No. 861,488. PATENTED JULY 30, 1907.

W. L. WATERS.

MOTOR COMPRESSOR.

APPLICATION FILED OCT. 16, 1906.

4 SHEETS—SHEET 1.

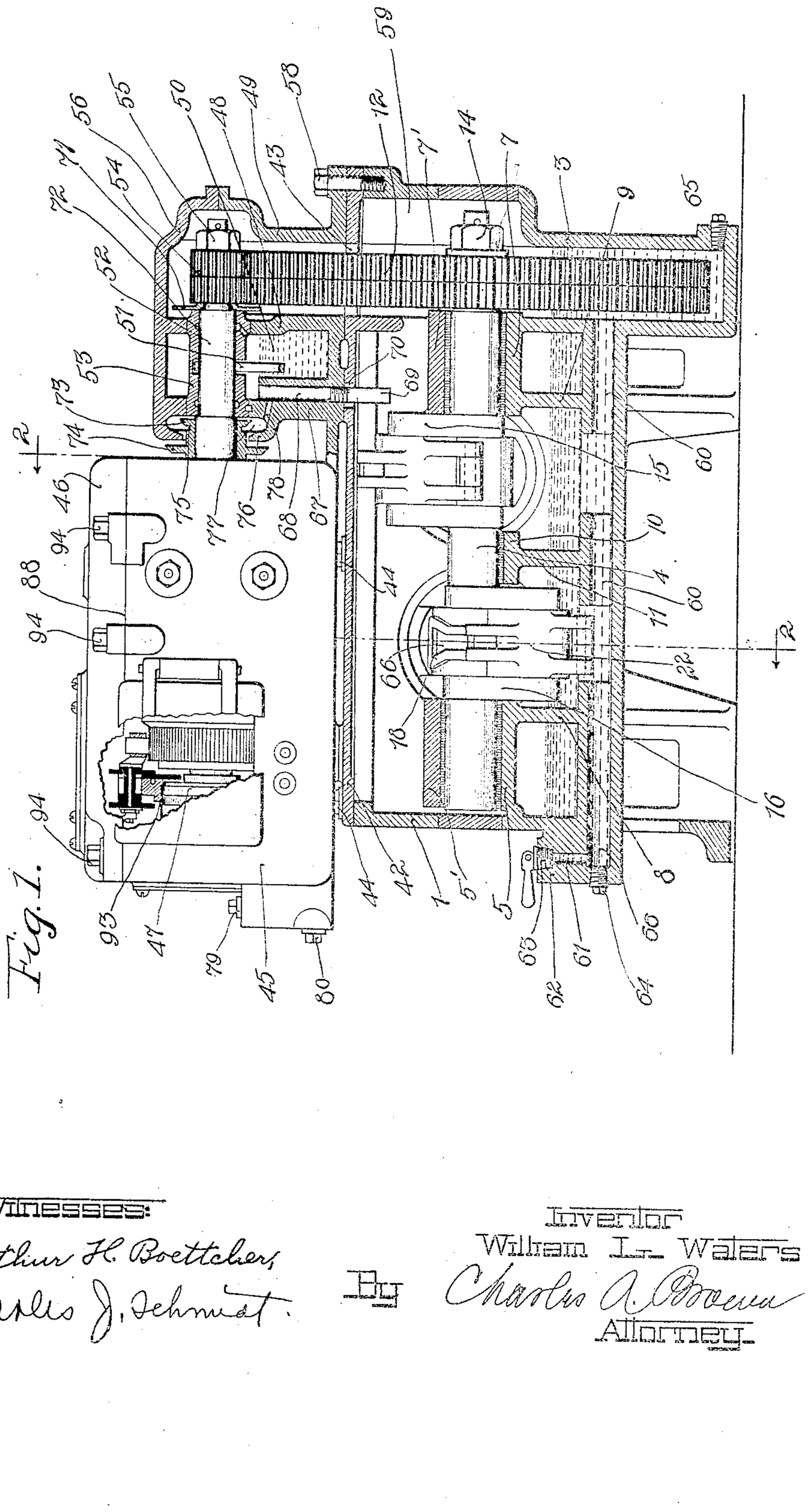

Fig. 1.

Witnesses:
Arthur H. Boettcher,
Charles J. Schmidt.

Inventor
William L. Waters
By Charles A. Brown
Attorney

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Fig. 5.

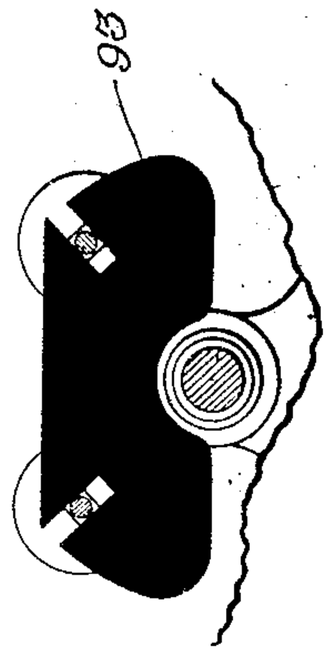


Fig. 6.

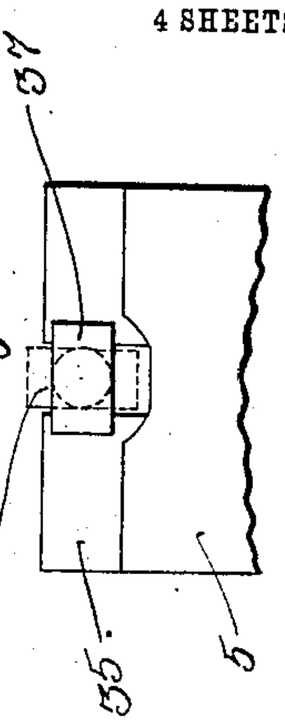
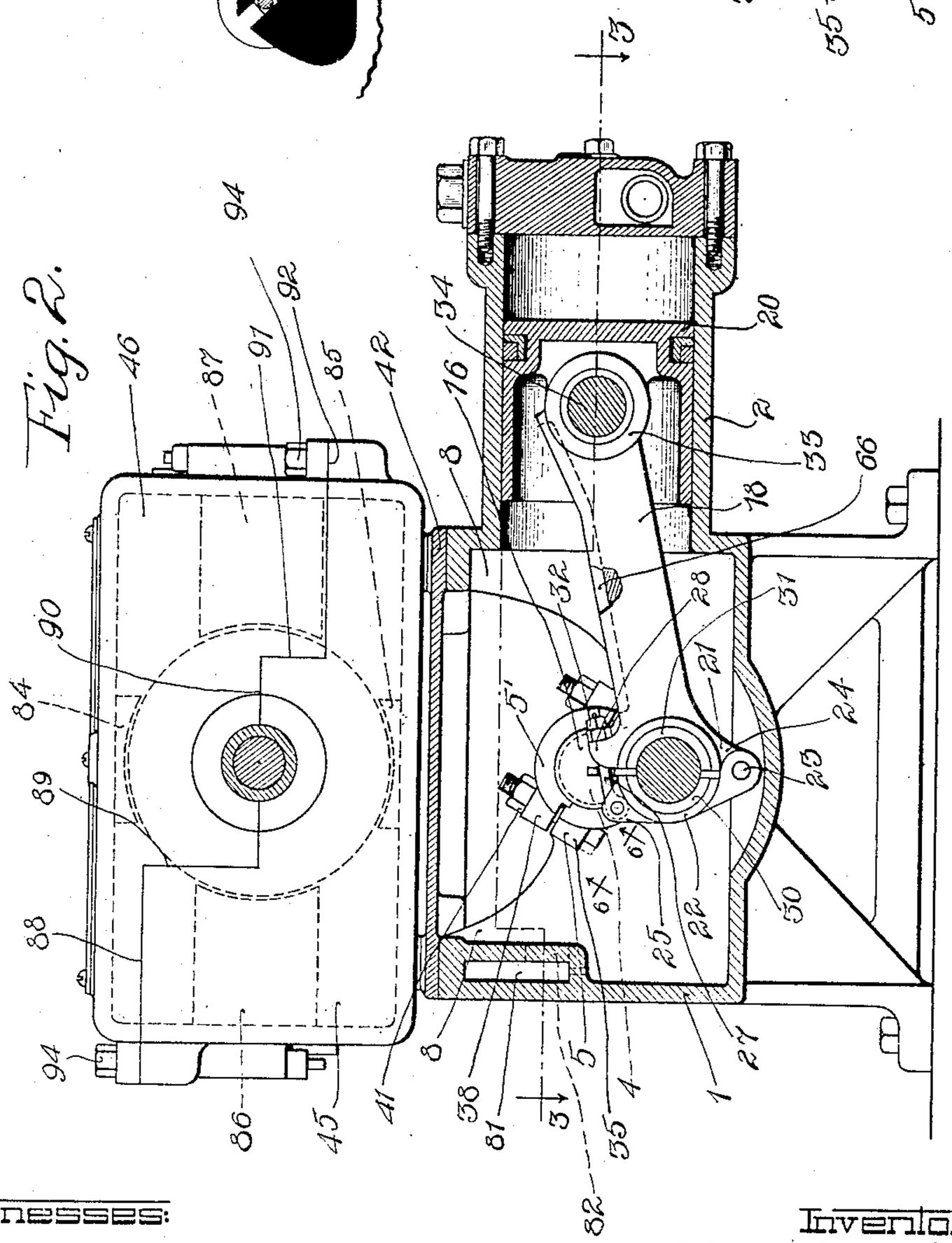


Fig. 2.



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4 SHEETS—SHEET 3.

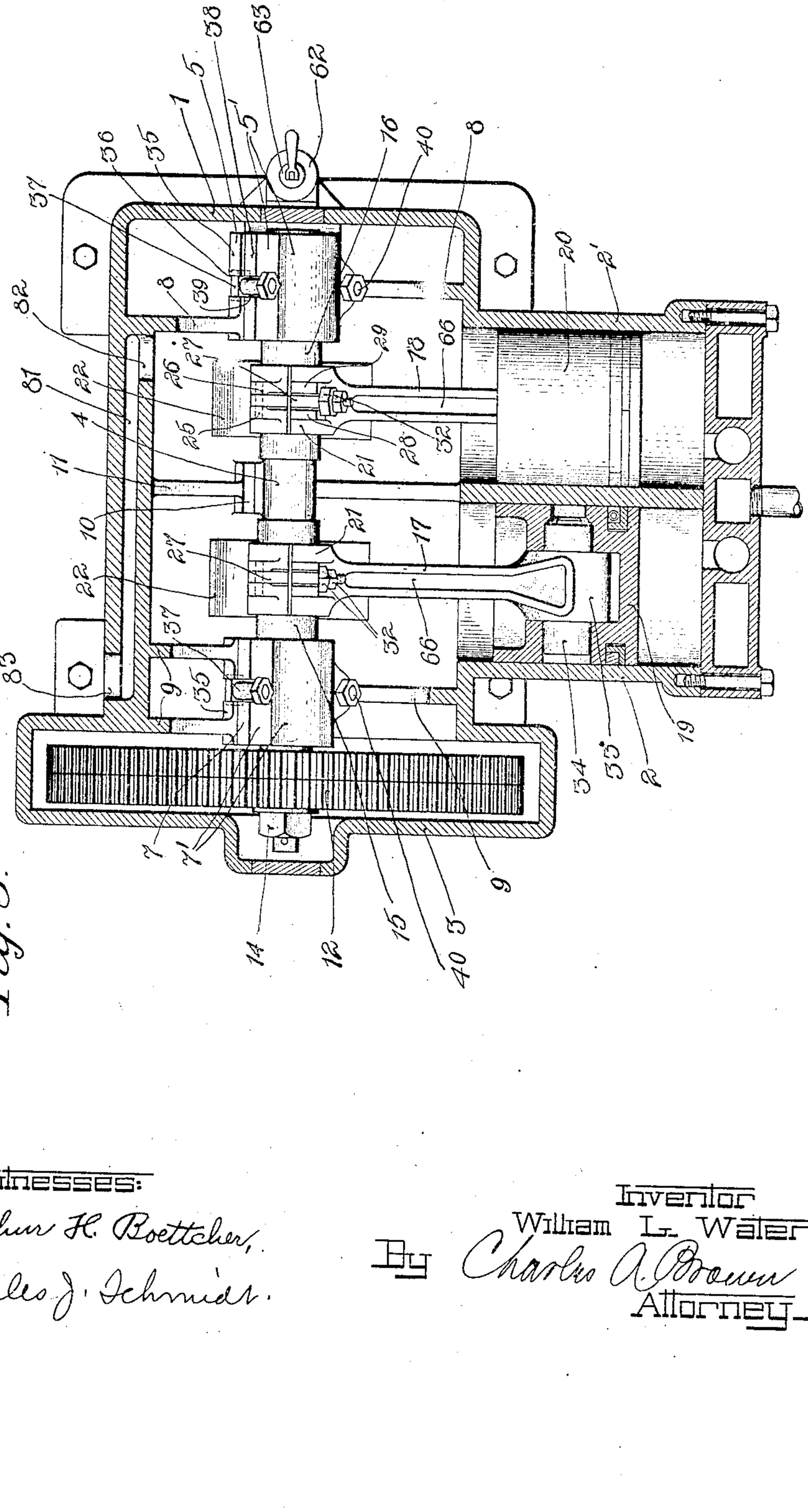

Fig. 3.

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Arthur H. Boettcher,
Charles J. Schmidt.

Inventor
William L. Waters
By Charles A. Brown
Attorney

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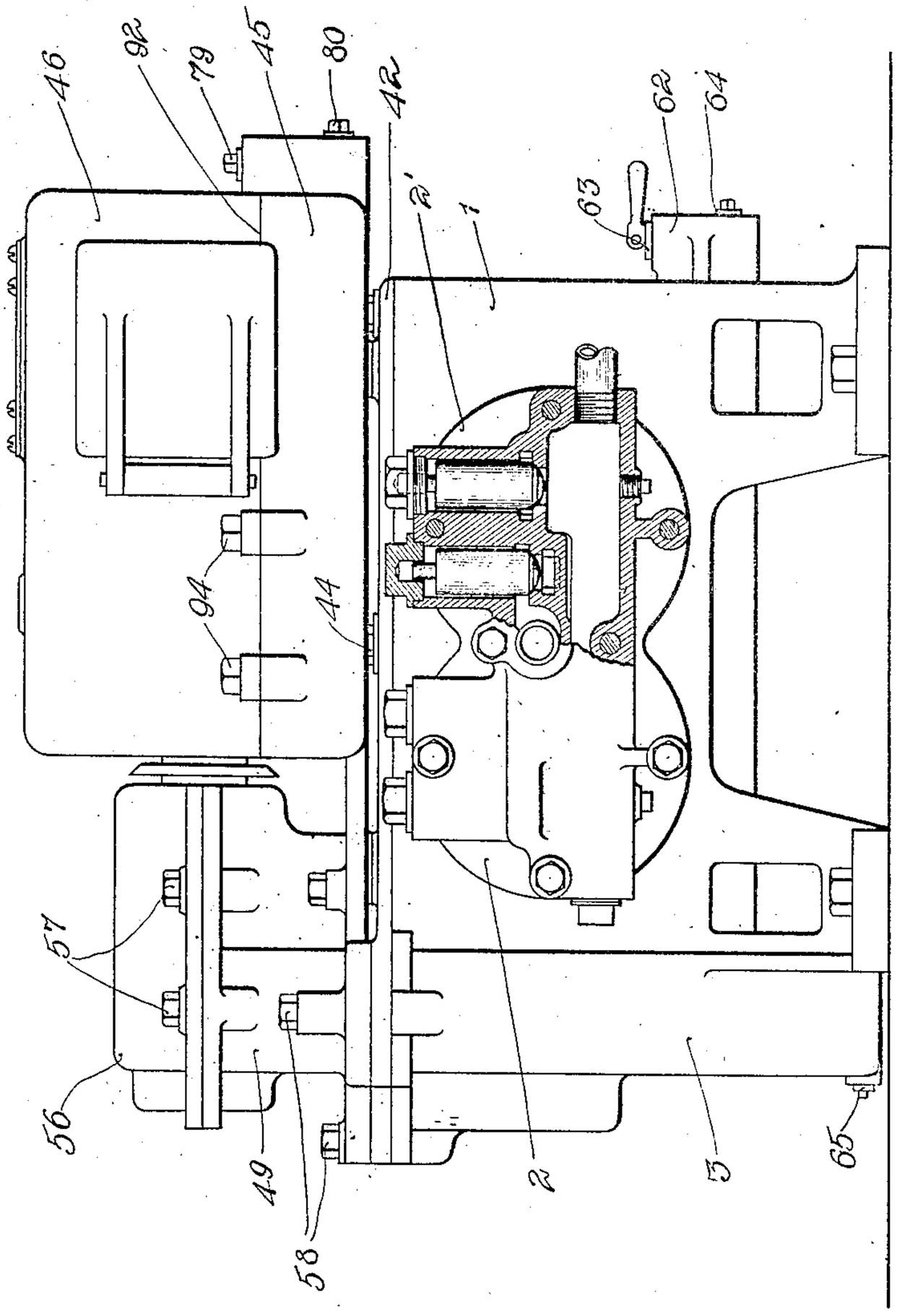

Fig. 4.

Witnesses:
Arthur H. Boettcher,
Charles J. Schmidt

Inventor
William L. Waters
By Charles A. Brown
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM L. WATERS, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO NATIONAL BRAKE & ELECTRIC COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

MOTOR-COMPRESSOR.

No. 861,488. Specification of Letters Patent. Patented July 30, 1907.

Application filed October 15, 1906. Serial No. 338,962.

To all whom it may concern:

Be it known that I, WILLIAM L. WATERS, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Motor-Compressors, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to motor compressors, its object being to incorporate improved features of construction and arrangement of the various parts in a device of this kind.

My device belongs to the class in which the electric motor is mounted on top of the pump cylinder case, the motor pinion connecting with the driving gear connected to the pump crank shaft.

The device is provided with oil wells into which the various moving parts dip to throw the oil over the bearing surfaces, and considerable difficulty has been experienced in providing inclosing casings or covers for preventing the straying or splashing of the oil to parts where it is not desired, as the motor armature, for instance. The inclosing casing parts should also be so arranged that very little work is required to separate them to expose the parts for inspection and repair, and the main object of this invention is to provide inclosing casing parts which thoroughly protect the operating parts, which are proof against leakage or straying of the oil and whose disposition is such that they can readily be dissembled to expose the various parts for inspection and repairs.

Other features of improvements are also present which together with the main features will be best understood when described with reference to the accompanying drawings in which

Figure 1 is a front view of the motor compressor of my invention, part of the casing being in section to reveal interior parts; Fig. 2 is a sectional view taken along plane 2—2 of Fig. 1; Fig. 3 is a sectional view taken along plane 3—3 of Fig. 2; Fig. 4 is a rear view of the motor compressor, part of the cylinder casing being in section to show the valve arrangement; Fig. 5 is an enlarged view of the upper end of the brush holder yoke, showing an insulating shield for preventing sparking from the brushes or commutator to the machine frame, and Fig. 6 is an enlarged view taken in the direction of the arrows 6, Fig. 2, showing the head of the T-bolt for holding the crank bearing parts together.

The crank chamber part 1 is cast integral with the cylinders 2 and 2′ and the gear wheel housing 3, as best shown in Fig. 3.

Extending across the crank chamber at right angles to the cylinders is the crank shaft 4 journaled in the bearings 5 and 7 and supported by the pedestal walls 8, 8 and 9, 9 respectively, there being also a central bearing 10 for the shaft supported from the pedestal wall 11.

At the right end of the crank shaft is secured the driving gear 12 within the housing 3, the gear being secured by means of the lock bolt 14 engaging the end of the crank shaft.

The crank arms 15 and 16 in the crank shaft are opposite the cylinders 2 and 2′ and are engaged respectively by means of crank rods 17 and 18 with the pistons 19 and 20. The crank end of each connecting rod forms a half bearing 21, the other half 22 of the bearing being pivoted at 23 to the extension 24 from the connecting rod bearing part. The upper end of each bearing part 22 has the two lugs 25, 26, between which is pivoted the end of a locking bolt 27 whose free end may be engaged between the lugs 28 and 29, extending upwardly from the bearing part 21. The bearing parts are suitably lined with bushing members 30 and 31.

To disengage a connecting rod from the crank shaft, the locking nuts 32 on the corresponding locking bolt 27 are sufficiently loosened to allow the bolt to be disengaged from the lugs 28 and 29 whereupon the pivoted bearing half 22 may be swung away from the crank shaft and the connecting rod with the bearing parts removed. Thus, these parts of the device may readily be taken apart for inspection or repairs and quickly reassembled into proper adjustment. The piston end of each connecting rod terminates in a bearing head 33, engaging a pin 34 suitably held in the side walls of the piston head, and upon rotation of the crank shaft the piston heads will be reciprocated within the cylinders.

The main crank shaft bearings 5 and 7 are split on an angle as shown in Figs. 2 and 3, so that the reaction of the reciprocating piston heads and rods is taken up by the solid part of the bearing and not by the bearing cap. The caps 5′ and 7′ are clamped to the lower bearing parts 5 and 7 in a novel and very efficient manner. The extension 35 from the upper end of each of the lower bearing members 5 and 7 has a slot 36 for receiving the shank and head of a T-bolt 37. At the upper end of the cap of each main bearing is an extension 38 having a slot or opening 39 registering with the slot 36 in the lower bearing part, this slot 39 receiving the upper end of the bolt 37. The lower ends of the bearing parts may also be provided with slots to be engaged by a T-bolt or may be held together by a screw or stud 40 which passes through an opening in the cap member having threaded engagement with the lower bearing member. When it is desired to lift the crank shaft from the main bearings, the stud 40 is unscrewed from

the lower bearing part and the nut 41 of the T-bolt is loosened sufficiently to allow turning of the bolt and head. The bolt head is normally crosswise of the slot and engaging below the edges of the slot 36. The width of the head is slightly less than the width of this slot, and upon turning of the bolt, the cap member may be lifted from the lower bearing member, the T head passing through the slot 36. If both bolts are T-bolts, it will merely be necessary to loosen their nuts and turn them to allow their heads to pass through the slots in the lower bearing when the upper bearing member cap is lifted. When the caps are replaced, the bolt heads pass through the slots in the lower bearing whereupon the heads are turned to engage the edges of the slots and the nuts are tightened to give the desired adjustment to the bearings.

The casing comprising the parts 1, 2, 2′ and 3 is closed on top by a plane cover 42 which has only the opening 43 for receiving the upper end of the driving gear 12, this cover being suitably held in place by cap bolts 44, the motor frame comprising a lower casting 45 and an upper casting 46 forming an inclosing casing for the motor fields, armature and commutator parts. The bearing 47 for the commutator end of the armature shaft is within the inclosing casing, but the lower half 48 of the bearing for the other end of the armature shaft is exterior to the inclosing casing but cast integral with the lower part 45 of the inclosing casing. The inclosing walls 49 are also cast integral with the lower bearing 48 and the lower inclosing part 45 and form a compartment for receiving the upper part of the driving gear 12. The lower bearing part 48 is hollow and provides an oil chamber 50, into which extends an oil bearing ring 51 suspended from the armature shaft 52, journaled in the bushing or bearing part sleeve 53 and secured in the walls of the bearing part 48, the armature pinion 54 being secured to the end of the armature shaft by any suitable means as by the lock nut 55, the pinion being adapted to mesh with the driving gear 12. The cap frame 56 engages with and over the lower bearing part 48 and the inclosing walls 49 and may be secured by means of cap screws 57, as shown in Fig. 4.

The motor frame may be secured to the frame 1, 2, 3 by means of cap bolts 58—58 which screw-thread into the lower framework and which may also pass through the cover 42 for this lower framework to assist in holding it in place. The motor frame and all the parts above the cover 42 are rigidly fastened together, and upon withdrawal of bolts 58 the motor with the attached parts may be bodily lifted from the cover 42, and upon withdrawal of bolts 44, the cover 42 may be lifted away to reveal the parts within the crank chambers. At the side of the housing 3 I also provide a vertical pocket 59 for receiving the nut 14 and end of the crank shaft engaged thereby, and if the crank shaft and gear wheel are to be removed, the connecting rods are disconnected therefrom by loosening and swinging back the pivoted lock bolts 27, and the caps of the main bearings are removed as before described, and when the crank shaft is lifted out, the nut 14 and crank shaft end will pass through the pocket 59. If it is desired only to inspect the armature shaft bearing and pinion, the bolts 47 are withdrawn and the cap 56 removed. This division and disposition of the casting parts for the device is very important in the art, it being evident that with this arrangement the least time is necessary for assembly or taking apart.

I shall now describe the means for thoroughly oiling all the operative parts. The various compartments between the bearing pedestals in the crank chamber are connected through channels or passageways 60, and the driving gear housing is also connected with the crank chamber through one of these passageways, as best shown in Figs. 1 and 4. The vertical passageway 61 in the extension 62 leads to the left passageway 60, and through this opening oil may be introduced which will then distribute itself in the crank chamber and the driving gear chamber. This inlet opening may be securely closed by means of the threaded plug 63, while the threaded plug 64 in line with the passageway 60 allows draining of the crank chamber, and the threaded plug 65 at the base of the driving gear housing allows draining of the driving gear chamber. The oil is of such height in the various compartments that the movable parts will dip therein to thus spatter and distribute the oil to the various bearing and gearing surfaces. To assist in this distribution of oil, the connecting rods are provided with channels or grooves 66 in which the oil is caught and led to the bearings. The armature pinion receives this oil from the driving gear, while the armature shaft bearing at the pinion end is supplied with oil by the ring 51 from the well 50. Through the enlargement 67 passes the overflow opening 68 from which extends a pipe 69 which leads through the holes 70 in the cover 42 to the crank chamber.

Surrounding the armature shaft at the inside of the pinion is the oil thrower disk 71, and about the adjacent edge of the bearing 53 is the oil groove 72, the oil throwing disk in the first place tending to prevent the passage of any oil to the armature shaft bearing from the gears, while the oil groove 72 receives any oil which does escape by the disk 71 and returns it to the driving gear chamber. The oil thrower disks 73, 74 and the oil grooves 75 are also provided between the bearings and the armature to prevent any leakage of oil from the bearing to the armature, the disk 73 and groove 75 being surrounded by the annular ledge 76 forming the drip chamber 77 which through opening 78 connects with the overflow channel 68 and thus any drip oil from the oil thrower disks will be returned to the crank chamber. A ring bearing, a similar oil thrower and grooves are provided for the shaft at the commutator end, this, however, not being shown. Suitable filling inlets may be provided for the armature bearing oil wells and suitable drain outlets may also be provided, as the openings controlled by plugs 79 and 80, as shown to the left of the armature frame, Fig. 1, in association with the oil wells for the commutator end bearing. This use of oil throwers and oil grooves prevents the straying or leaking of oil to the armature or other motor parts, the tendency to such leakages being one of the weak points in devices of this kind, over which my device is an improvement.

As the pistons are driven in and out of the cylinders, they alternately create a vacuum and pressure in the crank chamber, tending to blow the oil vapor into the motor, and in order to prevent this, it is necessary to provide some ventilating means to allow this pressure to escape to the atmosphere. The ventilating means I employ is best shown in Figs. 2 and 3. The crank

chamber wall opposite the cylinders is hollow along its upper end to form the pocket for chamber 81, from the right end of whose inner wall is the opening 82 and from the left end of whose outer wall is the opening 83, the opening 82 connecting with the crank chamber and the opening 83 connecting with the atmosphere. With the openings thus placed at the extreme ends of the pocket, it is impossible for oil to escape from the crank chamber, but at the same time free passage of air to and from the crank chamber is allowed. The length of the pocket between the openings also prevents dust from finding its way into the working parts of the device. Any oil which splashes or otherwise finds its way into the pocket drains back through the opening 82 which is at the bottom of the pocket, or other drain openings may lead from the pocket into the crank chamber. This pocket and the openings can be formed when the frame is cast, and this method of forming the crank chamber is, therefore, very inexpensive but at the same time very efficient.

As the motor is inclosed, there must be a machine fit between the top and the lower parts 45 and 46 of the housing thereof. As shown in Fig. 2, the motor frame has the vertical poles 84, 85 and the horizontal poles 86, 87. If the top and lower halves 45 and 46 of the housing were divided along a horizontal plane, passing through the axis of the shaft, it would be a very expensive and awkward job to plane or finish the engaging edges of the parts. I, however, separate the housing halves along the planes 88, 89, 90, 91 and 92, as shown in Fig. 2, the horizontal plane 88 being above the pole 86, the vertical plane 89 being between the poles 84 and 86, the horizontal plane 90 passing through the armature axis, the vertical plane 91 being between the poles 85 and 87, and the horizontal plane 92 being below the pole 87. This arrangement enables the engaging surfaces of each half to be finished during one operation by the proper assembly and adjustment of the milling cutters which can be run through from one end to the other without interfering with anything.

Although it forms no part of my present invention, sparking from the brushes and commutator to the machine frame is prevented by the use of an insulating shield 93 of insulating material, arranged as shown in Figs. 1 and 5, such sparking as that which occurs under conditions of sudden variations in voltage as where the motor is run on a trolley circuit.

The features which I have described are very important in devices of this kind. Any of the parts can be gotten at without first going through a series of disconnections of other parts. If it is desired to inspect the motor only, the bolts 94 are withdrawn and the top half 46 of the housing removed. In the same way the pinion and armature bearings may be inspected by lifting only the cover 56. If any parts within the crank chamber are to be inspected, the bolts 44 and 58 are withdrawn and the cover with all the parts above it lifted off. The feature of having the driving gear housing cast integral with the crank chamber housing eliminates the necessity of stuffing boxes between the crank chamber and the gear housing, and leakage is also prevented, this integral construction being also very much cheaper as the upper housing for the driving gear is cast integral with the motor framework. Leakage from the gearing chamber to the armature can much more readily be eliminated.

I do not wish to be limited to the precise arrangement and construction of the various parts, as changes may readily be made without departing from the scope of my invention.

I claim as new and desire to secure by Letters Patent:

1. In a motor compressor, the combination of a crank case, a driving gear case, a uniplaner cover for the crank case and the gear case having an opening over the gear case through which a gear may extend, a motor frame mounted on the cover, and a housing frame on said cover over the opening therein, said housing frame being cast integral with the motor frame.

2. In a motor compressor, the combination of a crank case, a lower gear case cast integral with the crank case, a uniplaner cover for the crank case and gear case having an opening over the lower gear case, a motor frame mounted on the cover over the crank case, and an upper gear case mounted on the cover over the lower gear case, said upper gear case being cast integral with the motor frame.

3. In a motor compressor, the combination of a crank case, the lower section of a gear case cast integral with the crank case, a common cover for the crank case and lower gear case part, a motor mounted on the cover over the crank case, a bearing frame for the motor armature mounted on the cover, and the upper part of a gear case mounted on the cover over the lower gear case part, said upper gear case part, said bearing frame and motor frame being cast integral.

4. In a motor compressor, the combination of a crank case, the lower section of a gear case cast integral with the crank case, a common cover for the crank case and lower gear case part, a motor mounted on the cover over the crank case, a bearing frame for the motor armature mounted on the cover, the upper part of a gear case mounted on the cover over the lower gear case part, said upper gear case part, said bearing frame and motor frame being cast integral, and an integral cover for the bearing case and upper gear case part.

5. In a motor compressor, the combination of a crank chamber, the lower part of a gear case cast integral with the crank chamber, a uniplaner cover closing the crank chamber and extending over the lower gear case part and having an opening over the lower gear case part, a motor frame mounted on the cover over the crank case, a bearing frame supporting one end of the motor shaft mounted on the cover, and the upper part of a gear case mounted on said cover to form a continuation of the lower case part, said upper gear case part and said bearing frame being cast integral with the motor frame.

6. In a motor compressor, the combination of a crank case, a crank shaft journaled in bearings within said crank case, a driving gear mounted on one end of the crank shaft and extending beyond the top of the crank case, the lower section of a gear case surrounding the lower part of the driving gear and cast integral with the crank case, a cover for the crank case, a lower gear case part having an opening over the lower gear case part through which the upper end of the driving gear passes, a motor mounted on the cover over the crank chamber, an armature shaft extending from the motor, a pinion secured to said armature shaft in position to mesh with the driving gear, and the upper section of a gear case mounted on the cover to receive the pinion and the upper end of the driving gear, said upper gear case part being cast integral with the motor frame.

7. In a motor compressor, the combination of a crank case, a crank shaft mounted in bearings within the crank case, a driving gear mounted on one end of the crank shaft and extending upwardly beyond the edge of the crank case, a lower gear case part for receiving the lower part of the driving gear, said gear case part being cast integral with the crank case, a uniplaner cover for the crank case and lower gear case part having an opening through which the upper end of the driving gear extends, the upper part of a gear case mounted on the cover to form a continuation of the lower gear case part to receive the upper end of the driving gear, and a motor mounted on the cover over the

crank case, the armature shaft of the motor terminating in a driving pinion disposed within the upper gear case section, said upper gear case section being cast integral with the motor frame.

8. In a motor compressor, the combination of a crank case, a crank shaft mounted in bearings within the crank case, a driving gear mounted on one end of the crank shaft and extending upwardly beyond the edge of the crank case, a lower gear case part for receiving the lower part of the driving gear, said gear case part being cast integral with the crank case, a uniplaner cover for the crank case and lower gear case part having an opening through which the upper end of the driving gear extends, the upper part of a gear case mounted on the cover to form a continuation of the lower gear case part to receive the upper end of the driving gear, a motor mounted on the cover over the crank case, an armature shaft for the motor extending from the motor case and terminating in a driving pinion disposed within the upper gear case section in mesh with the driving gear, and a bearing frame for the extending end of the armature shaft, said upper gear case section and said bearing frame being cast integral with the motor frame whereby said motor frame, bearing frame and upper gear case section may be lifted together from the cover of the crank case and lower gear case.

9. In a motor compressor, the combination of a crank case, a crank shaft mounted in bearings within the crank case, a driving gear mounted on one end of the crank shaft and extending upwardly beyond the edge of the crank case, a lower gear case part for receiving the lower part of the driving gear, said gear case part being cast integral with the crank case, a uniplaner cover for the crank case and lower gear case part having an opening through which the upper end of the driving gear extends, the upper part of a gear case mounted on the cover to form a continuation of the lower gear case part to receive the upper end of the driving gear, a motor mounted on the cover over the crank case, an armature shaft for the motor extending from the motor case and terminating in a driving pinion disposed within the upper gear case section in mesh with the driving gear, a bearing frame for the extending end of the armature shaft, said upper gear case section and said bearing frame being cast integral with the motor frame whereby said motor frame, bearing frame and upper gear case section may be lifted together from the cover of the crank case and lower gear case, and a common integral cover for the bearing frame and upper gear case section.

10. In a motor compressor, the combination of a crank case enlarged at one end to form a gear case, a uniplaner cover for the crank case having an opening over the gear case part, a crank shaft journaled within the crank case, a driving gear mounted on one end of said crank shaft and disposed within the gear case part with its upper end extending through the opening in the cover, an upper gear section mounted on said cover to form a continuation of the lower gear case part to receive the upper part of the driving gear, a motor mounted on the cover over the crank case, bearing frames for the motor armature shaft, a driving pinion mounted on one end of the armature shaft and disposed within the upper gear section in mesh with the driving gear, said motor having an upper and lower frame section, the bearing frames and the upper gear case sections being cast integral with the lower section of the frame, and an integral cover over the upper gear case section and the adjacent bearing frame.

11. In a motor compressor, the combination of a crank case enlarged at one end to form a gear case, a shaft within the gear case, a driving gear mounted on one end of the shaft and disposed within the gear case part, a cover for the crank case and gear case part having an opening over the gear case part, an upper gear case section mounted on said cover over the lower gear case part, a motor mounted on said cover over the crank case, an armature shaft extending from said motor, and a driving-pinion mounted on the end of the armature shaft and disposed within the upper gear case section in mesh with the driving gear, said upper gear case section being cast integral with the motor frame.

12. In a motor compressor, the combination of a crank case, a crank shaft within the crank case, a driving gear mounted on one end of the crank shaft within the gear case, a cover for the crank case, a motor mounted on said cover, an upper gear case section mounted on said cover over the driving gear, one end of the armature shaft of the motor extending from the motor frame and terminating in a driving pinion within the upper gear case section and in mesh with the driving gear, a bearing frame mounted on said cover between the motor frame and the upper gear case section, said upper gear case section and bearing frame being cast integral, an oil well within the crank case for containing oil into which the driving gear dips, and an oil throwing disk mounted on the armature shaft between the pinions and the adjacent bearing frame for preventing the escape of oil from the gears to the armature by way of the armature shaft.

13. In a motor compressor, the combination of a crank case, pump cylinders connected with the crank case, a crank shaft within the crank case, connecting rods connecting said crank shaft with the pump cylinder pistons, and bearings within the crank case for the crank shaft, said connecting rods being grooved to form pockets for receiving and distributing oil within the crank case.

14. In a motor compressor, the combination of a crank case, a driving gear case, a cover for the crank case and gear case having an opening over the gear case through which a gear may extend, a motor mounted on the cover, bearing frames for the motor armature, a housing on the cover over the gear case opening, said housing and bearing frames being cast integral.

15. In a motor compressor, the combination of a crank case, a lower gear case cast integral with the gear case, a cover common to the gear case and crank case and having an opening over the crank case through which a driving gear may extend, bearing frames mounted on the cover, a housing on the cover over the gear case opening to receive the upper end of the driving gear, and a motor between the bearing frames having its armature mounted in said bearing frames, said bearing frames and housing being cast integral.

16. In a motor compressor, the combination of a crank case, a lower gear case cast integral with the crank case, a uniplaner cover common to the crank case and gear case and having an opening over the gear case, bearing frames mounted on the cover, a housing mounted on the cover over the gear case opening, said housing and bearing frames being cast integral, and a motor having its armature supported in the bearing frames.

17. In a motor compressor, the combination of a crank case, a lower gear case cast integral with the crank case, a cover common to the crank case and gear case, a housing on said cover over the gear case opening forming an extension of the gear case, a motor, and a bearing frame supporting one end of the motor armature, said bearing frame and housing being cast integral.

18. In a motor compressor, the combination of a crank case, a driving gear case, a cover common to the crank case and gear case and having an opening over the gear case through which a driving gear may extend, a housing on said cover over the opening forming an extension of the gear case for receiving the upper end of the driving gear, a motor, and a bearing frame for the motor armature, said bearing frame and housing being cast integral.

19. In a motor compressor, the combination of a crank case, a driving gear case, a uniplaner cover for the crank case and the gear case having an opening over the gear case through which a gear may extend, said cover being unbroken over the crank case, a motor frame mounted on the cover but separated therefrom by an air space, and a housing frame on said cover over the opening therein.

In witness whereof, I hereunto subscribe my name this 12th day of October A. D., 1906.

WILLIAM L. WATERS.

Witnesses:
CHARLES J. SCHMIDT,
HARVEY L. HANSON.