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PATENTED NOV. 27, 1906.

F. J. A. SCHNARRENDORF.
ENGINE.

APPLICATION FILED MAR. 22, 1906.

3 SHEETS—SHEET 1.

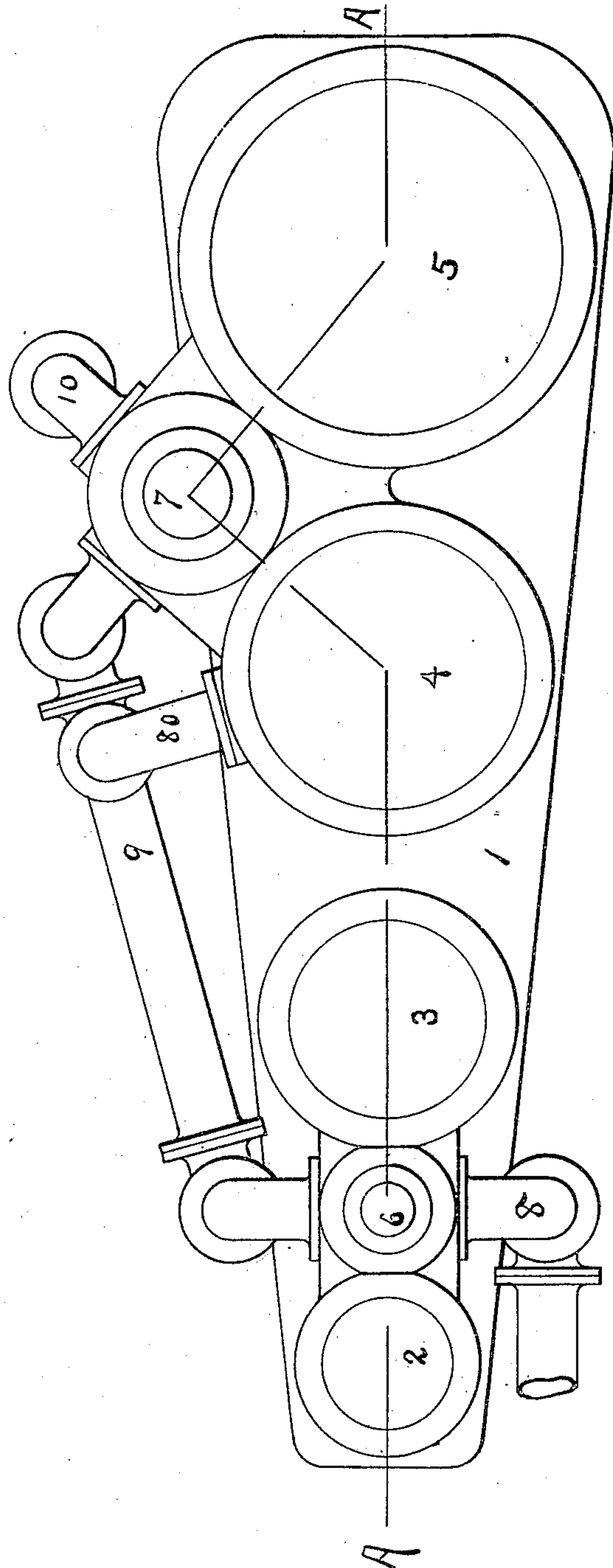


FIG. 1.

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Edward N. Page

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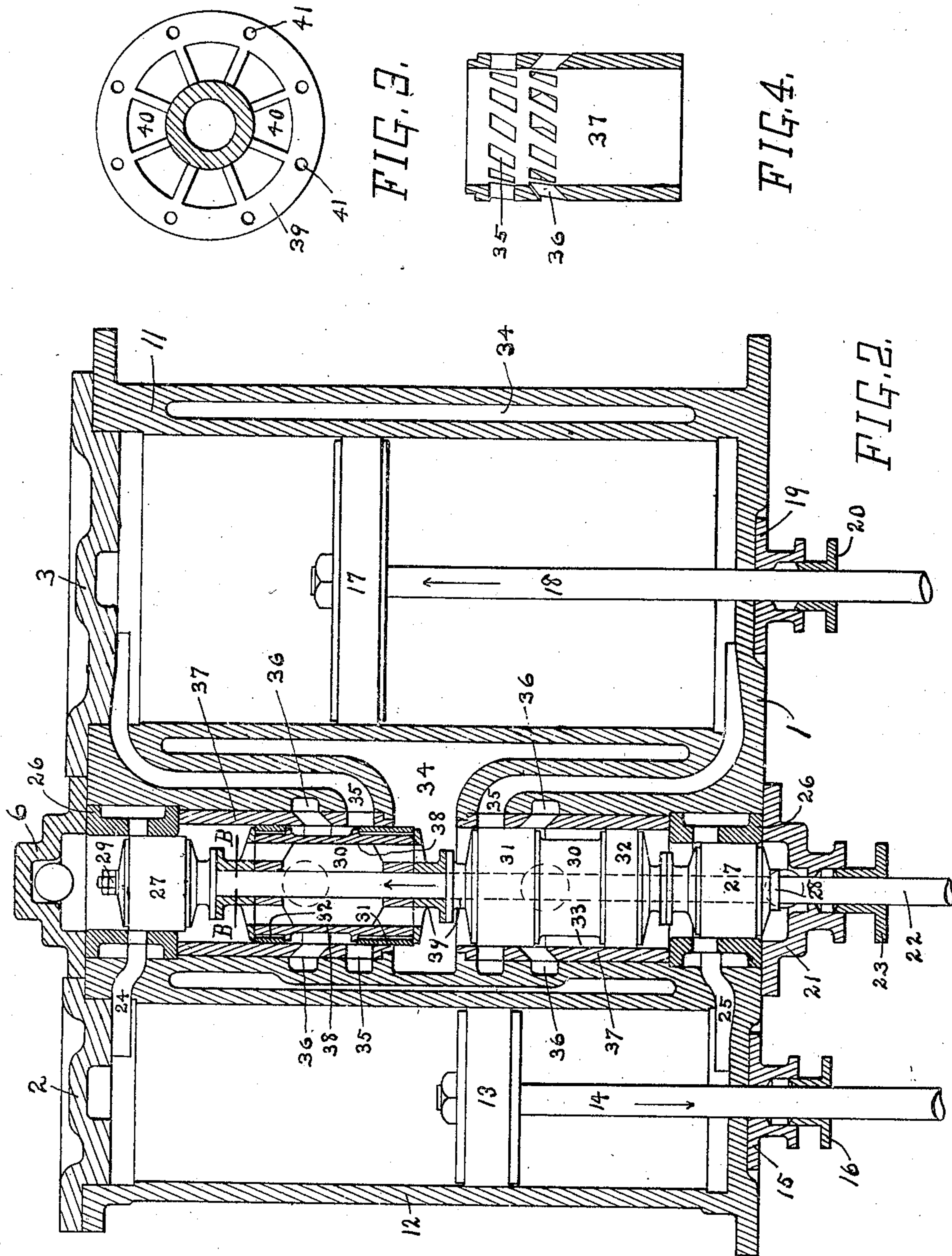
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3 SHEETS—SHEET 2.



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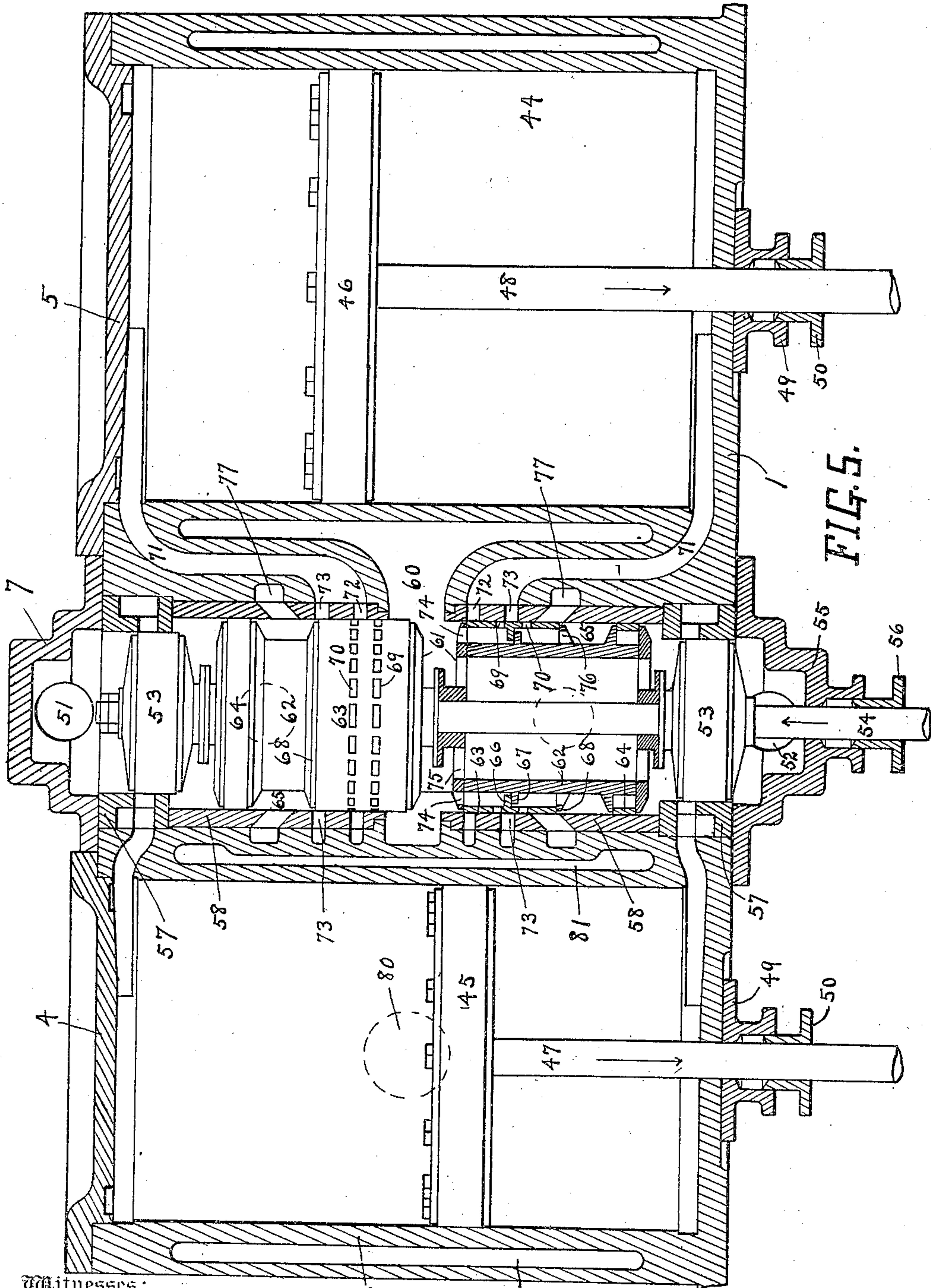
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3 SHEETS—SHEET 3.



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ENGINE.

No. 836,946.

Specification of Letters Patent.

Patented Nov. 27, 1906.

Application filed March 22, 1906. Serial No. 307,552.

To all whom it may concern:

Be it known that I, FRIEDRICH J. A. SCHNARRENDORF, a subject of the German Emperor, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented a new and useful Engine-Valve, of which the following is a specification.

My invention relates to valve mechanism for multi-expansion steam-engines, particularly for those of the quadruple-expansion type; and the object of my improvement is to unite the valve mechanism of two adjacent cylinders whereby a single valve-chamber and rigidly-connected set of valves will properly control the admission and exhaust of the steam from both cylinders.

My invention consists in properly uniting the cylindrical valves for two adjacent cylinders, one for higher and the other for lower pressures, upon the same valve-stem.

It consists, further, in providing a receiver for the exhaust of one cylinder where the steam may be stored in readiness for the second cylinder.

In the accompanying drawings, which illustrate my improvements in valve mechanism, Figure 1 is a plan of the cylinders of a quadruple-expansion engine. Fig. 2 is a cross-section of the high-pressure and the first intermediate-pressure cylinders. Fig. 3 is a cross-section of a portion of the valve for the first intermediate cylinder on the line B B of Fig. 2. Fig. 4 is a cross-section of a valve-chamber lining. Fig. 5 is a cross-section of the second intermediate and low pressure cylinders.

Similar reference characters refer to like parts throughout the several views of the drawings.

To permit the use of a single valve mechanism to govern the steam and exhaust of adjacent cylinders, one of which uses the exhaust-steam of the other, a receiver is necessary for the exhaust-steam of the high-pressure cylinder. The valve of the high-pressure cylinder must be so proportioned that the steam will begin to exhaust at one end before live steam from the boilers is admitted at the other end. As it is practically necessary that the cranks of multipiston engines be equally spaced, the admission of steam to adjacent cylinders of this type must be simultaneous. Of a necessity then a receiver must be provided to accommodate that portion of the exhaust-steam which escapes from the high-pressure cylinder between the

time of the opening of the exhaust-port of the high-pressure cylinder and the opening of the steam-port of the low-pressure cylinder.

In Fig. 1 of the drawings, 1 is a base for the cylinders of a quadruple-expansion engine; 2, the high-pressure cylinder-head; 3, that of the first intermediate; 4, that of the second intermediate, and 5 of the low-pressure cylinder. The valve-chest between the first two cylinders has a cover 6 and that between the second two has a cover 7. The steam-pipe is shown at 8, the receiver or connection between the two intermediate cylinders at 9, and the exhaust-pipe for the low-pressure cylinder at 10. The high-pressure cylinder 12 is provided with a piston 13, piston-rod 14, stuffing-box 15, and gland 16, of any desired construction, while the first intermediate cylinder 11 has a similar piston 17, piston-rod 18, stuffing-box 19, and gland 20. The cranks of these two cylinders are opposite. Between the two cylinders is a valve chest or chamber having a lower head 21, valve-stem 22, and gland 23. The cylinder 12 has ports 24 and 25. Secured in the ends of the valve-chamber by means of the heads 6 and 21 are short sleeves 26, in which are slidable the pistons 27 of the high-pressure-cylinder valve. The lower piston rests on a collar 28 on the valve-stem, and the nuts 29 at the upper end of the stem secure the upper piston. The pistons are held separated by the valve-pistons of the adjacent cylinder. The operation of this valve for the high-pressure cylinder is that of the usual piston-valve. In the drawings the upper piston 27 is just closing the steam-port, while the lower piston 27 still permits the escape of the exhaust to the space between the pistons 27. The openings in the walls of the sleeves 26 are similar to those shown in Fig. 4, so that the pistons will easily move over the same. Secured on the valve-stem 22 are two hollow pistons 30, which each has rings 31 and 32 and an annular space 33 between the rings. These pistons are separated, so that the exhaust-steam from the high-pressure cylinder can readily pass through into the receiver 34. This receiver extends around in the wall of the cylinder 11 and is adapted to receive the exhaust-steam from the high-pressure cylinder while the admission-port of the intermediate cylinder remains closed, which quite obviates undesirable back pressure on the piston 13. It has the further function of

keeping the walls of the intermediate cylinder at a high temperature. The steam from the high-pressure cylinder passes into the receiver 34 and when the valve has moved sufficiently into the ports 35 of the cylinder 11. When the work has been done, the steam passes out of the port into annular space 33 and thence into the exhaust-passage 36. The pistons 30 slide in the sleeves 37, which are held in position, as shown, by the sleeves 26 and these in turn by the heads 6 and 21. The ports 35 continue as annular passages that surround the sleeves 37, as shown, and connect with the diagonal openings in the sleeves, as shown in Fig. 4. The exhaust-passages 36 connect with the branches of the receiver 9, as indicated by the dotted circles at these passages. The valves of the intermediate cylinder are formed of the spools 38 and the heads 39, which heads have openings 40 for the passage of steam. If desired, the parts may be secured together by bolts passing through the holes 41 in the heads 39.

As shown in Fig. 2, the exhaust-port of cylinder 11 remains open the necessary time after the closing of the steam-port and will necessarily be open that length of time before the opening of the steam-port. The exhaust-steam from this cylinder is stored in the receiver 9 in the usual manner. The pistons of the valve just described may be of any desired construction, and the proportions of the various parts may be varied to suit conditions under which the engine is to be installed.

In Fig. 5 are shown the two larger cylinders 43 and 44, provided with pistons 45 and 46, piston-rods 47 and 48, stuffing-boxes 49, and glands 50. The cranks of these cylinders will probably be at right angles to the cranks of the high and first intermediate cylinders and like them opposite each other. The steam for the cylinder 43 enters through the openings 51 and 52, and is controlled by the pistons 53, as before described. The lower head 55 of the valve-chamber, its gland 56, and the sleeves 57 are similar to those of the other valve mechanism. The sleeves 58 have an extra row of openings 73, which will be described below. The cylinder 44 has a receiver 60 for the storage of exhaust-steam from the cylinder 43. The valve to control the admission and exhaust of steam for the cylinder 44 is secured to the stem 54, as before described, and consists of the heads 61, the spools 62, and the rings 63 and 64, the rings 64 being similar to the rings 32 and serving to close the ends of the annular spaces 65. The rings 63 have inwardly-extending beads 66, which form steam-tight contact with the flanges 67 on the spools 62. The outer edges of the rings rest against the perforated ridges or flanges 68 on the spools, while the inner edges contact with the heads 61. The rings have two rows of slots 69 and

70. The ports 71 of the cylinder 44 unite the openings 72 and 73. The heads 61 have openings 74 and 75, while the flanges 68 have openings 76.

The operation of this valve is as follows: The steam passes from the cylinder 43 into the receiver 60 and then as the valve moves to proper position through the openings 72 into the port 71 and through the openings 74, slots 69, and openings 73 into the port. The exhaust from the cylinder passes at first through the openings 73, slots 70, and openings 76 and annular space 65 into the exhaust-passage 77, and later, when the valve has moved farther, through openings 73 and annular space 65 to the exhaust-passage, as shown in the upper part of Fig. 5. At the same time exhaust-steam will pass from the openings 72 through the slots 70 and openings 76 into this annular space. The receiver 9 between the first and second intermediate cylinders is not always of sufficient size to properly store the exhaust-steam from the first intermediate before the opening of the ports of the second intermediate cylinder, and an excessive back pressure results. To obviate this, I form a branch connection 80 on the receiver 9 and connect this to the space 81, formed in the wall of the second intermediate cylinder, which space forms a large storage-space for this exhaust-steam. This also provides very effective heating means for the second intermediate cylinder.

Having now explained my improvements, what I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-engine, the combination of adjacent cylinders, a combined valve for controlling the passage of steam for the same, a chamber for said valve, said valve comprising pistons for one of said cylinders, and separate hollow pistons for the second cylinder, said second cylinder being formed with a receiver for the exhaust-steam from the first cylinder.

2. The combination of parallel cylinders of a multi-expansion engine and their ports, a valve-chamber placed between the cylinders, sleeves in the ends of said chamber, pistons slidable therein to control the steam of one of said cylinders, pistons placed between the first to control the steam for the second cylinder, said pistons being hollow to permit the passage of steam, sleeves in said chamber to guide said pistons, perforated rings carried by said pistons adapted to control the passage of the steam, all said pistons adapted to operate together, said second cylinder having a receiver formed in its wall to receive the exhaust-steam from the first cylinder.

3. In a steam-engine, the combination of two adjacent cylinders, one adapted to receive the exhaust-steam of the other, a tubular slide-valve adjacent the two cylinders to govern the passage of steam to one of said

5 cylinders by means of pistons forming the outer ends of said valve, and to govern the passage of the exhaust-steam from the first cylinder to the second by means of pistons forming the intermediate portion of said valve, said second cylinder being provided with a circumferential receiver to store the exhaust-steam of the first cylinder before the opening of the ports of the second cylinder.

10 4. The combination of parallel cylinders of a multi-expansion engine and their ports, a valve-chamber placed adjacent said cylinders,

connections to admit steam to the ends of said chamber, pistons slidable therein to control the steam of one of said cylinders, pistons placed between the first to control the passage of steam from the first cylinder to the second, said second pistons being hollow to permit the passage of steam, and all said pistons being adapted to operate together.

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