

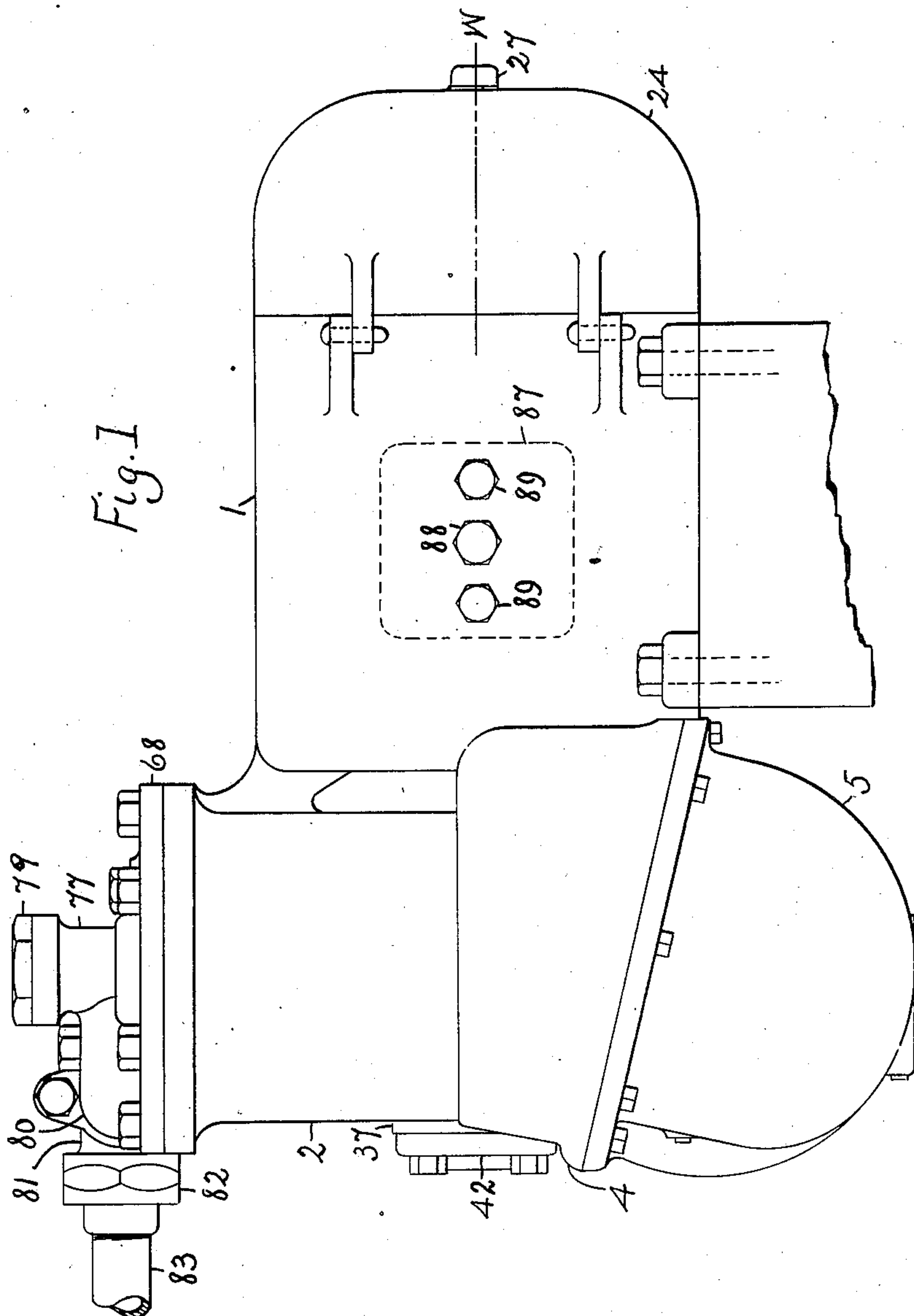
No. 877,369.

PATENTED JAN. 21, 1908.

W. K. RANKIN.
ELECTROPNEUMATIC MACHINE.

APPLICATION FILED FEB. 15, 1906.

4 SHEETS—SHEET 1.



Witnesses.
Henry F. Colvin
J. E. R. Lambert

Inventor.
William K. Rankin.
By R. E. Wright
att'y.

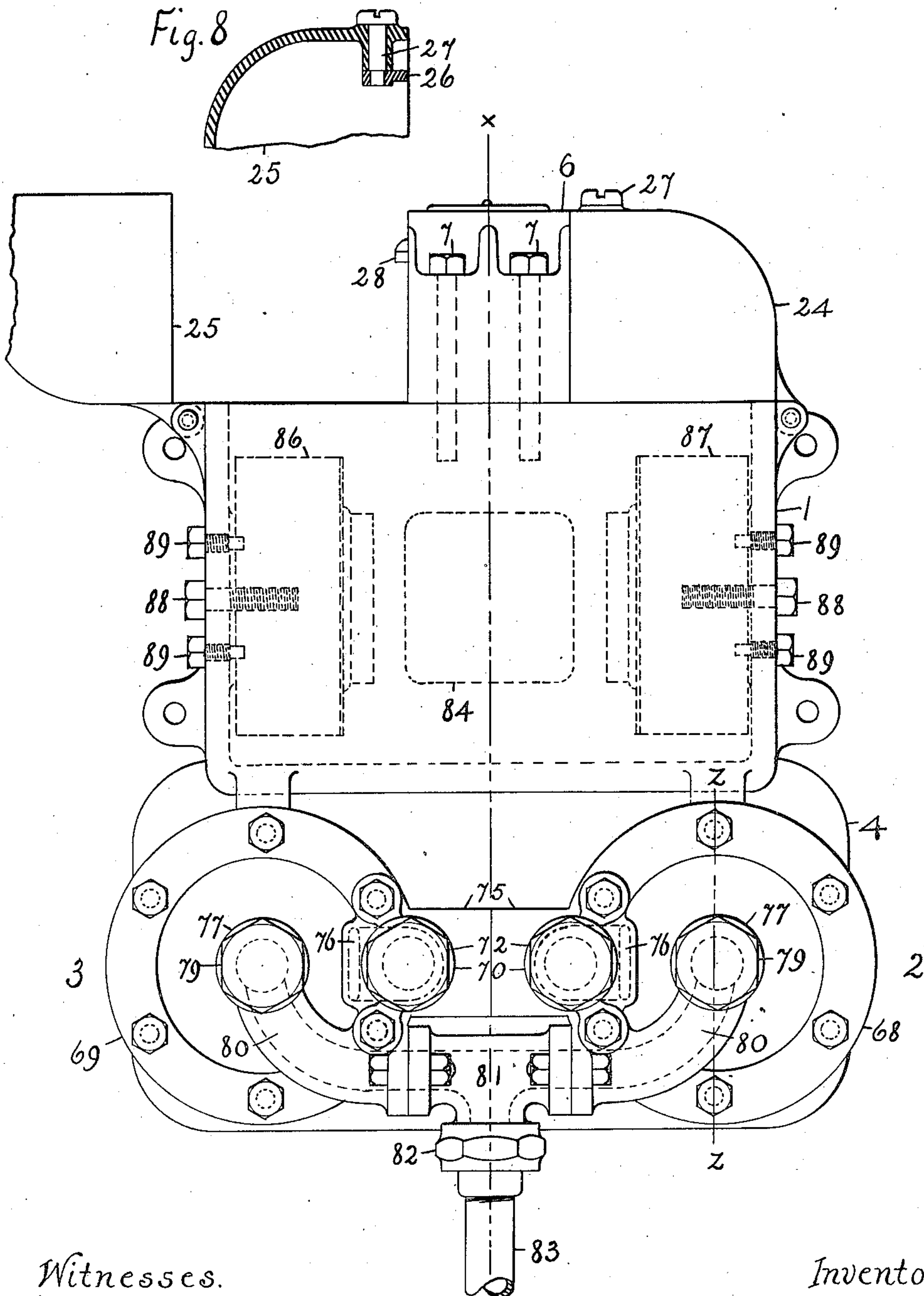
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Fig. 2

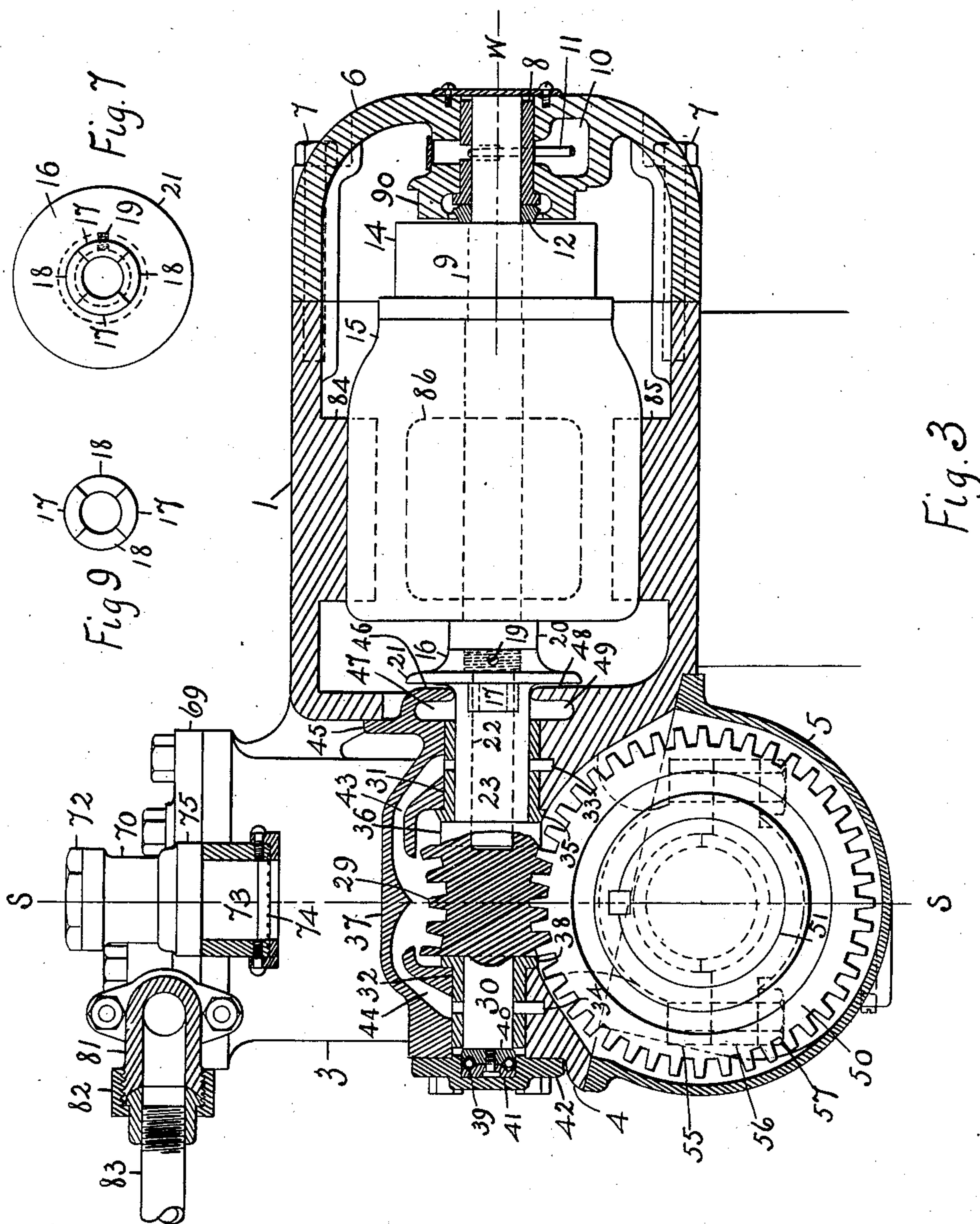
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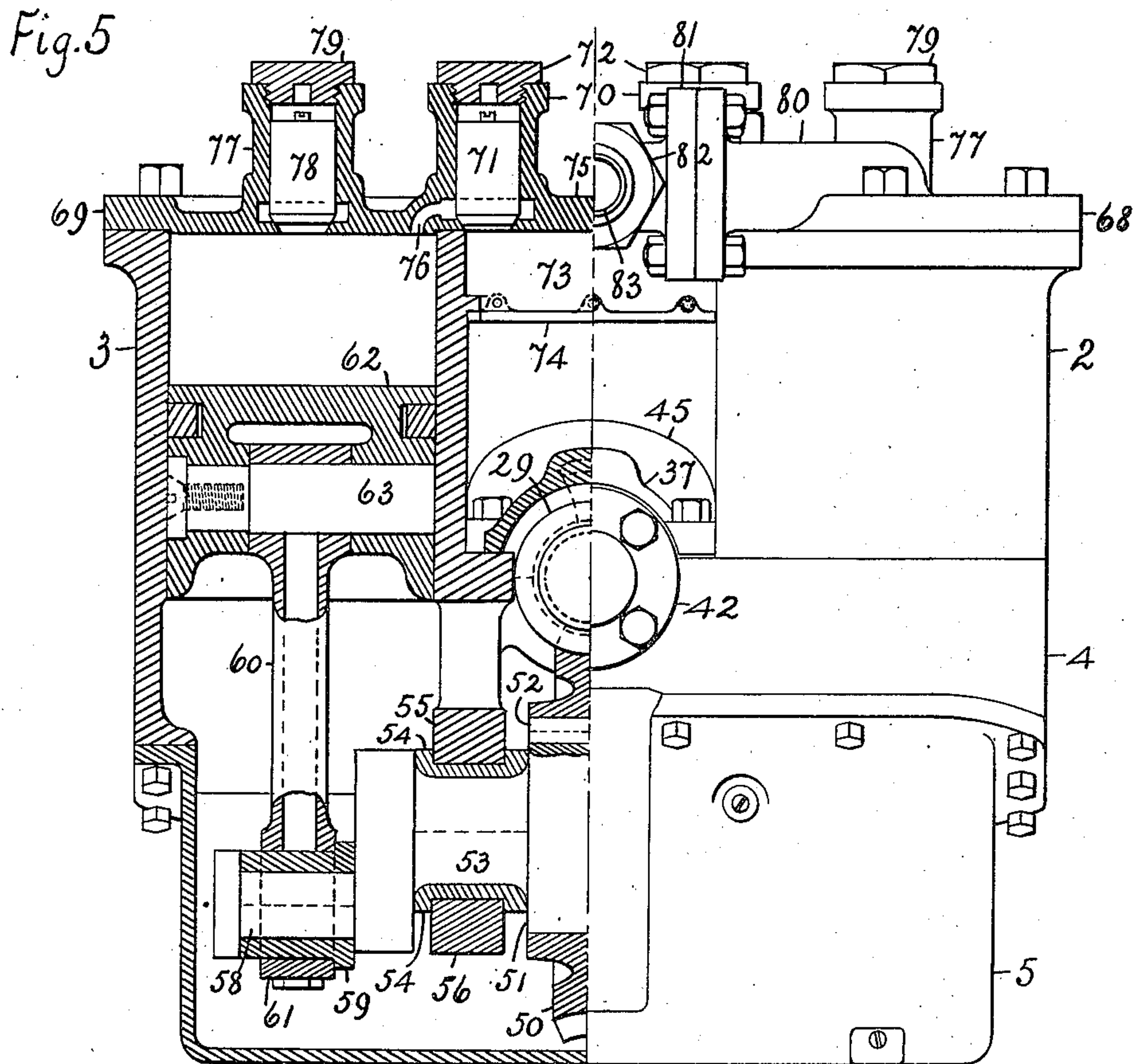
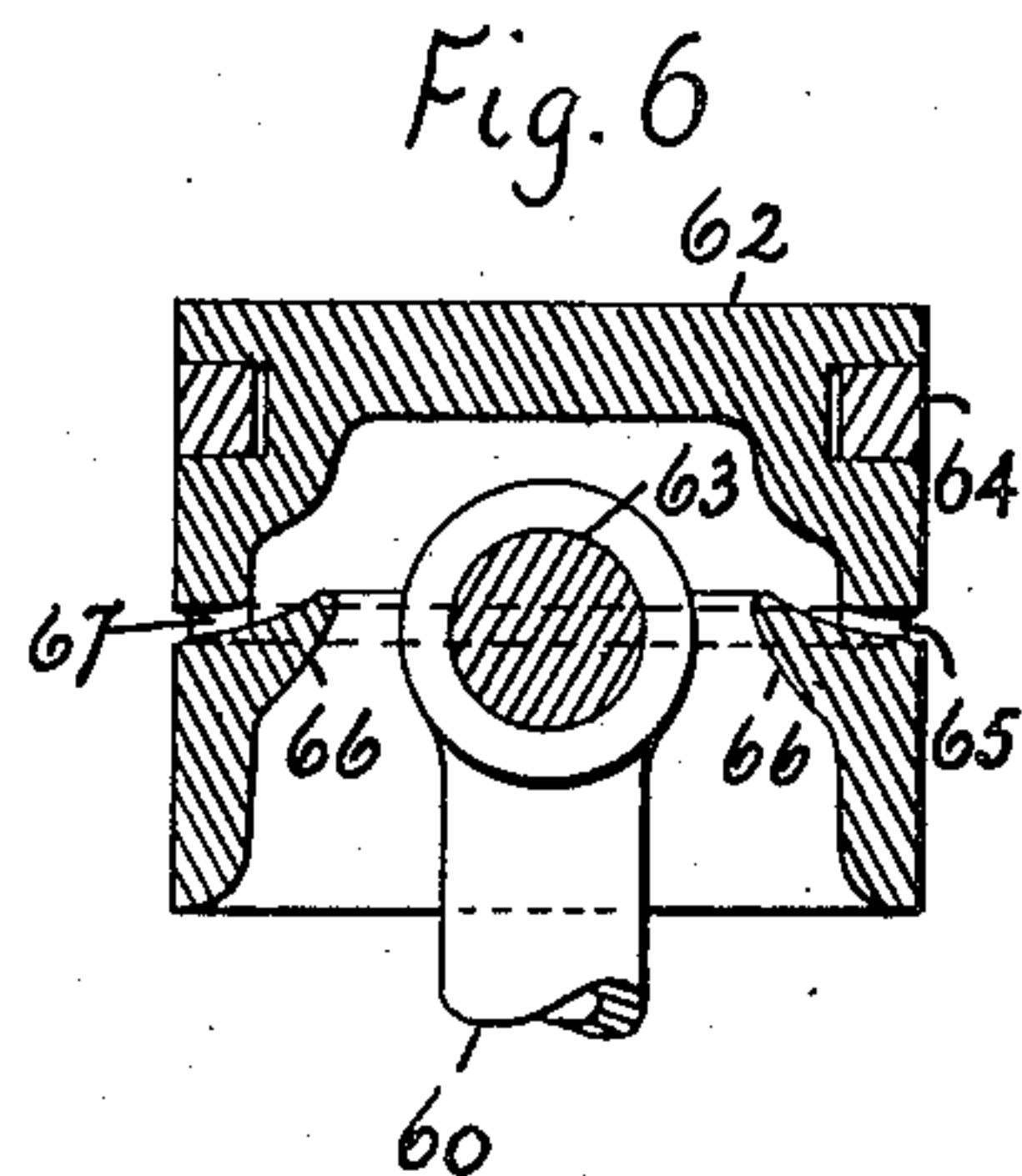
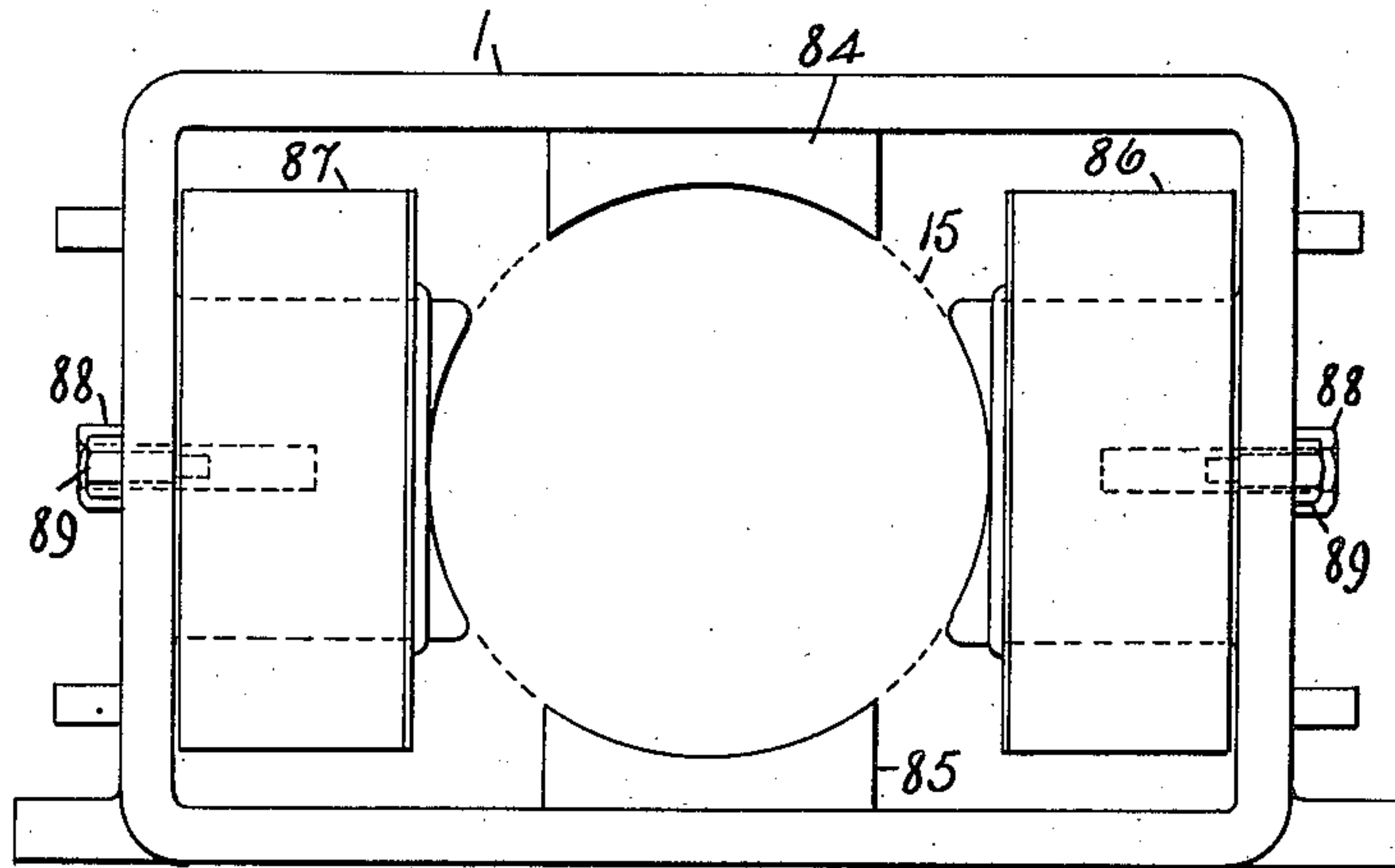
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4 SHEETS—SHEET 4.



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Fig. 4

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UNITED STATES PATENT OFFICE.

WILLIAM K. RANKIN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO JOHN E. REYBURN,
OF PHILADELPHIA, PENNSYLVANIA.

ELECTROPNEUMATIC MACHINE.

No. 877,369.

Specification of Letters Patent.

Patented Jan. 21, 1908.

Application filed February 15, 1906. Serial No. 301,151.

To all whom it may concern:

Be it known that I, WILLIAM K. RANKIN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Electropneumatic Machines, of which the following is a specification.

This invention relates to electrically driven motor-compressors, designed more especially for electrically driven cars and their pneumatic brakes. A special feature is the removal of the motor and pumps from close proximity, so that the heat generated by the pumps, in compressing, shall not be communicated to the armature and fields. While the motor is in horizontal position, and the pumps in vertical position, they are inclosed in one integral casing, but in compartments so inclosed and covered that the pump plungers and the armature are entirely separated, for convenience of removal, when needing inspection or renewal. The fields are also removable. The compartment for the crank shaft and worm wheel is also provided with a cover which can be removed without interference with the pumps or motor. By the arrangement of a horizontal motor, and vertical pumps, the durability of the pumps, their pistons and packings are greatly increased over the horizontal pumps heretofore in use, and by employing a worm and worm wheel for transmitting the power the jar and noise produced by the machine are reduced to a minimum, something very desirable in passenger cars.

There are other new, useful and desirable features which will be further pointed out in the specification and illustrated in the accompanying drawings in which similar characters of reference indicate similar parts throughout the views, in which

Figure 1 is a side elevation. Fig. 2 is a top view. Fig. 3 is a section on line X X Fig. 2. Fig. 4 is partly a section on line S S Fig. 3, and partly an exterior view, or elevation at the pump end. Fig. 5 is an elevation view of the motor case with the doors and central support removed. Fig. 6 is a section through the pump piston oppositely to that seen in Fig. 4, or on line Z Z Fig. 2. Fig. 7 is an end view of the clutch for the armature and worm shaft. Fig. 8 is a section on line W Figs. 1, 3 of the motor compartment doors. Fig. 9 is an end view of the worm shaft 23.

There is an integral casing comprising the motor compartment 1, the pump barrels 2, 3 and the worm wheel and crank shaft compartment 4, the latter having an under cover 5 which also serves as an oil reservoir into which the cranks for the pumps dip, and by their rapid rotation throw oil to the piston's interiors and the ledges thereon, for lubricating the pump cylinders and pistons, as hereinafter set forth. The motor compartment is rectangular in cross section, and its front end is covered with a central support 6 removably secured by bolts 7, the support carries a bearing 8 for the armature shaft 9 above an oil chamber 10 in which runs an oiling ring 11, and a thrust collar 12 abuts bearing 8 and commutator 14. Shaft 9 carries the commutator 14 and armature 15, and towards its inner end there is a clutch 16 with projections 17 and depressions 18 which engage similar projections and depressions in the worm shaft, the clutch is screwed to the shaft and further secured by a set screw 19 and abuts a collar 20 integral with the shaft, the clutch has a flange 21 which acts to prevent oil from the worm reaching the armature. The inner end 22 of the armature shaft is of smaller diameter than part 9 and is pocketed in the inner end 23 of the worm shaft, this forms a substantial support for the armature and insures the true alinement of the two shafts which prevents undue friction, and enables the withdrawal of the armature by simply removing support 6. At the front end of the motor compartment there are two doors 24, 25, hinged to swing outwardly, and having latches 26 on studs 27 to engage lugs 28 of the support 6. When the doors are opened there is free access to the fields, armature, etc. and they prevent any entrance of dust or foreign matter to the motor. Adjoining the armature shaft is the worm 29 with the inner shaft 23 already described, and an outer shaft 30; 23, 29, 30 being integral, bearings 31, 32 carry the shaft, each bearing being secured from turning by dowel pins 33, 34, bearing 31 having a collar 35 abutting collar 36 of worm 29 and seated in case 4 and cover 37 against end movement, while bearing 32 is similarly provided for by a collar 38. At the outer end of shaft 30 there is a ball bearing thrust having balls 39 inclosed between disks 40, 41 and secured to case 4 and cover 37 by cap 42. Cover 37 incloses worm 29 and bearings 31,

32 and is provided with oil channels 43, 44 to convey the oil thrown up by worm 29 to the bearings, the inner end of the cover has a flange 45 abutting compartment 1, and a flange 46 forming a receptacle 47 which with a similar flange 48 and receptacle 49 in compartment 4 prevent any oil from entering the interior of compartment 1. Worm 29 drives a worm wheel 50 which is secured to a central hub 51 of the crank shaft by a key 52, the part 50 being preferably of phosphor bronze. The crank shaft has a journal 53 at each side of the hub 51 running in bearings 54, made in halves, and secured in bracketed boxes 55 reaching down from and integral with compartment 4 and having an under cap 56 secured by bolts 57. By removing the under cover 5 and caps 56 the crank shaft and pistons may be removed without disturbing any other parts. The shaft has right angle cranks with journals 58 having bearings 59 made in halves, over which fit the lower ends of the connecting rods 60, and their caps 61, the upper ends of the rods being secured to pistons 62 by pins 63. The pistons have a solid upper part and annular lower part and are provided with packing rings 64 and a central circumferential oil groove 65 upon their exterior annular part, and upon their interior with integral up-turned oil catching ledges 66 (see Fig. 6) partially encircling two sides of the interior of the piston, with passages 67 therefrom to the groove 65, by this means the oil which is thrown up by the cranks is caught on the ledges and flows to the exterior of the piston for the lubrication of the pump cylinder and its piston. Pumps 2, 3 have heads 68, 69 each head having at its side nearest the center a valve chamber 70 inclosing an inlet valve 71 and having a cap or cover 72. Under these valves, and connecting the pump bodies, is an intake passage 73 having a screen 74 secured underneath, covered by extensions 75 of the heads and leading through ports 76 into the pumps. Centrally disposed on each head is a valve chamber 77 inclosing an outlet valve 78 and having a cap or cover 79. From chambers 77 there are passages 80 connecting with a central T 81 with a coupling 82 to a pipe 83 leading to the air tank or reservoir, (not shown.) Within compartment, above and below the armature 15, are the integral pole plates 84, 85, and at the sides of the armature are the fields 86, 87 removably secured by bolts 88, and having dowel bolts 89 to secure alignment. Central support 6 has a seat 90 upon which is secured the brush holder yoke.

60 I claim.

1. In an electro-pneumatic machine, an integral case comprising a motor compartment, vertical pump cylinders and a worm

wheel and crank shaft compartment the pump cylinders, a central support attached to the front of the motor compartment, doors hinged at the front of the motor compartment and fastened to the central support, a cover secured under the worm wheel and crank compartment, removable heads for the pump cylinders, valves in the heads, a motor within its compartment, pistons within the pump cylinders, a worm and a worm wheel driven by the motor, and connections therefrom for the reciprocation of the pump pistons.

2. In an electro-pneumatic machine, an integral case, one part of which incloses a motor, its front being inclosed in part by a removably secured central support, and by hinged doors; another part of the case inclosing a worm, a worm wheel and a crank shaft, with a bottom cover removably secured; and another part of the case comprising pump barrels vertically disposed; a motor within its part of the case, a worm, a worm wheel, and a crank shaft within their part of the case, heads for the pumps and valves therefor, pistons in the pumps, connections from the pistons to the crank shaft, a bearing in the central support for one end of the motor shaft, and a hollow shaft for the worm into which the motor shaft is inserted to form a bearing at its opposite end.

3. In an electro-pneumatic machine, an integral case, comprising a compartment for a motor with an outer attached end cover in three parts, the side parts being hinged doors, the central part forming a bearing for a motor shaft, an oil chamber and a seat for a brush holder and a motor with removable fields in the compartment, the shaft for the motor having its outer end seated in the bearing aforesaid; a worm and worm wheel compartment, being an integral part with the motor compartment, of the whole case, a worm therein, a shaft for the worm which is annular at its inner end and into which the inner end of the motor shaft is inserted, an interlocking clutch for the motor and worm shafts; bearings for the worm shaft, a cover for the bearings and the worm, oil passages therein leading to the bearings, and a ball bearing thrust for the outer end of the worm shaft, and pump cylinders integral with the motor and worm wheel compartment, and vertically located above the worm wheel compartment, and valves and pistons therefor.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM K. RANKIN.

Witnesses:

LOUIS H. REDNER,
RANSOM C. WRIGHT.