No. 791,847. PATENTED JUNE 6, 1905.

J. WHITELAW.

PNEUMATIC DRILL.

APPLICATION FILED SEPT. 26, 1903. RENEWED NOV. 3, 1904.

5 SHEETS—SHEET 1.

Fig. 1.

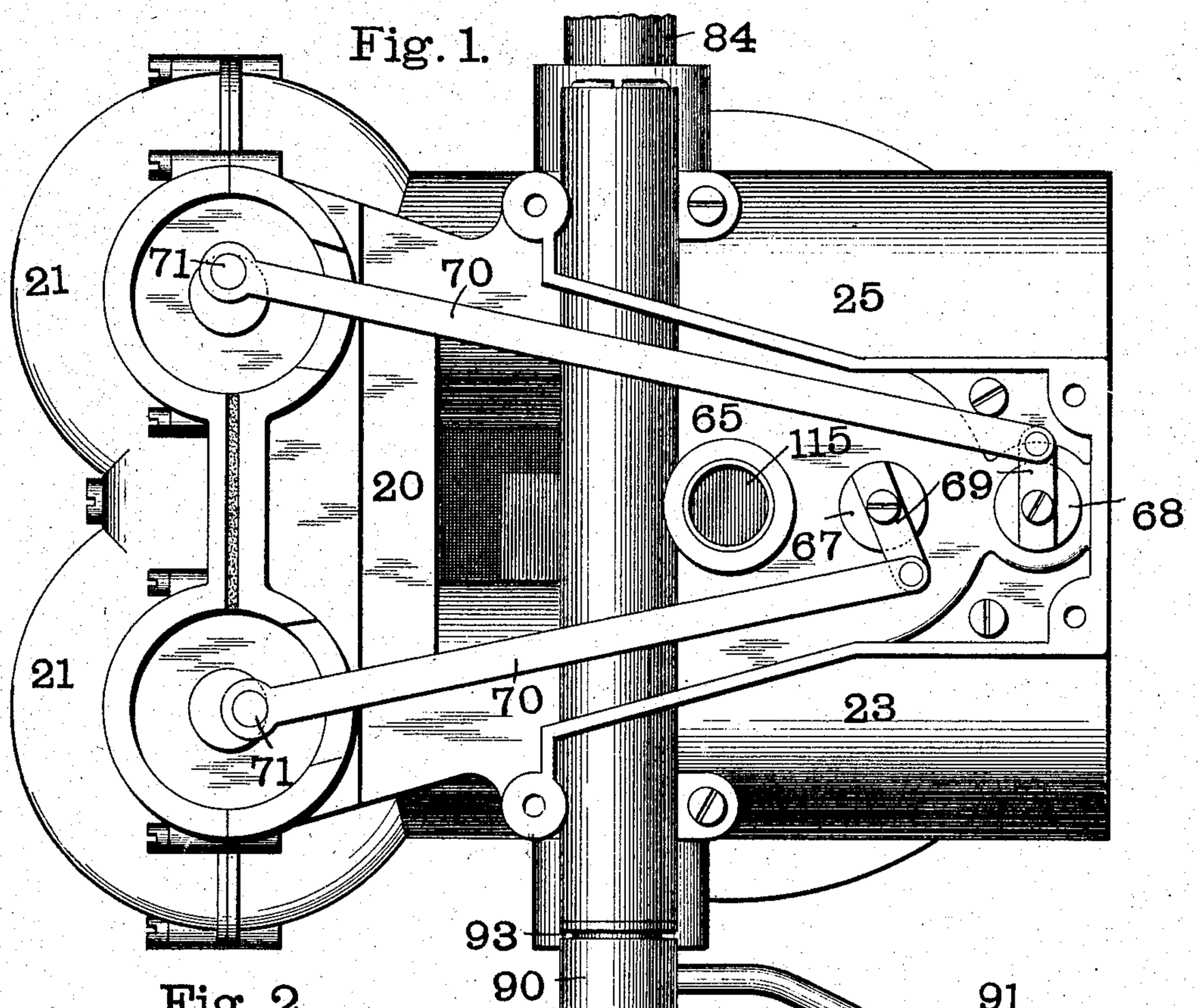


Fig. 2.

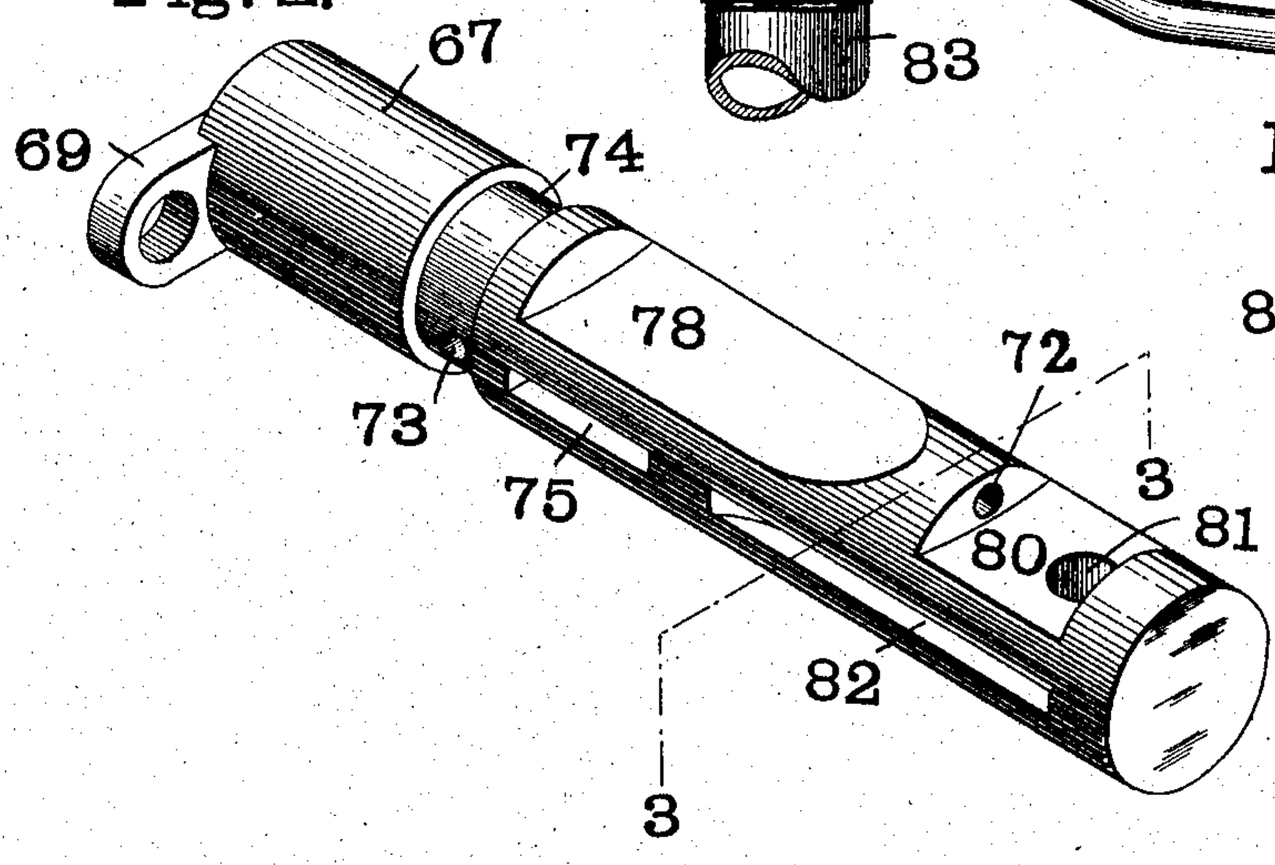
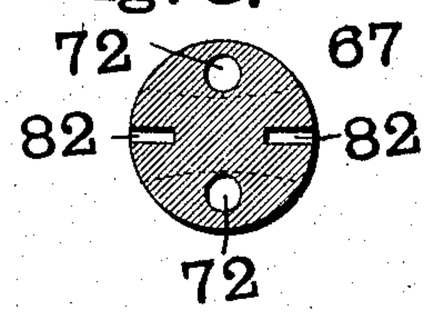


Fig. 3.



Witnesses

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5 SHEETS—SHEET 2.

Fig. 4.

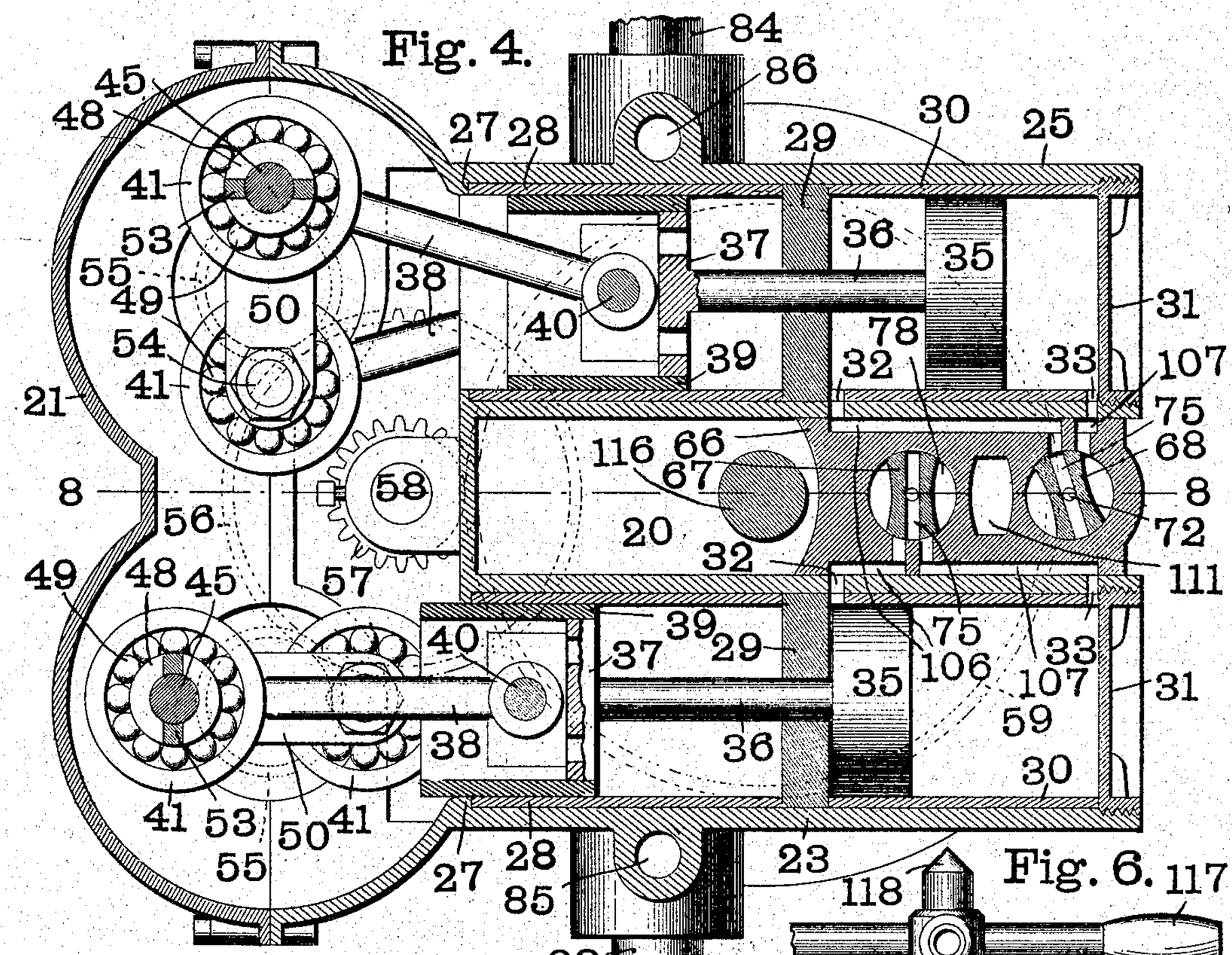
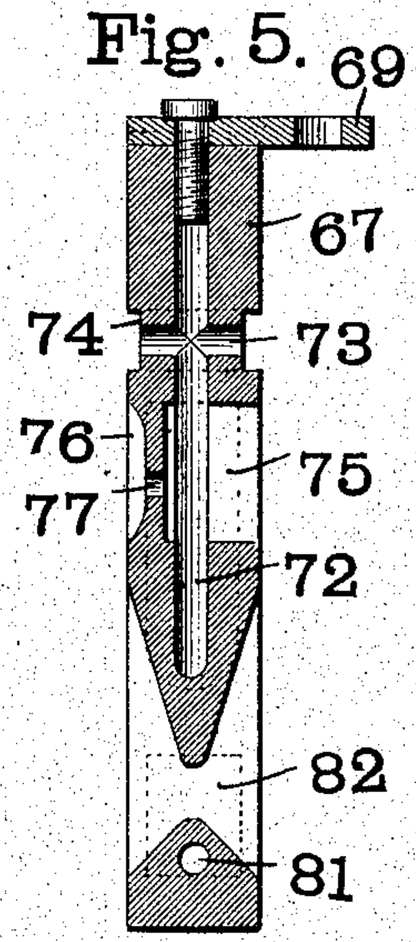


Fig. 6.

Fig. 5.



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5 SHEETS—SHEET 3.

Fig. 7

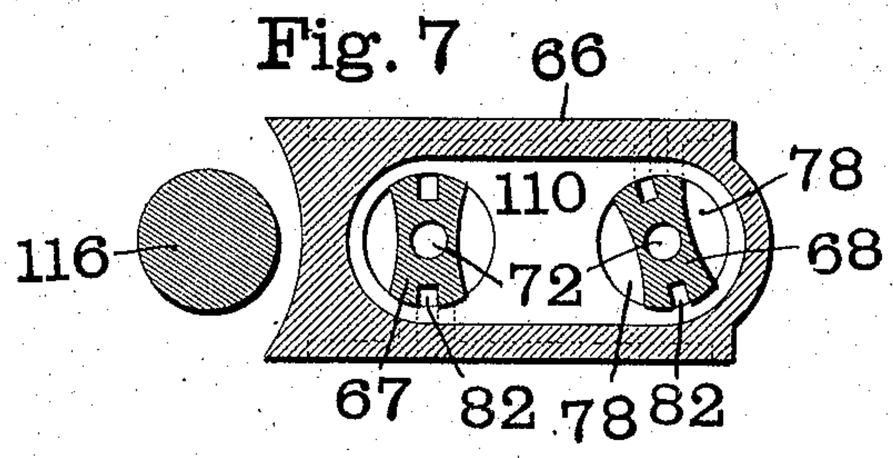
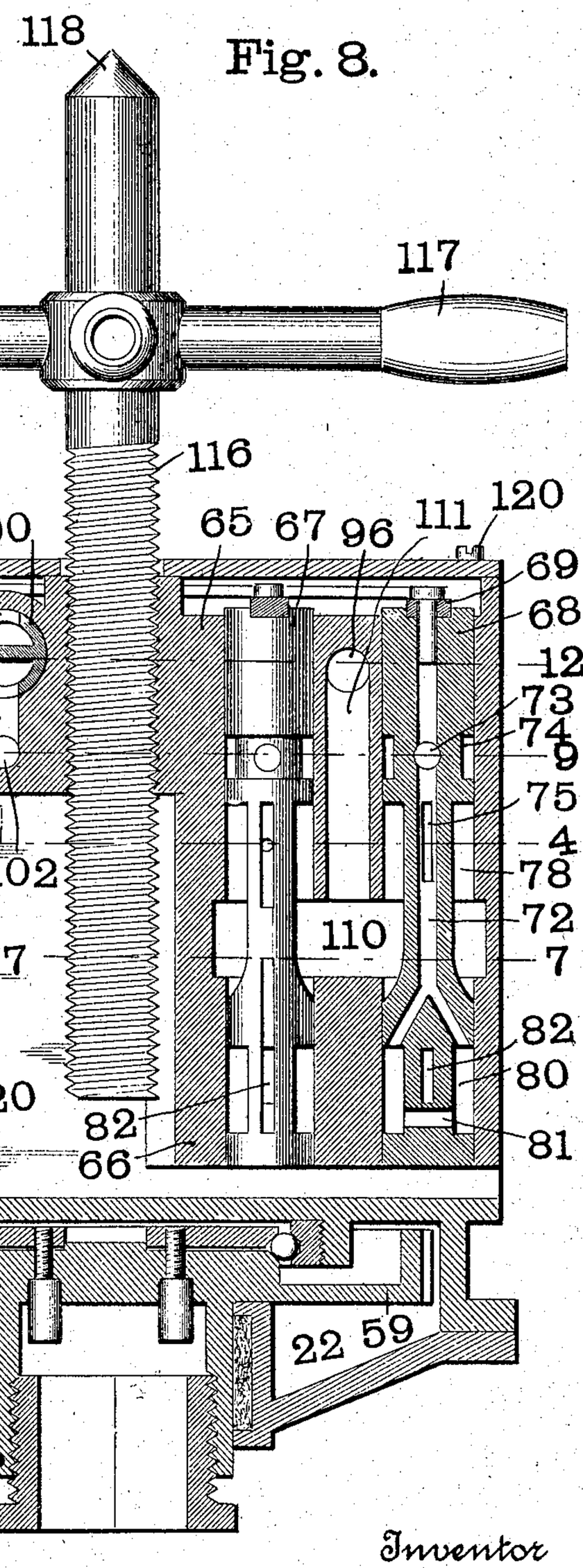


Fig. 8.



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5 SHEETS—SHEET 4.

Fig. 9.

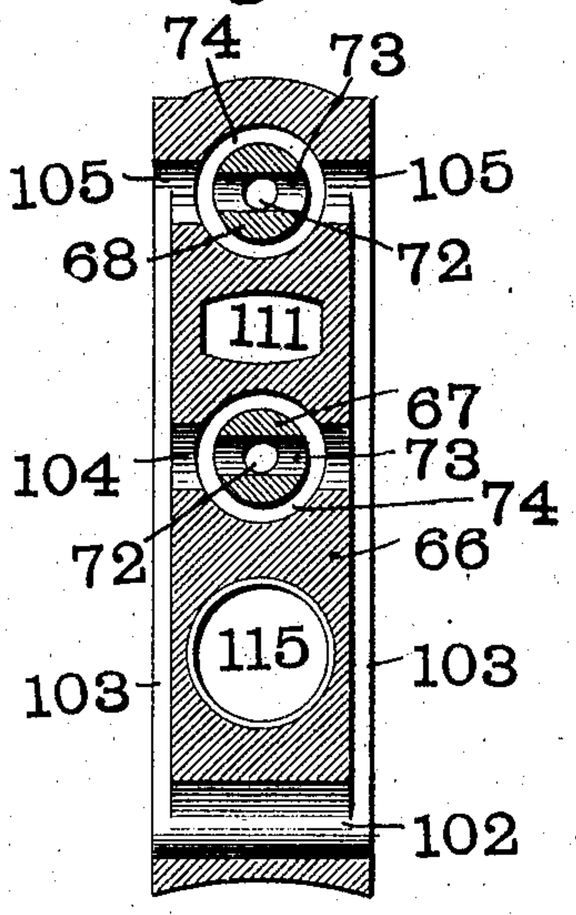


Fig. 10.

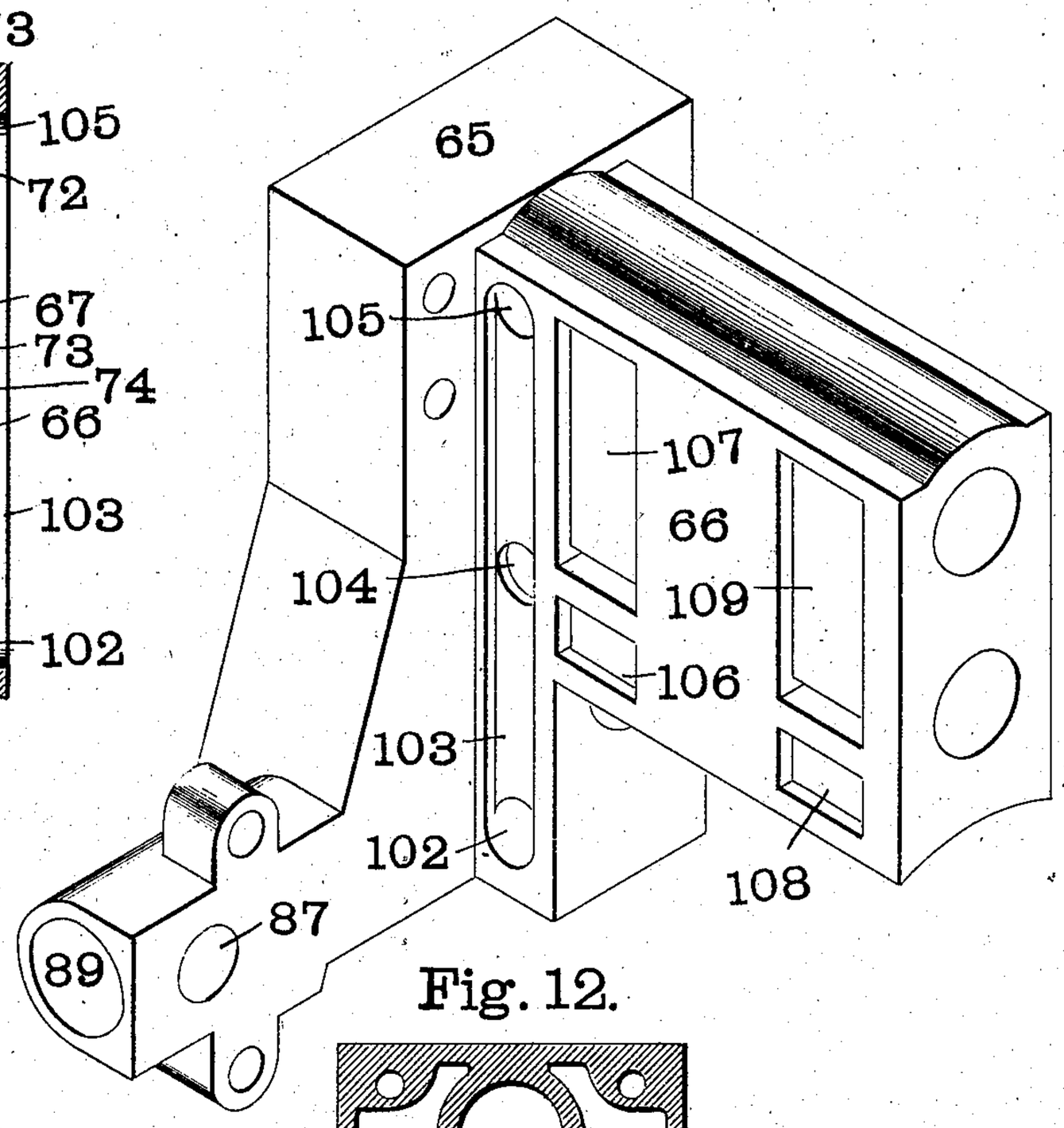


Fig. 11.

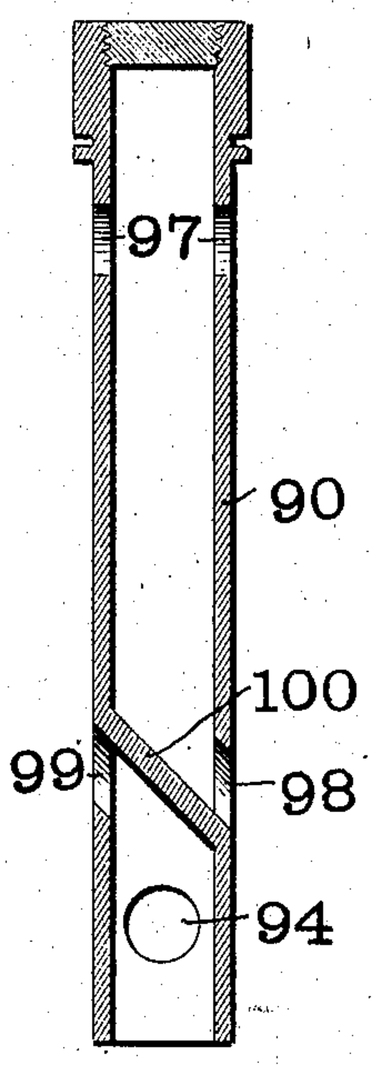
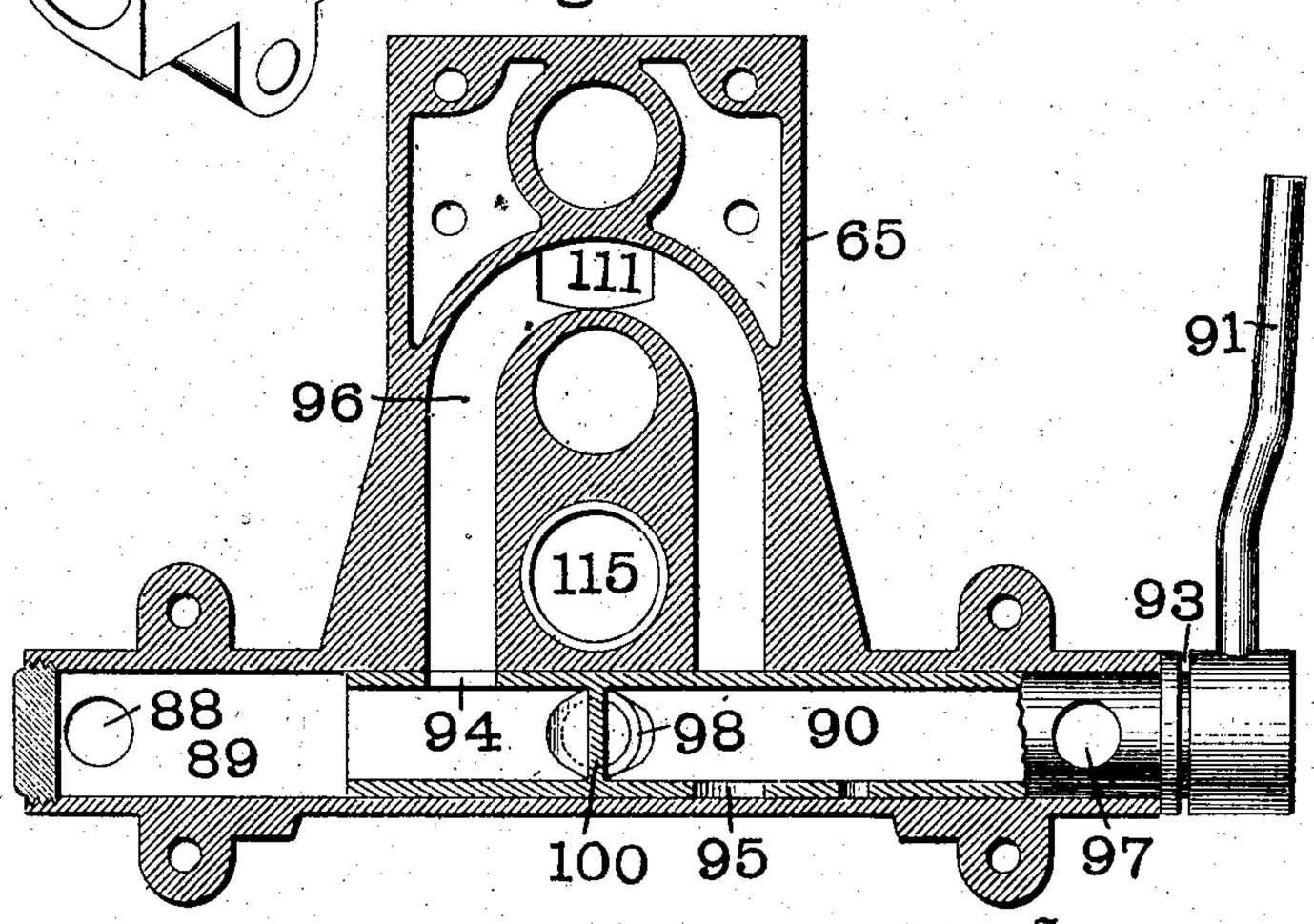


Fig. 12.



Witnesses

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5 SHEETS—SHEET 5.

Fig. 13.

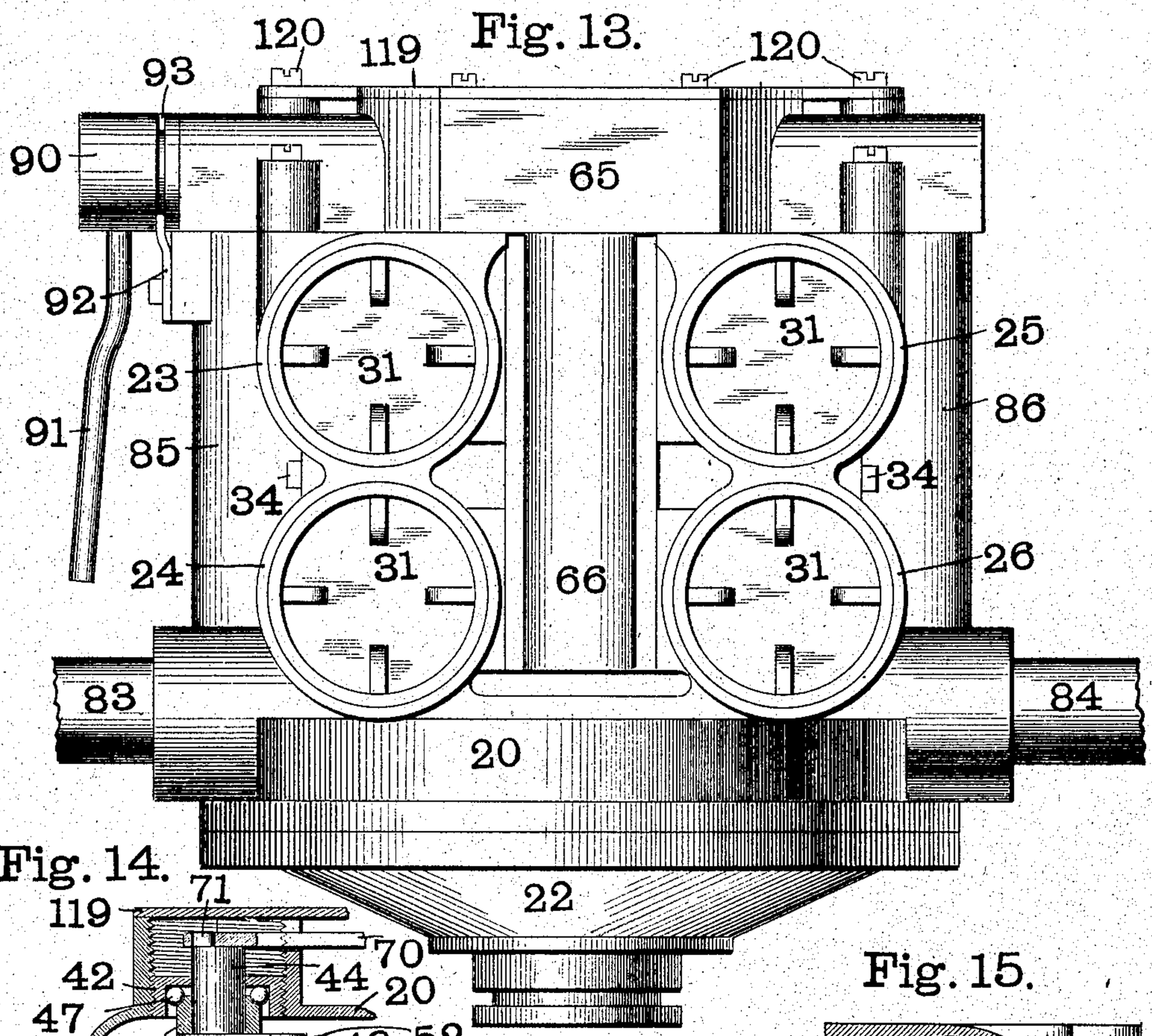
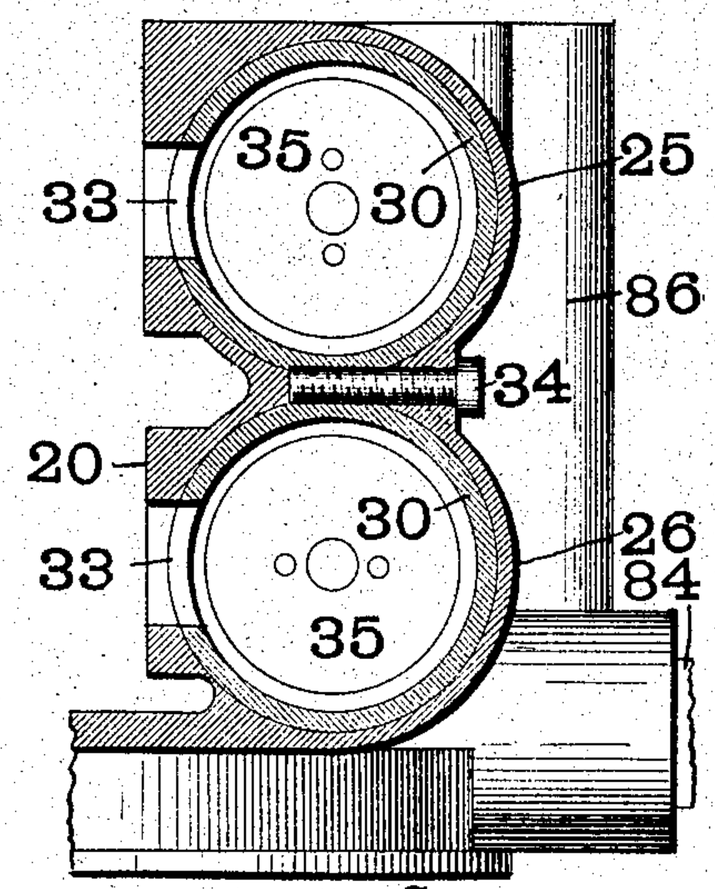


Fig. 14.

Fig. 15.



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No. 791,847. Patented June 6, 1905.

UNITED STATES PATENT OFFICE.

JAMES WHITELAW, OF ST. LOUIS, MISSOURI.

PNEUMATIC DRILL.

SPECIFICATION forming part of Letters Patent No. 791,847, dated June 6, 1905.

Application filed September 26, 1903. Renewed November 3, 1904. Serial No. 231,203.

To all whom it may concern:

Be it known that I, JAMES WHITELAW, a citizen of the United States, residing at the city of St. Louis, in the State of Missouri, have invented a certain new and useful Fluid-Motor for Drills or the Like, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates more particularly to fluid-motors for drills or the like. It may, however, be applied to fluid-motors for various other purposes.

The object of my invention is to provide a fluid-motor for drills or the like which will be compact and at the same time efficient and reliable in operation.

My invention consists in part in the combination with a housing containing cylinders, of pistons in said cylinders, mechanisms for transmitting the power from said pistons, and a removable valve-casing carried by said housing and extending between said cylinders to supply fluid thereto.

My invention also consists in various other novel features and details of construction, all of which will be described in the following specification and pointed out in the claims affixed hereto.

In the accompanying drawings, which illustrate one form of drill made in accordance with my invention, Figure 1 is a top plan view, the top plate being removed. Fig. 2 is an enlarged isometric projection of one of the valves. Fig. 3 is a section on the line 3 3 of Fig. 2. Fig. 4 is a horizontal section on the line 4 4 of Fig. 8. Fig. 5 is a vertical section of one of the valves. Fig. 6 is a side elevation on a reduced scale. Fig. 7 is a section on the line 7 7 of Fig. 8. Fig. 8 is a section on the line 8 8 of Fig. 4. Fig. 9 is a section on the line 9 9 of Fig. 8. Fig. 10 is an isometric projection of the valve-casing. Fig. 11 is a longitudinal section of the reversing-valve. Fig. 12 is a section on the line 12 12 of Fig. 8. Fig. 13 is an end elevation. Fig. 14 is a sectional view on a reduced scale, showing one of the crank-shafts; and Fig. 15 is a section showing the detail construction.

Like marks of reference refer to similar parts in the several views of the drawings.

The housing of the drill consists of three parts—a main or body part 20, an end cap 21, covering the crank-shafts, and a bottom cap 22, covering the gearing. Formed in the main part of the housing are four cylinders 23, 24, 25, and 26, respectively. These cylinders are arranged in two pairs, the cylinders 23 and 24 being at one side of the drill and the cylinders 25 and 26 at the opposite side thereof. The forward end of each of the cylinders is provided with a shoulder 27, against which rests the end of a lining 28. Resting against the rear end of each of the linings 28 is a disk 29, forming a partition to divide the cylinder into two parts. Resting against each of the partitions 29 is a second lining 30. These linings, together with the partition 29, are held in position by a threaded cap 31 screwing into the end of the cylinder and bearing against the rear end of the walls 30.

Formed in each of the linings 30 and in the adjacent metal of the housing 20 are two ports 32 and 33, respectively, for supplying the fluid to the rear chamber of the cylinder and exhausting the same therefrom. The linings 30 are prevented from turning by means of screws 34, placed in each side of the housing 20 and engaging with the linings 30, as shown in Figs. 6 and 15. In the rear chamber of each of the cylinders 23, 24, 25, and 26 is a piston 35, which is secured to a piston-rod 36, passing through a central opening in the partition 29. The forward end of each of the piston-rods 36 is provided with a slotted head 37, in which is pivoted one end of a pitman-rod 38. Each of the heads 37 is surrounded by a sleeve 39, secured to the said head by the pin 40, which pivots the pitman-rod 38 to the head. These sleeves 39 form guides for the pistons 35. The opposite end of each of the pitman-rods 38 is provided with an annular member 41.

Between the main part of the housing 20 and the end cap 21 are placed threaded cups 42, which form the outer members of ball-bearings for the crank-shafts. The upper part of

each of the crank-shafts consists of an arm 43, provided with an upwardly-projecting pin 44 and a downwardly-projecting bolt 45. Surrounding the pin 44 is a collar 46. Between this collar 46 and the cup 42, hereinbefore described, are placed antifriction-balls 47. Surrounding the bolt 45 is a hardened collar 48. Between this collar 48 and the annular member 41, hereinbefore described, are placed antifriction-balls 49. The central portion of the crank-shaft is formed by an arm 50, having oppositely-projecting shoulders 51. Each of these shoulders 51, as well as the arm 43, is provided with grooves 52, which engage with tongues 53, formed on the collars 48. The arm 50 is held in position on the bolt 45 by means of a nut 54. The lower end of the crank-shaft is composed of parts similar to those described. The pin 44 of the lower arm 43 is, however, of greater length than the upper pin 44 and has keyed to it a gear-wheel 55. The two gear-wheels 55 mesh with a gear-wheel 56, which is rigidly secured to a smaller gear-wheel 57. These gear-wheels 56 and 57 are loosely mounted upon a pin 58, secured in the main housing 20. The gear-wheel 57 meshes with a master-wheel 59. This master-wheel 59 is arranged to drive the drill or other tool. As the manner of supporting the master-wheel 59 is the same as that shown and described in my prior application, Serial No. 139,879, filed January 21, 1903, the same will not be particularly described.

65 is a valve-casing which is provided with a downwardly-projecting portion 66, which projects into an opening in the housing 20 between the cylinders 23 and 24 and the cylinders 25 and 26. In the casing 65 are two oscillating valves 67 and 68. The valve 67 controls the supply and exhaust to and from the cylinders 23 and 24, and the valve 68 controls the supply and exhaust to and from the cylinders 25 and 26. Secured to the upper end of each of the valves 67 and 68 is a short arm 69, which is connected, by means of a rod 70, with an eccentric-pin 71, formed on the pin 44 of one of the crank-shafts. Each of the valves 67 and 68 is provided with a central opening 72. These central openings 72 communicate by passages 73 with an annular depression 74 in the upper part of the valve. Below the annular depression 74 is a port 75, communicating with the said central port 72. Opposite the port 75 is a corresponding longitudinal depression 76, which communicates with the port 75 by an opening 77, so as to equalize the pressure on the two sides of the valve. At each side of the port 75 is a cut-away portion 78, forming external ports. These ports 78 extend down farther than the ports 75 for the purpose hereinafter to be described. The lower end of the internal ports 72 is bifurcated, as best shown in Fig. 8, and communicates with cut-away portions 80, forming external ports in the lower end of the valve. These ports 80 are connected by an opening 81 to equalize the pressure on the sides of the valve and to increase the capacity of the ports. Between the ports 80 is a port 82, the sides of which are inclined downwardly and overlap the ports 78, as best shown in Fig. 5.

83 and 84 are handles. The handle 83 serves as a supply-passage and the handle 84 as an exhaust-passage. Leading from the handle 83 is an upwardly-extending passage 85, and leading to the handle 84 is a downwardly-extending passage 86. These passages 85 and 86 are preferably formed in the main casing 20. These passages 85 and 86 communicate with openings 87 and 88, respectively, formed in lateral extensions of the valve-casing 65. These openings 87 and 88 communicate with a passage 89 in said valve-casing. Within this passage 89 is the reversing-valve 90. The reversing-valve 90 is provided with a handle 91, by means of which it is operated, and it is held in position in the passage 89 by means of a spring-detent 92, which enters an annular groove 93 in the projecting end of said valve. Formed in the reversing-valve 90 are two ports 94 and 95. These ports 94 and 95 are adapted to communicate with the ends of a U-shaped port 96 in the upper part of the valve-casing 65. The port 94 is in communication with one end of this port 96, as shown in Fig. 12, when the motor is running in one direction, while the port 95 is in communication with said other end of the said port 96 when the motor is running in the opposite direction. The outer end of the valve 90 is provided with two openings 97, one of which is in communication with the opening 87 when the motor is running in one direction and the other being in communication with said opening when the motor is running in the other direction.

98 and 99 are two oppositely-disposed openings in the valve 90. These openings 98 and 99 are separated by an inclined partition 100, as best shown in Fig. 11, so that the opening 98 communicates with the outer end of the reversing-valve and the opening 99 communicates with the inner end of said valve. These openings 98 and 99 are adapted to be brought into communication with a downwardly-extending port 101 in the valve-casing 65. This downwardly-extending port 101 communicates, by means of a cross-port 102, with grooves 103 in the downwardly-projecting portion 66 of the valve-casing. The grooves 103 are provided with ports 104, communicating with the annular depression 74 in the valve 67, and with ports 105, communicating with the annular depression 74 of the valve 68.

The ports 75 and 78 of the valve 67 are adapted to communicate with ports 106 and 107, formed in the side of the valve-casing 65, while the ports 80 and 82 of said valve communicate with similar ports 108 and 109.

The ports 106 and 107 in turn communicate with the ports 32 and 33 of the cylinder 23, and the ports 108 and 109 communicate with the ports 32 and 33 of the cylinder 24. The corresponding ports of the valve 68 communicate with corresponding ports formed in the opposite side of the valve-casing 65, and these ports in turn communicate with the ports 32 and 33 of the cylinders 25 and 26. The overlapping ports 78 and 82 of the valves 67 and 68 communicate with a chamber 110 in the valve-casing 65. This chamber 110 in turn communicates, by means of port 111, with the U-shaped port 96 hereinbefore described.

The valve-casing 65 is provided with a threaded opening 115, in which is a threaded stem 116. This stem 116 is provided with a handle or star-wheel 117, by means of which it is rotated, and is provided on its upper end with a conical bearing 118. The stem 116 is used to feed the drill in the usual manner. The upper part of the drill is covered by a plate 119, which is secured in position by means of screws 120. These screws 120 also aid in holding the valve-casing 65 in position.

The operation of my drill is as follows: Supposing the reversing-valve 90 to be in position shown in Fig. 12, the air or other fluid passes in through the handle 83 and thence up through the passage 85 and one of the ports 97 into the end of the reversing-valve 90. It then passes down through the opening 98 in said valve and ports 101 and 102 in the valve-casing into the grooves 103. From the groove 103 it passes through the passage 104 into the annular depression 74 of the valve 67 and thence through the passage 73 into the port 72. Passing down through the port 72 it is fed through the port 75 into one of the ports 106 or 107 of the cylinder 23, and at the same time the steam will be exhausted from the other of said ports 106 and 107 through one of the ports 78 and thence through the chamber 110, passage 111, and port 96 and port 94 into the passage end of the reversing-valve 90 and thence down through the opening 88 to passage 86 to the handle 84, from which it is exhausted. At the same time the air will pass down through the bifurcated end of the passage 72 and through one of the ports 80 and the port 108 or 109 into one end of the lower cylinder 24, while at the same time the air from the opposite end of said cylinder will pass out through the other of said ports 108 or 109 and the port 82 into the chamber 110, where it will be exhausted, as before described. The valve 68 in the same manner controls the supply and exhaust to the cylinders 25 and 26. When it is desired to reverse the direction of the drill, the handle 91 is grasped, and the valve 90 is rotated through one-half revolution, so that the port 94 will be brought into communication with the port 96 and the port 99 with the port 101. The supply and exhaust will thus be reversed, and the drill will run in the opposite direction.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a fluid-motor, a housing containing cylinders and provided with flat contact-surfaces, pistons in said cylinders, mechanism for transmitting the power from said pistons, a gear-casing carried by said housing, and a removable valve-casing carried by said housing and extending between said cylinders to supply fluid thereto, said valve-casing being provided with flat contact-surfaces coöperating with the contact-surfaces of said housing.

2. In a fluid-motor, a housing consisting of two parts each containing a cylinder and each provided with a flat contact-surface, and a removable valve-casing between said parts and provided with flat contact-surfaces coöperating with the contact-surfaces of said housing, said parts being connected by a gear-casing.

3. In a fluid-motor, a housing consisting of two parts integral with each other and separated by a passage forming flat contact-surfaces, each of said parts containing a cylinder, pistons in said cylinders, and a removable valve-casing carried by said housing and projecting into said passage, said valve-casing being provided with flat contact-surfaces coöperating with the contact-surfaces of said housing.

4. In a fluid-motor, a housing containing cylinders and provided with flat contact-surfaces, pistons in said cylinders, mechanism for transmitting the power from said pistons, a gear-casing carried by said housing, and a removable valve-casing carried by said housing and extending between said cylinders, said valve-casing being provided with flat contact-surfaces having recesses coöperating with the contact-surfaces of said housing to form ports for said cylinders.

5. In a fluid-motor, a housing consisting of two parts each containing a cylinder and each provided with a contact-surface, and a removable valve-casing carried by said parts, said valve-casing being provided with flat contact-surfaces having recesses coöperating with the contact-surfaces of said housing to form ports for said cylinders, the parts of said housing being connected by a gear-casing.

6. In a fluid-motor, a housing consisting of two parts integral with each other and separated by a passage forming flat contact-surfaces, a cylinder in each of said parts, and a removable valve-casing carried by said housing and projecting into said passage, said valve-casing being provided with flat contact-surfaces having recesses coöperating with the contact-surfaces of said housing to form ports for said cylinders.

7. In a fluid-motor, a housing containing two pairs of cylinders, pistons in said cylinders, mechanism for transmitting the power

from said pistons, a removable valve-casing carried by said housing and intruding between said pairs of cylinders, and two valves in said casing, each controlling the supply of fluid to and exhaust thereof from one pair of cylinders.

8. In a fluid-motor, a housing containing cylinders, pistons in said cylinders, mechanism for transmitting power from said cylinders, a removable valve-casing carried by said housing and intruding between said cylinders, valves in said casing, and connections between said power-transmitting mechanism and said valves for actuating the latter.

9. In a fluid-motor, a housing containing two pairs of cylinders, pistons in said cylinders, mechanism for transmitting the power from said pistons and a removable valve-casing carried by said housing and intruding between said pairs of cylinders, two valves in said casing, each controlling the supply of fluid to and exhaust thereof from one pair of cylinders, and connections between said power-transmitting mechanism and valves for actuating the latter.

10. In a fluid-motor, a housing consisting of two cylinders and a gear-casing formed integral with one another and provided with a pair of flat contact-surfaces, and a removable valve-casing carried by said housing and intruding between said cylinders, said valve-casing being provided with a pair of contact-surfaces coöperating with the contact-surfaces of said first-named part.

11. In a fluid-motor, two cylinders, pistons in said cylinders, mechanism for transmitting the power from said pistons, an oscillating valve for each cylinder, each of said valves having an internal port and two external ports, and means for actuating said valves to place each end of the cylinders alternately in communication with the supply and exhaust.

12. In a fluid-motor, two cylinders, pistons in said cylinders, mechanism for transmitting the power from said pistons, an oscillating valve for each cylinder, each of said valves having an internal port communicating with the supply, and two external ports communicating with the exhaust, means for actuating said valves to place each end of the cylinders alternately in communication with the supply and exhaust, and means for reversing the supply and exhaust.

13. In a fluid-motor, a pair of cylinders, pistons in said cylinders, mechanism for transmitting the power from said pistons, an oscillating valve for said cylinders, said valve having a supply and two exhaust ports for one cylinder, and an exhaust and two supply ports for the other cylinder, and means for actuating said valve.

14. In a fluid-motor, a pair of cylinders, pistons in said cylinders, mechanism for transmitting the power from said pistons, an oscillating valve for said cylinders, said valve having a supply and two exhaust ports for one cylinder, and an exhaust and two supply ports for the other cylinder, means for actuating said valve, and means for reversing the supply and exhaust.

15. In a fluid-motor, a pair of cylinders, pistons in said cylinders, mechanism for transmitting the power from said pistons, an oscillating valve for said cylinders, said valve having an internal supply and two external exhaust ports for one cylinder and an internal exhaust and two external supply ports for the other cylinder, and means for actuating said valve.

16. In a fluid-motor, a pair of cylinders, pistons in said cylinders, mechanism for transmitting power from said pistons, an oscillating valve for said cylinders, said valve having an internal supply and two external exhaust ports for one cylinder, and an internal exhaust and two external supply ports for the other of said cylinders, means for actuating said valves, and means for reversing the supply and exhaust.

17. In a fluid-motor, two pairs of cylinders, pistons in said cylinders, mechanism for transmitting the power from said pistons, two oscillating valves, each of said valves having a supply and two exhaust ports for one cylinder and an exhaust and two supply ports for another cylinder, means for actuating said valves, and means for reversing the supply and exhaust.

18. In a fluid-motor, a housing containing cylinders, a removable valve-casing consisting of two parts one of which projects between said cylinders and the other of which bears on said casing, a controlling valve or valves in the first-named part of said casing, and a reversing-valve in the second-named part of said casing.

In testimony whereof I have hereunto set my hand and affixed my seal in the presence of the two subscribing witnesses.

JAMES WHITELAW. [L. S.]

Witnesses:

JOHN G. LEWIS,

J. H. BRYSON.