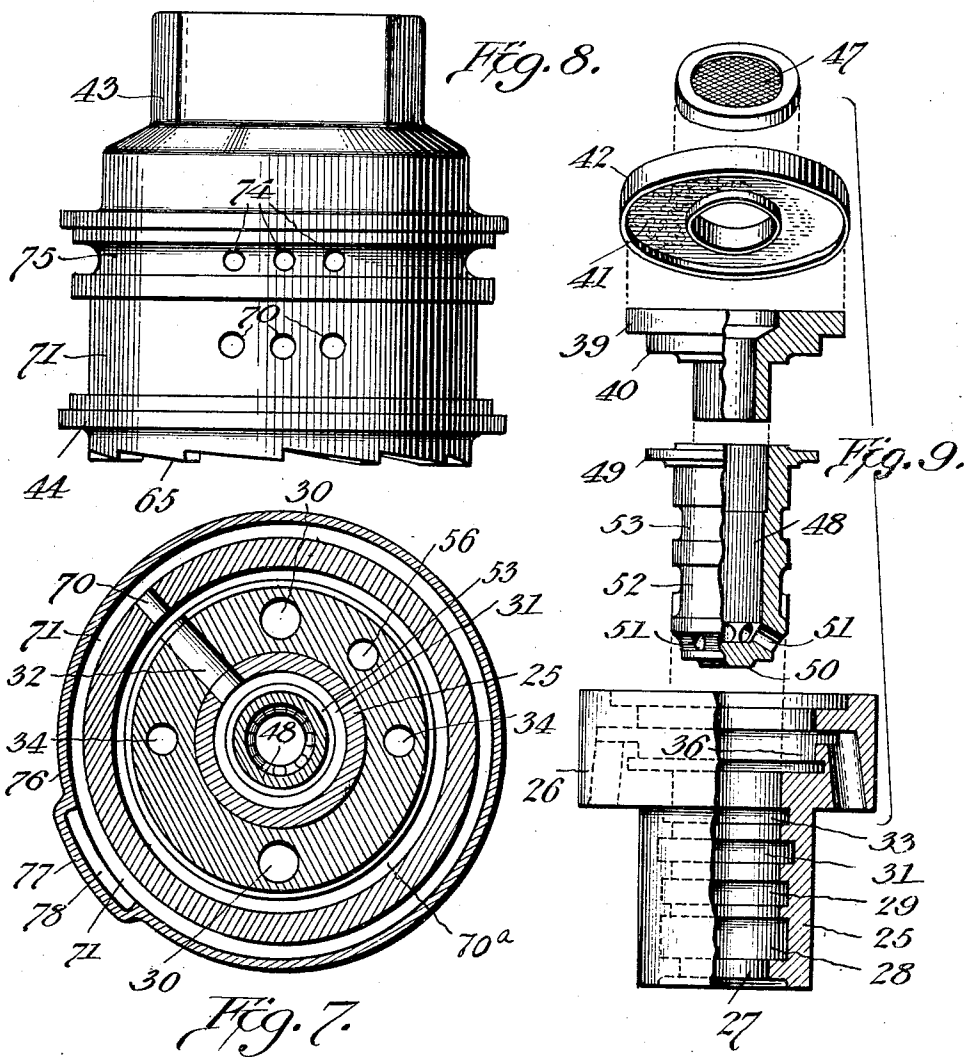
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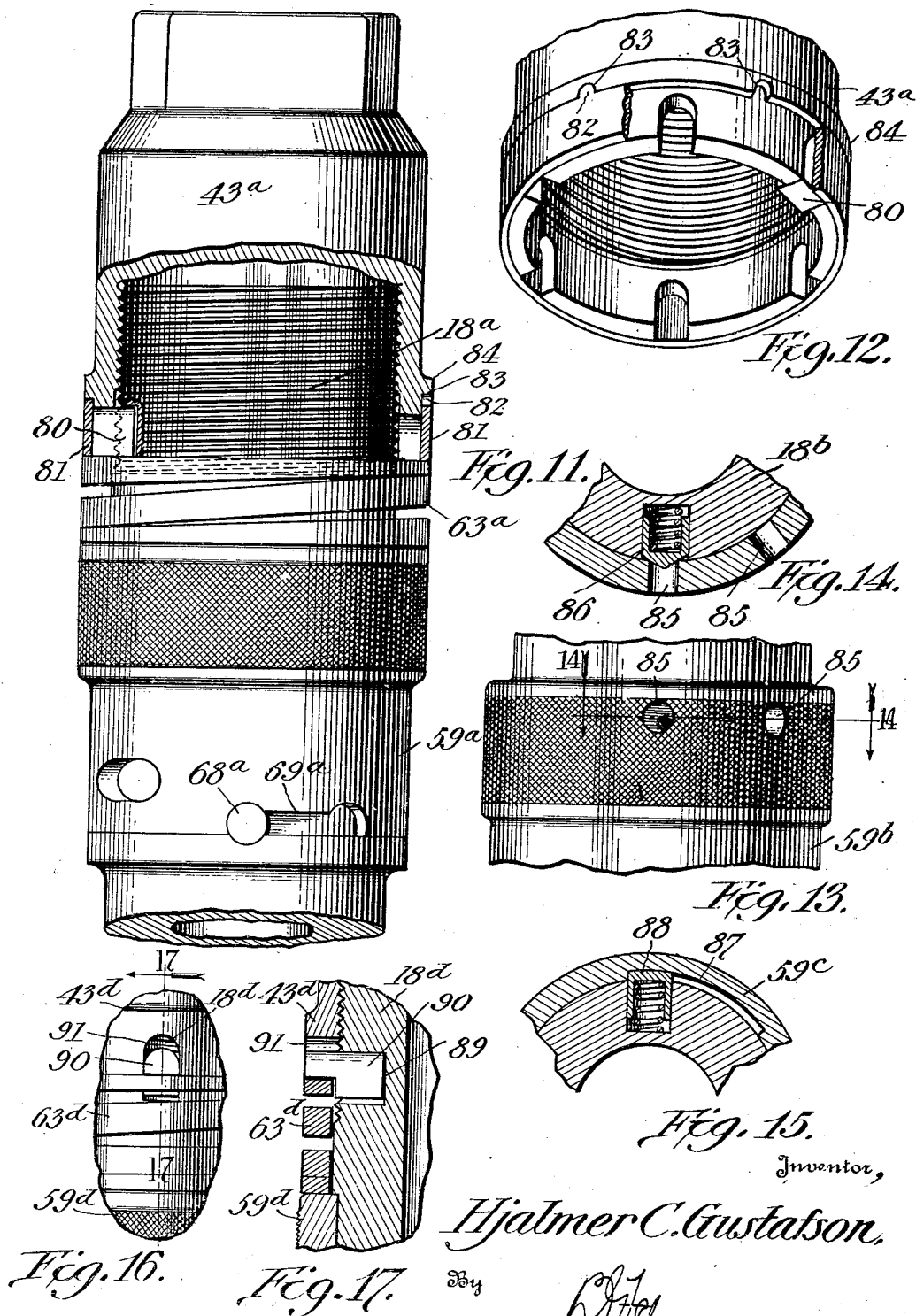
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VARIABLE STROKE TOOL

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The present invention relates more particularly to rammers and like structures. In foundry work it is sometimes desirable when packing sand around a core to use short and less powerful strokes than when packing around the edge of the mold where firmness is essential.

The object of the present invention is to provide a tool of this character, in which the stroke of the piston can be varied. While particularly intended for ramming sand in molds, obviously its use is not thus limited, but the tool may be employed for other purposes, such as backfill tamping, clipping and in fact any place where a variable stroke tool is desired.

A preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a view partially in elevation and partially in section.

Figure 2 is a longitudinal sectional view on an enlarged scale through the rear end portion of the cylinder and associated mechanism.

Figure 3 is a view similar to Figure 2, but showing the piston at the rear end of its stroke and the mechanism arranged for a short stroke operation.

Figures 4 and 5 are cross sectional views respectively on the lines 4—4 and 5—5 of Figure 3.

Figure 6 is a detail longitudinal sectional view on the line 6—6 of Figure 3.

Figure 7 is a cross sectional view on the line 7—7 of Figure 2.

Figure 8 is a side elevation of the rear cylinder head.

Figure 9 is a view of the various parts which constitute the distributing valve mechanism.

Figure 10 is a detail longitudinal sectional view of the cylinder.

Figure 11 is a detail view partially in section of a modification of the means for holding the rear head against detachment.

Figure 12 is a perspective view of the rear head.

Figure 13 is a detail view in elevation of a

modified form of means for holding the controlling sleeve in its different positions.

Figure 14 is a sectional view on the line 14—14 of Figure 13.

Figure 15 is a view similar to Figure 14, but showing a modified form of holding means for the controlling sleeve.

Figure 16 is a view in elevation of a modified form of structure for holding the rear head against turning.

Figure 17 is a sectional view on the line 17—17 of Figure 16.

In the embodiment disclosed, a cylinder is employed in the form of a barrel 18 having fitted thereon a front head 19 and containing in its front end a suitable packing structure or gland 20. Through this gland reciprocates the stem or shank 21 of a piston 22 that operates in the piston chamber 23 of the cylinder 18. On the shank is fixed a suitable tamping or other tool 24.

The piston chamber 23 opens through the rear end of the cylinder 18, and detachably fitted into said rear end is a valve casing 25 having a flange 26 abutting the rear end of the cylinder. The front end of the valve casing 25 has an opening 27 therethrough affording communication between the interior of the casing and the rear end of the piston chamber 23. In rear of said opening 27 there is formed an internal annular motive fluid supply groove 28 and in rear of said groove 28 there is formed an annular internal distributing groove 29. This distributing groove is in communication by a passageway 30 with the front end of the piston chamber 23 (see Figure 10). Behind the distributing groove 29 there is formed an internal annular exhaust groove 31, from which an exhaust port 32 opens through the cylinder wall, and behind said exhaust groove there is another groove 33 into which opens a passageway 34 that opens at 35 into the interior of the piston chamber 23. Behind the groove 33 and in the rear end of the valve casing 25 is formed an internal annular trip groove 36 of larger diameter than the above mentioned grooves. From the front portion of said groove 36, a bleed port shown in dotted lines at 37 in Figure 3 opens to atmosphere.

The rear end of the valve casing 25 is furthermore provided with a recessed seat 38, in which is fitted the flange 39 of a bushing 40 that extends into the rear end of the valve casing 25 in spaced relation to the walls thereof. This bushing is engaged by a packing gasket 41 preferably held in a cupped washer 42, and the latter being abutted against by a rear head 43, the skirt 44 of which is threaded on to the rear end of the cylinder. To the rear head is connected a stem or shank 45 carrying a suitable handle 46, to which may be coupled the usual hose line. The handle and shank thus constitute a part of a conduit that supplies motive fluid, as air, to the bushing 40. A screen 47 is preferably interposed between the packing cup 41 and the rear head and extends across the passageway for the fluid.

In the casing 25 is a reciprocatory tubular distributing valve designated 48. This valve slidably fits within the valve casing and has its rear end slidably fitting on the bushing 40. Obviously therefore motive fluid is supplied to the interior of this valve through said bushing 40. The rear end of the valve is provided with a trip flange 49 operating in the trip groove 36. It is provided with a closed front end 50 that is movable to and from a position to plug the open end 27 of the valve casing. It is further provided at its front end with lateral supply ports 51 opening into the supply groove 28. Behind these ports the exterior of the valve is reduced, as shown at 52 to afford communication between the supply groove 28 and the distributing groove 29 when the valve is in its foremost position or as shown in Figure 2. When, however, the valve is in its rear position and the opening 27 is uncovered, then communication between the supply groove 28 and the distributing groove 29 is cut off, as shown in Figure 3. The valve further is provided behind the reduced portion 52 with another reduced portion 53 that establishes and cuts off communication between the exhaust groove 31 and the groove 33, accordingly as the valve is in one or the other position, illustrated in Figures 2 and 3.

The cylinder 18 is provided with a front exhaust port 54 and a rear exhaust port 55. These exhaust ports are successively covered and uncovered by the piston 22 during its reciprocation. Leading from the piston chamber 23 at a point in rear of the front exhaust port 54 is a trip passageway 56 that opens into the rear portion of the trip groove 36 and behind the valve flange 49.

Another and shorter trip passageway 57 also opens into said trip groove 36 behind the valve flange 49. At the front end of said trip passageway 57 and really forming a part of the same under certain conditions is a port 58 that opens into the piston chamber 23 at a point behind the rear exhaust port 55 and in

rear of the front end of the trip passageway 56. Rotatably mounted on the cylinder is a controlling sleeve 59 that extends over the ports 55 and 58. This sleeve is provided with a port 60 adapted to register with the rear exhaust port 55. It is also provided with a channel 61 affording communication between the port 58 and the short trip passageway 57 when port 60 aligns with the port 55.

The sleeve 59 has its front end abutted against a flange 62 formed on the cylinder. Its rear end is abutted against by a spring 63 which as shown in Figure 1 engages a ratchet ring 64 that engages ratchet teeth 65 formed on the front end of the skirt 44 of the rear head 43. The ring 64 as shown in Figure 5 is provided with keys 66 engaged in grooves 67 in the cylinder 18 and thus is held against rotation. The movement of the controlling sleeve 59 is limited by an outstanding pin 68 (see Figure 1) which engages in a slot 69 formed in the sleeve, the ends of the slot being enlarged to receive the pin 68 and thus holding the sleeve against accidental rotation. (This is shown in detail in the modified form of structure illustrated in Figure 11.)

The skirt 44 is provided with an exhaust port 70 in communication with the exhaust port 32 through an annular groove 70a and said exhaust port 70 opens into an annular groove 71. The rear portion of the trip groove 36 has a bleed port 72 of less diameter than the trip passageways 56 and 57. This trip port (see Figure 3) opens into an annular groove 73 formed in the interior of the skirt 44 of the rear head 43 and this groove in turn is in communication by means of a port 74 with an annular groove 75 located in rear of the groove 71. The two annular grooves 71 and 75 are covered by a rotatable ring 76 which is provided at one point with an enlargement 77, the interior 78 constituting an exhaust port opening forwardly, as shown at 79 to atmosphere and permitting the escape of motive fluid from the grooves 71 and 75, to atmosphere. By turning this ring the point of exhaust or escape can be placed at any point desirable to the operator.

It is believed that the operation of the structure can now be made clear. When a long stroke operation of the piston 22 is desired, the controlling sleeve 59 is turned so that the exhaust port 55 is closed and communication is cut off between the port 58 and the short trip passageway 57. If now air or motive fluid is supplied to the distributing valve, assuming the valve in its rearward position as shown in Figure 3, and the piston at the rear end of its stroke, the air will pass through the interior of the valve out of the ports 51, through the supply passageway 28 and opening 27, into the piston chamber 23 behind the piston. The exhaust in advance of the piston takes place through the port 54. As the piston uncovers the port 58 no action will

take place because said port is out of communication with the passageway 57 and therefore the piston continues its advance until it uncovers the trip passageway 56, thereby admitting motive fluid from behind the piston through said passageway and behind the flange 38 of the valve. The area of said flange being great enough to overcome the pressure against the front end of the valve, the valve is shifted to its forward position or to the position shown in Figure 2. When this position is taken the front end of the valve plugs the opening 27 and cuts off further supply of motive fluid to the rear end of the piston chamber 23, but at the same time communication is opened between the supply groove 28 and the distributing groove 29. The motive fluid therefore finds its way through the passageway 30 to the front end of the piston chamber 23, and operating against the front end of the piston, drives it rearwardly. The exhaust now takes place through the port 54 until said port is closed, and thereafter through the port 35, passageway 34, groove 33, reduced portion 48 of the distributing valve, groove 31, port 32, port 70, groove 71 and exhaust outlet 79. When the port 35 is passed by the piston, fluid pressure will be built up behind said piston until its force on the front end 50 of the valve is sufficient to force said valve rearwardly, the pressure on the flange 36 in the meantime being reduced by the escape of motive fluid through the bleed port 74. The ports are now in the position first described.

When it is desired to shorten the stroke of the tool it is only necessary to turn the controlling sleeve 59 until the exhaust port 55 is opened by the port 60 in said sleeve and the port 58 is brought into communication with the short trip passageway 57 by the channel 61, as shown in Figure 3. When this occurs, the trip passageway 56 becomes idle because as soon as the piston 22 uncovers the port 58, fluid under pressure will pass through the short trip passageway 57 and shift the valve as above described. The exhaust port 55 now becomes active to permit the initial escape of motive fluid from behind the piston on the rear stroke thereof, while the exhaust port 54 still serves to permit the escape of fluid in advance of the piston during the front stroke. Otherwise the operation is the same, except that the length of the stroke is reduced.

Various modifications of the structure may be employed. Thus in Figure 11, the means for holding the rear head here designated 43a is accomplished by means of a key 80 engaged with the head and with the cylinder 18a. This key is overlaid by a ring 81 against which the spring 63 bears. The ring 81 is provided with projections 82 engaging in notches 83 formed in the flange 84 of the head 43a. The controlling sleeve 59a

as shown is provided with the usual slot 69a engaged by a pin 68a that limits the rotation of said sleeve 59a. This limiting or positioning movement of the controlling sleeve may be accomplished in various ways. Thus in Figures 13 and 14 the sleeve here designated 59b is provided with spaced openings 85 and a spring-pressed plunger 86 carried by the cylinder 18b is adapted to engage in either of said openings 85.

In Figure 15 a still different form of construction is shown. Here the controlling sleeve 59c is provided with an internal channel 87 of limited length and in said channel is engaged a springpressed friction limiting and holding flange 88.

As shown in Figures 16 and 17, the means for holding the rear head against rotation can be further varied. Thus, therein shown is a portion of the cylinder 18d and the head is shown at 43d threaded on the cylinder. Engaged in a socket 89 of the cylinder 18d is a key 90 that engages in a notch 91 in the head 43d. The spring shown at 63d overlies a portion of the key and holds it in place, this spring bearing against the controlling sleeve, a portion of which is shown at 59d.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art without further description and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

What I claim, is:

1. In a variable stroke fluid operated tool, the combination with a cylinder having a piston chamber and a piston operating in the chamber, of means for causing the piston to have strokes of different lengths including exhaust ports for the piston chamber opening from the piston chamber at different distances from the valve and covered and uncovered by the piston, an automatic distributing valve, a plurality of trip passageways leading from the piston chamber at different distances from the valve and extending to the valve and covered and uncovered by the piston, and means for closing and opening the exhaust port and the trip passageway that are closer to the valve.

2. In a variable stroke fluid operated tool, the combination with a cylinder having a piston chamber and a piston operating in the chamber, of means for causing the piston to have strokes of different lengths including exhaust ports opening from the piston chamber at different points and covered and uncovered by the piston, an automatic distributing valve, a plurality of trip passageways leading from the piston chamber at different points to the valve and covered and uncov-

ered by the piston, and a sleeve rotatably mounted on the cylinder and having means for closing and opening one of the exhaust ports and one of the trip passageways.

5 3. In a variable stroke fluid operated tool, the combination with a cylinder having a piston chamber and a reciprocatory piston operating therein, of an automatic valve for distributing fluid to the piston having a
10 pressure surface, said piston chamber having a front and a rear exhaust port opening at different points and successively covered and uncovered by the piston, trip passageways
15 to the pressure surface of the distributing valve and having front and rear inlet ports opening into the piston chamber and successively covered and uncovered by the piston, and a sleeve rotatably mounted on the
20 cylinder and having a port movable into and out of alinement with the rear exhaust port and a passageway that is movable into and out of a position to establish communication with the rear inlet port and one of the trip
passageways.

25 4. In a variable stroke fluid operated tool, the combination with a cylinder having a piston chamber, of a rear head for the cylinder threaded thereon, a piston in the piston
30 chamber, said piston chamber having exhaust ports at different positions and successively covered and uncovered by the piston, an automatic valve for distributing motive fluid to the piston, trip passageways for the valve
35 leading from the piston chamber at different points and successively covered and uncovered by the piston, a sleeve journaled on the cylinder and controlling one of the exhaust
40 ports and one of the trip passageways, and a spring interposed between the cylinder head and sleeve.

5. In a variable stroke fluid operated tool, the combination with a cylinder having a
45 piston chamber, of a rear head for the cylinder threaded thereon, a piston in the piston chamber, said piston chamber having exhaust ports for the piston chamber at different positions and successively covered and uncovered by the piston, an automatic valve
50 for distributing motive fluid to the piston, trip passageways for the valve leading from the piston chamber at different points and successively covered and uncovered by the piston, a sleeve journaled on the cylinder and controlling one of the exhaust ports and one
55 of the trip passageways, a spring interposed between the cylinder head and sleeve, and means pressed against by the spring for holding the piston head against rotation on the cylinder.

60 6. In a variable stroke motor, the combination with a cylinder member having a piston chamber and a piston operating in the chamber, of an automatic distributing valve for controlling the delivery of motive fluid
65 to the piston chamber to operate the piston

therein, means including supply ports opening into the piston chamber at different points and uncovered successively by the piston for delivering fluid from the piston chamber to the valve for shifting it, said cylinder member having an exhaust port opening from the piston chamber between the supply ports and uncovered by the piston after one of said supply ports is uncovered and the other is covered by the piston, and means
70 for closing the first supply port that is uncovered and closing said intermediate exhaust port to cause the fluid to operate on the piston until the second supply port is uncovered.
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7. In a variable stroke motor, the combination with a cylinder member having a piston chamber and a piston operating in the chamber, of an automatic distributing valve for controlling the delivery of motive fluid to the piston chamber to operate the piston therein, means for delivering fluid from the piston chamber to the automatic valve for tripping the said automatic valve at different points in the travel of the piston including
85 a first and a second supply port opening into the piston chamber and successively uncovered by the piston on its travel in one direction, an exhaust port to atmosphere between the supply ports and uncovered by the piston
90 after the first of the supply ports is uncovered and before the second is uncovered, and common means for closing the first supply port and the intermediate exhaust port.
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8. In a variable stroke motor, the combination with a cylinder member having a piston chamber and a piston operating in the chamber, of an automatic distributing valve for controlling the delivery of motive fluid to the piston chamber to operate the piston therein, means for delivering fluid from the piston chamber to the automatic valve for tripping said automatic valve at different points in the travel of the piston including a
100 first and a second supply port opening into the piston chamber and successively uncovered by the piston on its travel in one direction, a first exhaust port to atmosphere between the supply ports and uncovered by the piston after the first of the supply ports is
105 uncovered and before the second is uncovered, a second exhaust port uncovered by the piston after the second supply port is uncovered, and means for closing the first exhaust port.
110

9. In a variable stroke motor, the combination with a cylinder member having a piston chamber and a piston operating in the chamber, of an automatic distributing valve for controlling the delivery of motive fluid to the piston chamber to operate the piston therein, means for delivering fluid from the piston chamber to the automatic valve for tripping said automatic valve at different points in the travel of the piston including a first and a
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second supply port opening into the piston chamber and successively uncovered by the piston on its travel in one direction, a first exhaust port to atmosphere between the supply ports and uncovered by the piston after the first of the supply ports is uncovered and before the second is uncovered, a second exhaust port uncovered by the piston after the second supply port is uncovered, and means for closing the first exhaust port and closing the first supply port while leaving the second supply port and second exhaust port open.

10. In a variable stroke motor, the combination with a cylinder member having a piston chamber and a piston operating in the chamber, of an automatic distributing valve for controlling the delivery of motive fluid to the piston chamber to operate the piston therein, means for delivering fluid from the piston chamber to the automatic valve for tripping said automatic valve at different points in the travel of the piston including a first and a second supply port opening into the piston chamber and successively uncovered by the piston on its travel in one direction, a first exhaust port to atmosphere between the supply ports and uncovered by the piston after the first of the supply ports is uncovered and before the second is uncovered, a second exhaust port uncovered by the piston after the second supply port is uncovered, and common means on the cylinder member for closing the first exhaust port and closing the first supply while leaving the second supply port and second exhaust port open.

In testimony whereof, I affix my signature.
HJALMER C. GUSTAFSON.

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