No. 743,615. PATENTED NOV. 10, 1903.

A. B. BROWN.

REVERSING VALVE GEAR.

APPLICATION FILED APR. 20, 1903.

NO MODEL. 5 SHEETS—SHEET 1.

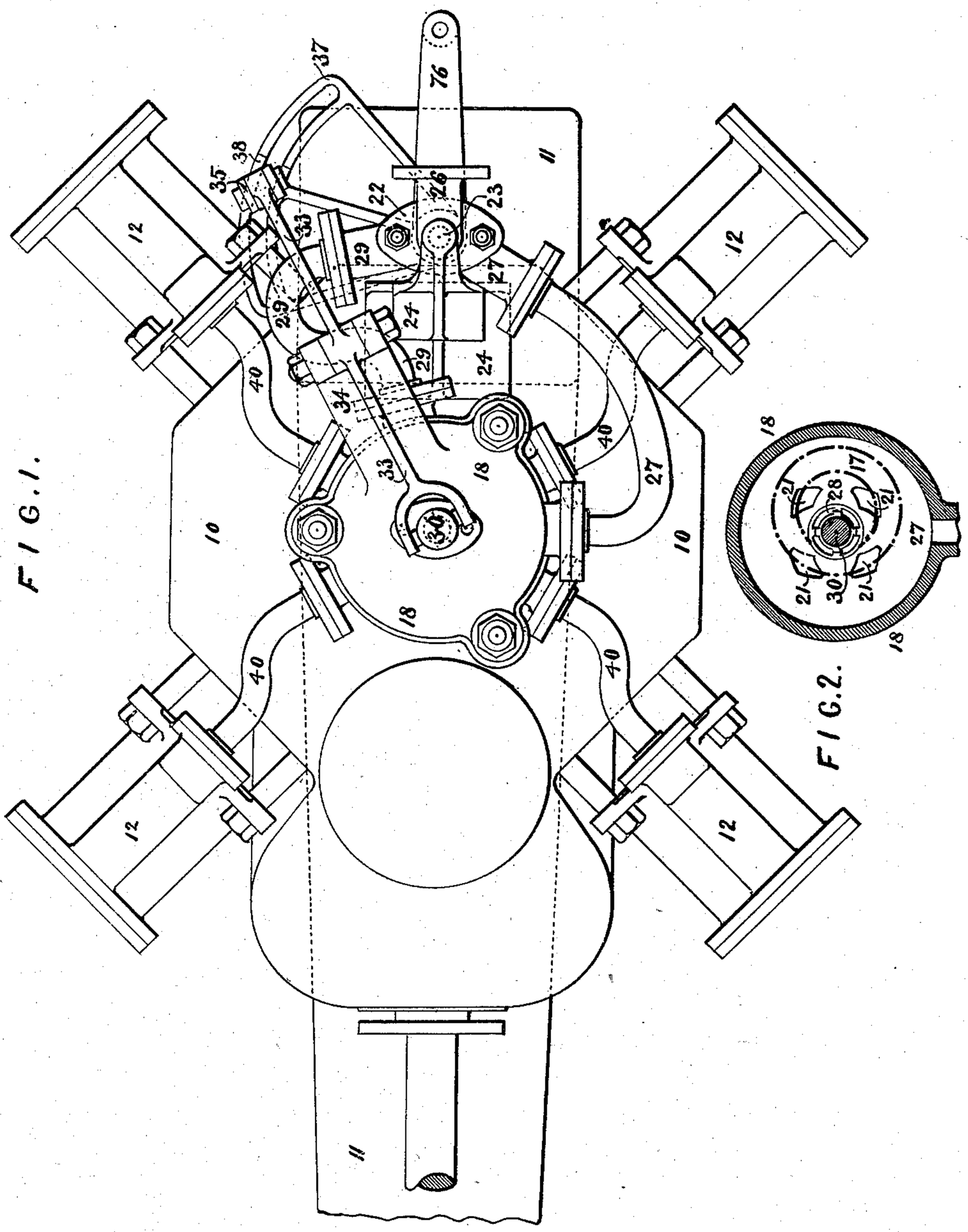

FIG. 1.

FIG. 2.

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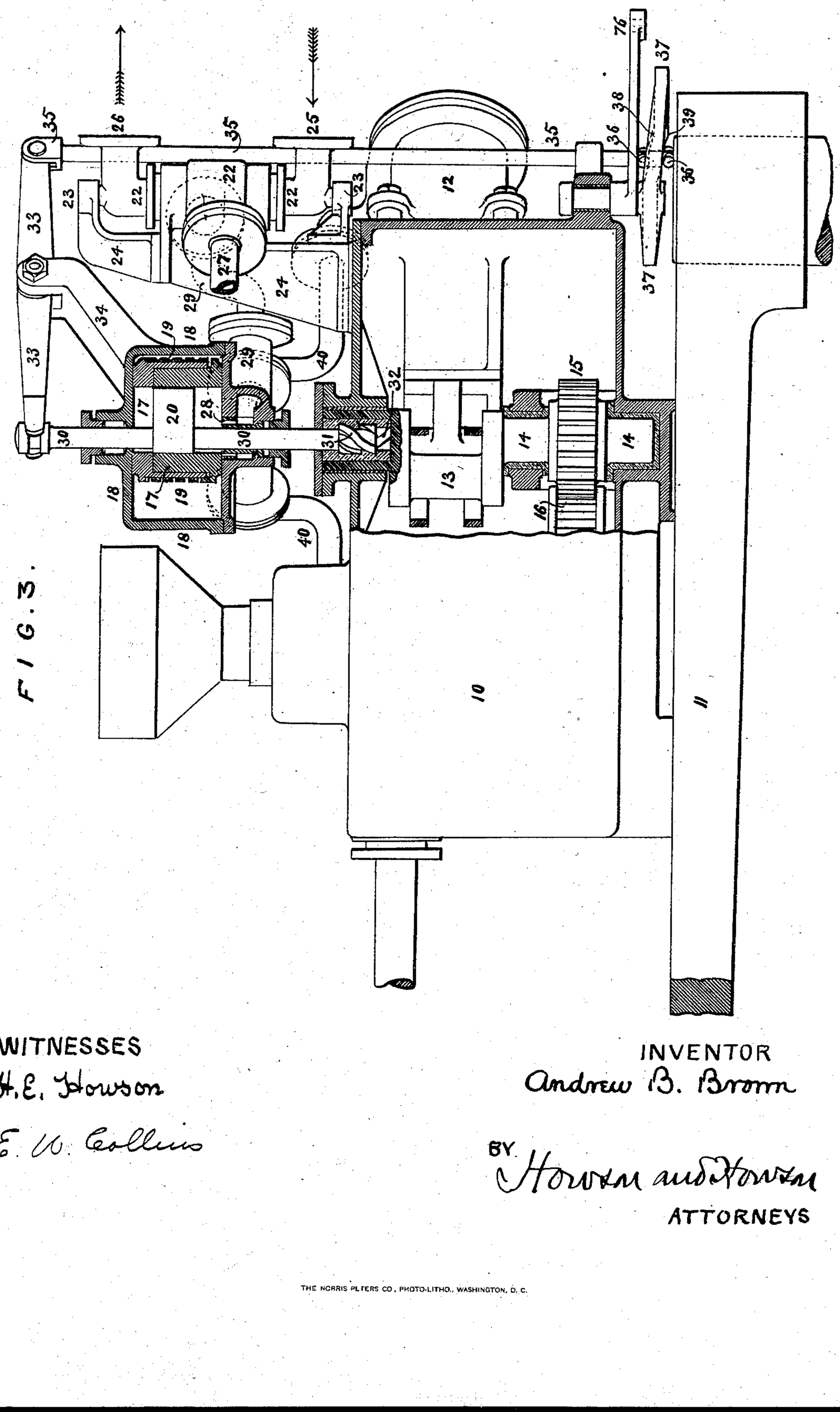
NO MODEL. 5 SHEETS—SHEET 2.

FIG. 3.



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NO MODEL. 5 SHEETS—SHEET 3.

FIG. 4.

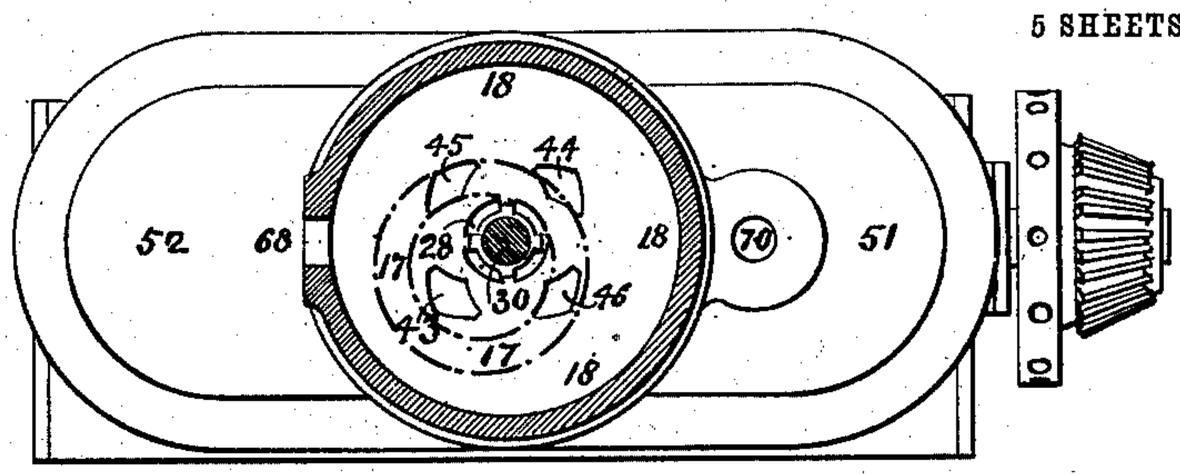
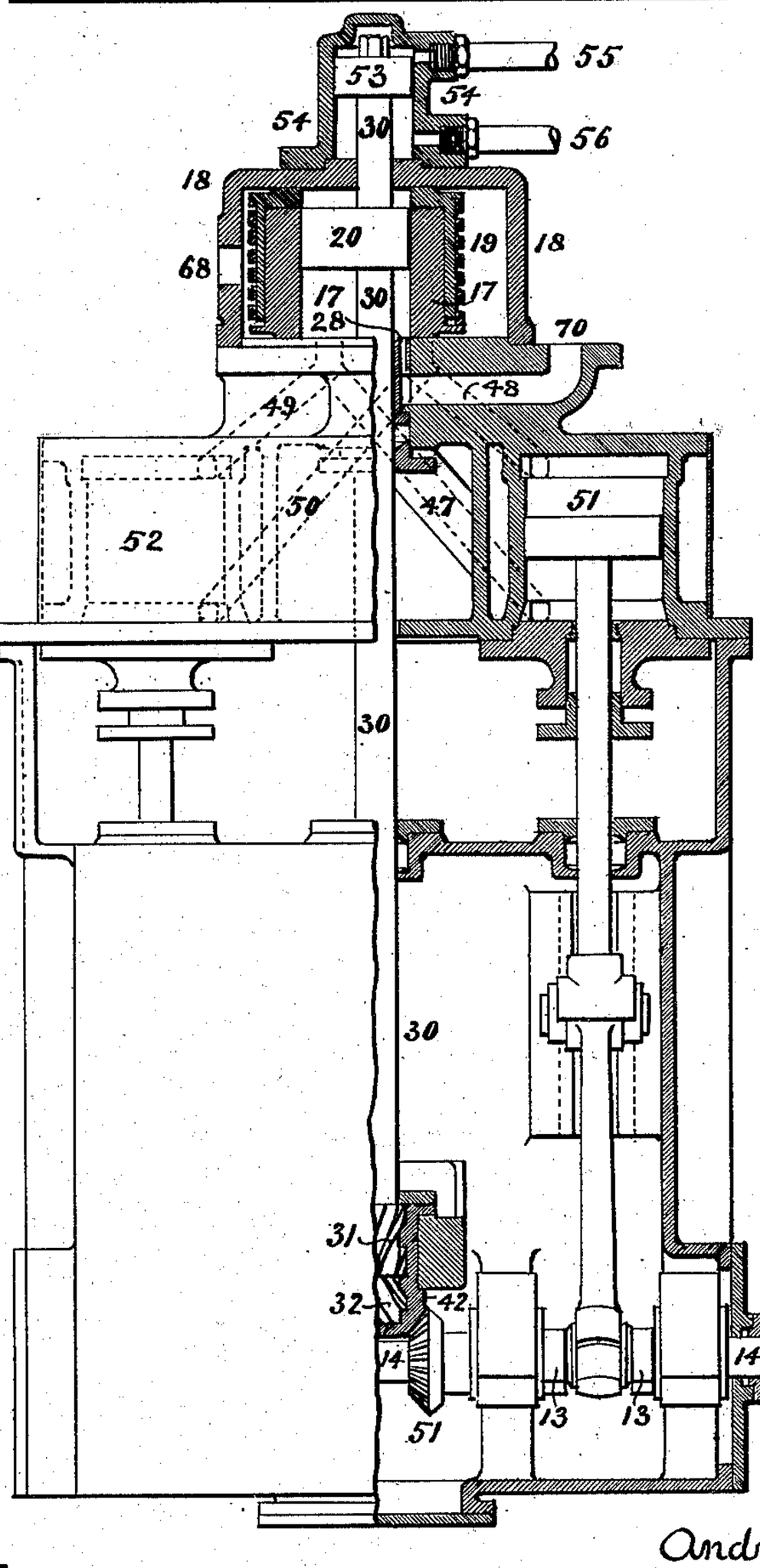


FIG. 5.



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NO MODEL. 5 SHEETS—SHEET 4.

FIG. 6.

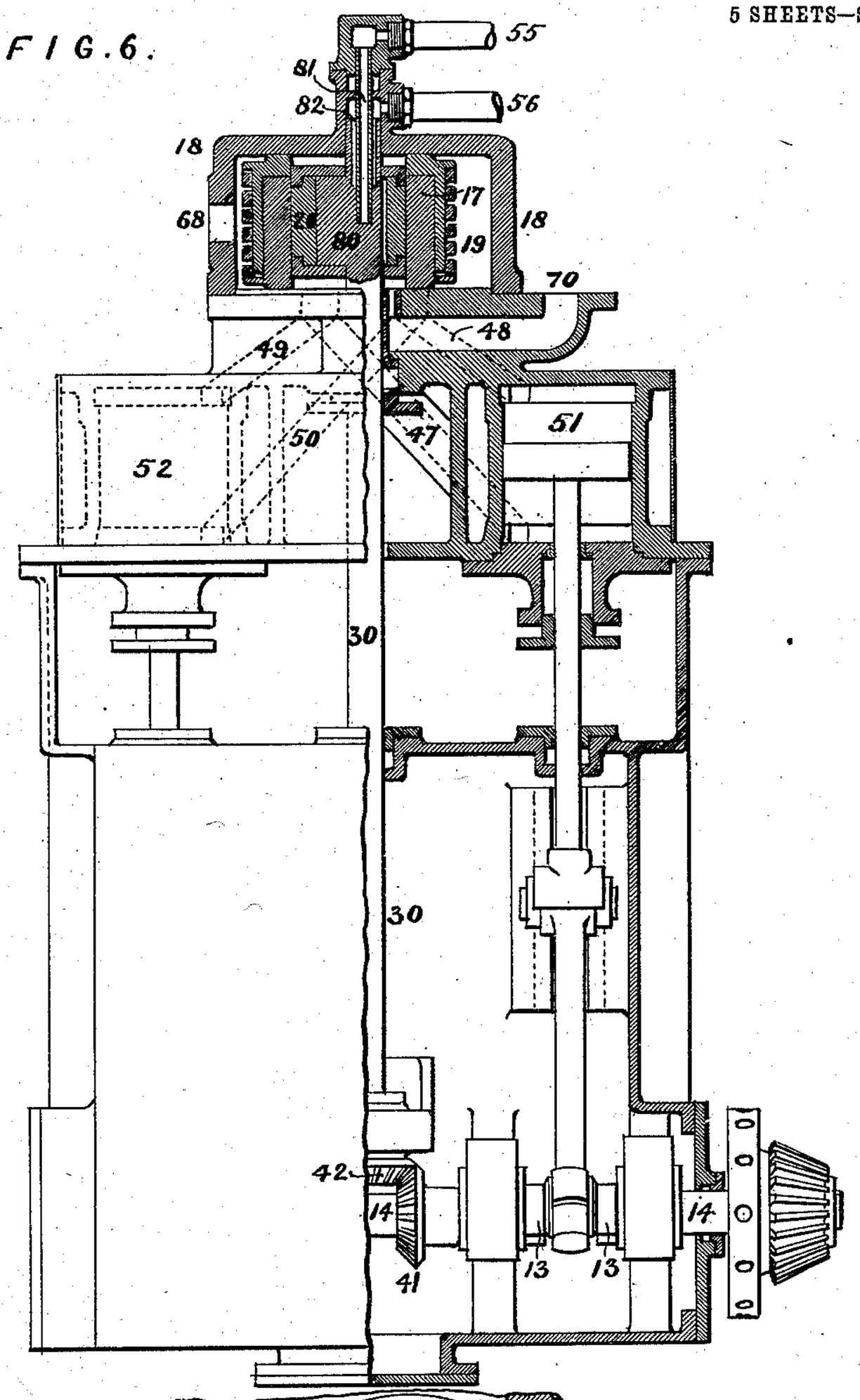
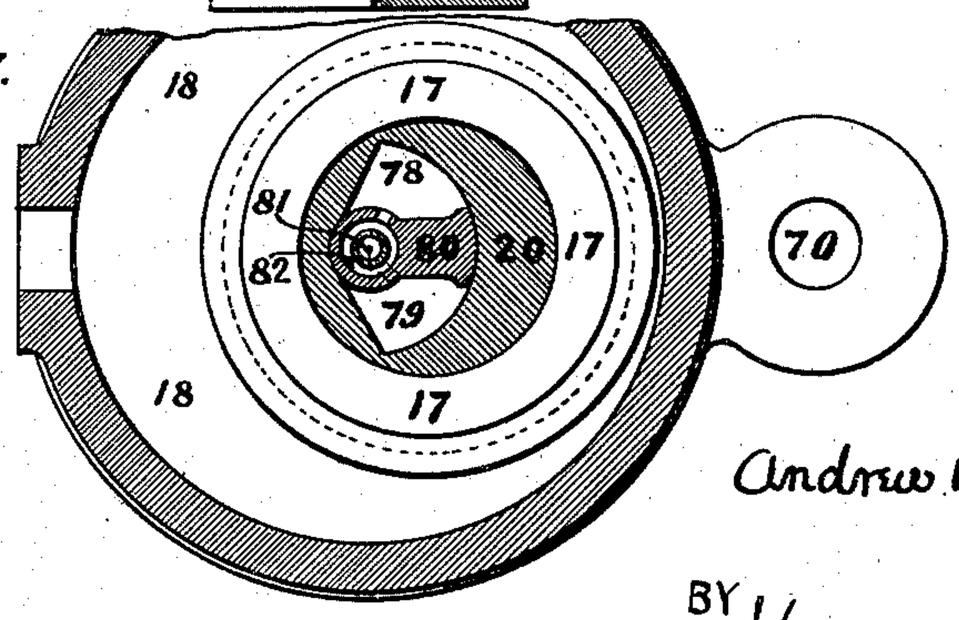


FIG. 7.



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NO MODEL. 5 SHEETS—SHEET 5.

FIG. 8

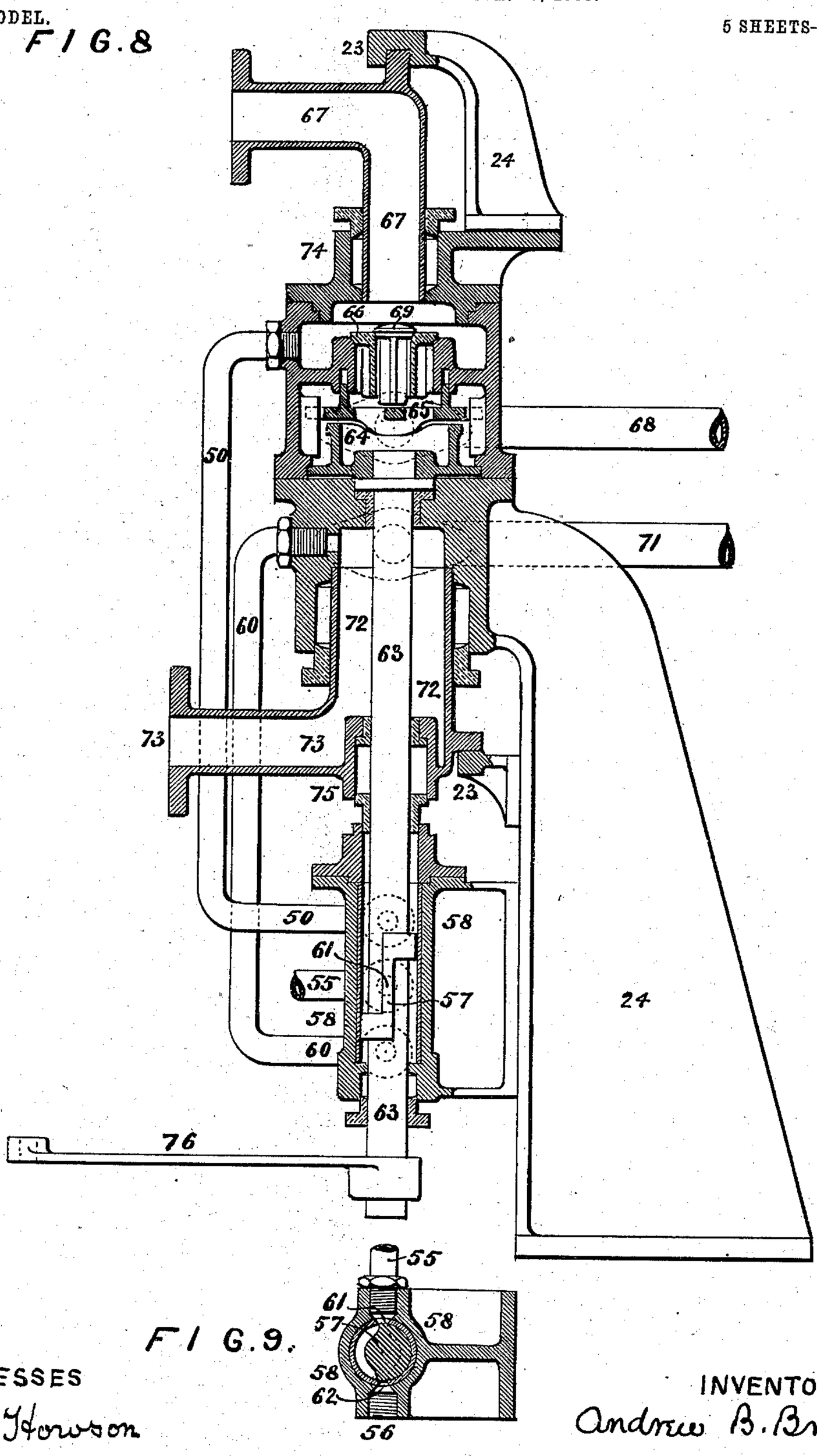

FIG. 9.

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No. 743,615. Patented November 10, 1903.

UNITED STATES PATENT OFFICE.

ANDREW B. BROWN, OF EDINBURGH, SCOTLAND.

REVERSING-VALVE GEAR.

SPECIFICATION forming part of Letters Patent No. 743,615, dated November 10, 1903.

Application filed April 20, 1903. Serial No. 153,528. (No model.)

To all whom it may concern:

Be it known that I, ANDREW BETTS BROWN, a subject of the King of Great Britain and Ireland, and a resident of Edinburgh, in the county of Mid-Lothian, Scotland, (whose postal address is Rosebank Iron Works, Edinburgh, Scotland,) have invented certain new and useful Improvements in Reversing-Valve Gear, (for which I have applied for a British patent, No. 3,799, dated February 18, 1903,) of which the following is a specification.

My said invention relates to reversing-valve gear for steam-engines, and has for its object to improve and simplify the construction and operation of such gear.

In carrying out my invention I provide a steam-distribution valve which controls the admission of steam to the cylinder or cylinders of an engine, which may be of any suitable known form. The steam-distribution valve is annular in form and is moved over the steam-distribution ports by an eccentric within it. This eccentric is driven from the crank-shaft of the engine, and means are provided so that the angular position of the eccentric relative to the crank-shaft can be varied when desired in order to effect the change of relative position of the annular steam-distribution valve necessary to alter the direction of rotation of the crank-shaft of the engine.

My improvements are shown on five sheets of accompanying drawings, to be hereinafter referred to.

Figure 1 is a plan, Fig. 2 a horizontal section of a detail, and Fig. 3 a sectional elevation, showing the application of my improvements in connection with a steering-engine. Figs. 4 and 5, Sheet 3, are respectively a sectional plan and a sectional elevation showing a variation in the method of throwing the eccentric. Fig. 6 is a sectional elevation showing a third method of operating the eccentric, and Fig. 7 a horizontal section of a detail connected therewith. Fig. 8 is a vertical section of valves used in connection with the second and third arrangements, and Fig. 9 is a horizontal section of one of the valves.

In Figs. 1 to 3 my improvements are shown as applied to a steering-engine 10, carried on a tiller 11, the engine having four single-acting cylinders 12, the pistons of which are operatively connected to a single crank 13 on a vertical shaft 14, the inner ends of the cylinders being open to the atmosphere. A spur-wheel 15 on the engine-shaft 14 gears with a spur-wheel 16, forming part of gearing (not shown) carried on the tiller 11 and engaging a fixed rack or toothed quadrant (not shown) more or less in the manner described in the specifications of some of my earlier patents—for instance, Nos. 659,128, 669,230, and 707,382. In carrying out my present invention I provide a steam-distribution valve 17, which is annular in form, being also made in two parts pressed outward against the ends of the chamber 18, within which it works, by a spring 19. The valve 17 is moved, as hereinafter described, by an eccentric 20 within it over steam-distribution ports 21, Fig. 2, in the bottom of the chamber 18, the ports being connected by pipes 40 with the cylinders 12. A pipe 22, carried in trunnions 23 on a bracket 24 on the engine-frame, is made with steam inlet and exhaust passages 25 26, the inlet 25 communicating by a pipe 27 with the space in the chamber 18 outside the annular valve 17, so that that space is always under steam-pressure. The space within the annular valve 17 is, on the other hand, always in communication with the exhaust 26 by a central exhaust-port 28 and a pipe 29, leading from such port 28 to the exhaust 26 in the trunnion-pipe 22. The eccentric 20 is carried on a shaft 30 coaxial with the crank-shaft 14. The shaft 30 has formed on one end of it a helix 31, Fig. 3, gearing with a nut or internal helix 32, carried in the end of the crank-shaft 14. Upon the eccentric-shaft 30 being moved endwise, as hereinafter described, it will through the helix 31 and nut 32 be rotated relatively to the crank-shaft 14, as is required to effect the change of position of the valve 17 necessary to alter the direction of rotation of the engine. The engine is so set that when running it tends to keep (depending on the direction in which it is running) one or other end of the helix 31 up against one or other end of the nut 32 and the eccentric-shaft 30 will remain in the same

position relatively to the crank 13 while both are rotating. The endwise movement of the helix 31 is in this modification effected by connecting the upper end of the eccentric-shaft 30 to one end of a lever 33, centered in a bracket 34 in the engine-framing, the other end of this lever being connected to a rod 35, having a jaw 36 on its lower end engaging a cam 37, actuated by a telemotor-lever 76. On the movement of the cam in either direction it raises or lowers the rod 35 by means of the inclined parts 38 39 engaging the jaw 36, and thus shifts the eccentric in either direction from the mid-position in which it is shown through the action of the nut 32 and helix 31, as hereinbefore described. This starts the engine to run in one or other direction, and the movement of the tiller thereby brought about through the gearing hereinbefore referred to brings back the parts to the mid-position in the well-known manner. In some cases the lever 33 can be actuated by hand.

In the modification shown in Figs. 4 and 5 my improvements are shown as applied to a stationary two-cylinder double-acting vertical engine having cranks at right angles to each other, only one, 13, of which is shown. In this modification the eccentric-shaft 30 is at right angles to and driven from the crank-shaft 14 by a pair of bevel-wheels 41 42, the latter carrying the nut 32, in which works the helix 31 on the lower end of the vertical shaft 30, carrying the eccentric 20. The distribution-ports 43 44 45 46, over which the annular distribution-valve 17 works within the chamber 18, communicate by passages 47 48 49 50 with the ends of the cylinders 51 52, and, as in the preceding modification, the space in the chamber 18 outside the valve 17 is always under steam-pressure, while the space within the valve is always in communication with the exhaust 28. The helix 31 is shown at the upper end of the nut 32 and the eccentric 20 therefore fully thrown to cause the engine to rotate in the one direction, the piston in the cylinder 51 being at mid-stroke and the ports 43 44, respectively, exhausting from and admitting steam to that cylinder by the passages 47 48, respectively, while the piston in the cylinder 52 is at the end of the stroke, the ports 45 46 being covered by the annular valve 17. The upper end of the eccentric-shaft 30 carries a piston 53, working in a cylinder 54, which receives steam or other motive fluid from a valve or valves worked by a telemotor arrangement or by hand and connected up by pipes 55 56 to each end of the cylinder 54, so that on steam being admitted to either end of this cylinder the eccentric-shaft 30 is moved on end and the eccentric 20 and annular valve 17 is thrown by the helix 31 and nut 32, as hereinbefore described. The form of valve I may use for controlling the supply of steam to the cylinder 54 is preferably of the semi-rotatory type. (Shown at 57 in Figs. 8 and 9.) This valve 57 works in a casing 58, having a steam-supply pipe 59 connected at one end and an exhaust-pipe 60 connected to its other end, the valve 57 controlling two openings 61 62 from the casing 58, to which openings the pipes 55 56, leading to the cylinder 54, are connected. On turning the telemotor-lever 76 on the end of the valve-spindle 63 the valve 57 will be turned, so that steam will pass at once through either the opening 61 or 62 and the pipe 55 or 56 to either the top or bottom side of the piston 53 in the cylinder 54, depending on the direction in which the lever 76 is turned. At the same time the steam then on the opposite side of the piston 53 will pass by the other one of the two pipes 55 or 56 back through either the opening 61 or 62 into the casing 58 and escape from thence by the exhaust-pipe 60. The valve-spindle 63 passes upward through the casing 58 and has inclines 64, carried on a disk on its upper end, which inclines can act on counterpart inclines on the under side of an annular disk 65, so carried beneath a steam stop-valve 66 that when the spindle 63 is turned from mid-position in which it is shown the inclines 64 will raise the disk 65 and cause it to lift the steam stop-valve 66. This allows steam entering by a pipe 67 to pass by a pipe 68 to the casing 18, in which the annular distribution-valve 17 works, after that valve has been thrown fully in either direction, as hereinbefore described. The stop-valve 66 is shown as being fitted with a small valve 69 in its center, which is first opened to relieve the pressure before the larger main stop-valve 66 is lifted. The exhaust from the port 28 within the annular distribution-valve 17 passes by a passage 70, Fig. 5, and pipe 71, Fig. 8, connected therewith, to a chamber 72 having an outlet 73. When the engine described in this modification is arranged as a steering-engine on a tiller, as in the first modification hereinbefore described, the parts shown in Figs. 8 and 9 are also carried on the tiller and the main steam inlet and exhaust pipes (not shown) are connected to the inlet and exhaust pipes 67 73, carried in trunnion-bearings 23 and provided with stuffing-boxes 74 75, as shown in Fig. 8; but if the valve apparatus is stationary the trunnion-bearings and stuffing-boxes 74 75 may be dispensed with and the lever 76 be actuated through any suitable known arrangement of floating lever, which, as is well understood, will bring the parts back to their middle or neutral position.

In the modification shown in Figs. 6 and 7 the engine is the same as that described with reference to Figs. 4 and 5; but instead of the eccentric 20 being movable on end and being thrown by the action of a helix and nut it does not move endwise, and it and the annular distribution-valve 17 are thrown as desired by forming a steam-chamber inside the eccentric 20 and dividing this chamber into two

compartments 78 79, Fig. 7, (drawn to a larger scale,) by a blade 80, carried on the eccentric-shaft 30, the latter being driven by bevel-gearing 41 42 from the engine-shaft 14, as in the previous modification hereinbefore described. A central passage 81 is formed leading into the compartment 79 on one side of the blade 80, and an annular passage 82 is also formed leading into the compartment 78 on the other side of the blade 80, and steam may be admitted to and allowed to escape from either of these compartments by these passages, being controlled by any suitable form of valve or valves, preferably such as is hereinbefore described with reference to Figs. 8 and 9. The steam acting on the side of the compartment to which it has been admitted forces that side away from the fixed blade 80. This brings the opposite side of the other compartment against the blade, and thus moves the eccentric 20 in a manner to cause it to throw the annular distribution-valve 17 as required to reverse the engine. As the eccentric or blade shaft 30 revolves with the engine-shaft 14, the parts will remain in the same relative position while rotating together with the blade 80 against one side or other of either compartment 78 or 79 of the steam-chamber within the eccentric 20, depending on which way steam has been admitted to the chamber.

What I claim as my invention is—

1. In reversing-valve gear, an annular steam-valve controlling the admission of steam to the engine-cylinders, a shaft, means for operating said shaft from the crank-shaft, an eccentric adapted to move said valve always in the same plane, said shaft and valve being adapted to be moved independent in direction, and means for changing the angular relation of the valve and crank-shaft, said means operating to produce said independent direction of movement of said shaft within the valve.

2. A reversing-valve gear for a steam-engine, comprising an annular steam-distributer valve adapted to control the admission of steam to the engine-cylinders, an eccentric within the valve adapted to operate said valve, a shaft to which said eccentric is secured, a crank-shaft and means adapted to move first said shaft therefrom, means for moving said eccentric and shaft longitudinally to vary the angular position of the valve relatively to the crank-shaft, substantially as described.

3. In reversing-valve gear, an annular steam-valve, controlling the admission of steam to the engine-cylinders, a shaft, means for operating said shaft from the crank-shaft, an eccentric adapted to move said valve always in the same plane, said shaft and valve being adapted to be moved independent in direction, and means for changing the angular relation of the valve and crank-shaft, said means operating to produce said independent direction of movement of said shaft within the valve, in combination with controlling means entering said valve-casing from the upper part and operatively connected with the eccentric whereby said controlling means are adapted to produce said angular relative position of said valve and shaft, substantially as described.

4. In reversing-valve gear, an annular steam-distribution valve controlling the admission of steam to the cylinders of an engine, an eccentric within the valve, a crank-shaft, a shaft carrying the eccentric movable on end and driven from the crank-shaft, and a nut and helix in the actuating-gearing, so that when the eccentric-shaft is moved on end the eccentric is rotated relatively to the crank-shaft, substantially as described.

5. In reversing-valve gear, an annular steam-distribution valve controlling the admission of steam to the cylinders of an engine, an eccentric within the valve, a crank-shaft, a shaft carrying the eccentric and driven from the crank-shaft, and means attached to the eccentric-shaft adapted to move it on end, telemotor apparatus to control said means, and means for throwing the eccentric when so moved, substantially as described.

6. In reversing-valve gear, an annular steam-distribution valve controlling the admission of steam to the cylinders of an engine, an eccentric within the valve, a crank-shaft, a shaft carrying the eccentric, a helix on the eccentric-shaft, a nut in the crank-shaft in which the helix works, means attached to the eccentric-shaft adapted to move it on end, and telemotor apparatus adapted to control said means, substantially as described.

7. In reversing-valve gear, an annular steam-distribution valve controlling the admission of steam to the cylinders of an engine, an eccentric within the valve, a crank-shaft, a shaft carrying the eccentric-gearing driving the eccentric-shaft from the crank-shaft, a helix on the eccentric-shaft, a nut in the gearing in which the helix works, a piston attached to the eccentric-shaft, a cylinder in which such piston works, and valve control for the admission of motive fluid to and the exhaust from such cylinder substantially as described.

8. In reversing-valve gear an annular steam-distribution valve, a chamber within which it works, distribution-ports in the chamber over which the valve moves, a peripheral steam-inlet and a central exhaust also in the chamber, an eccentric within the valve, a crank-shaft, a shaft carrying the eccentric, and driven from the crank-shaft, a piston attached to the eccentric-shaft, a cylinder in which such piston works, valve control for the admission of motive fluid to and exhaust from such cylinder so that the eccentric and its shaft can be moved on end, means for throwing the eccentric when so

moved, inclines on the spindle of the controlling-valve, a steam stop-valve actuated by such inclines and controlling the admission of steam to the chamber within which the annular steam-distribution valve works, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

A. B. BROWN. [L. S.]

Witnesses:
ALEXR. F. FRASER,
WILLIAM KERR STEEDMAN.