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PATENTED FEB. 4, 1908.

N. M. WATSON.
ELECTRIC AIR COMPRESSOR.

APPLICATION FILED APR. 23, 1906.

2 SHEETS—SHEET 1.

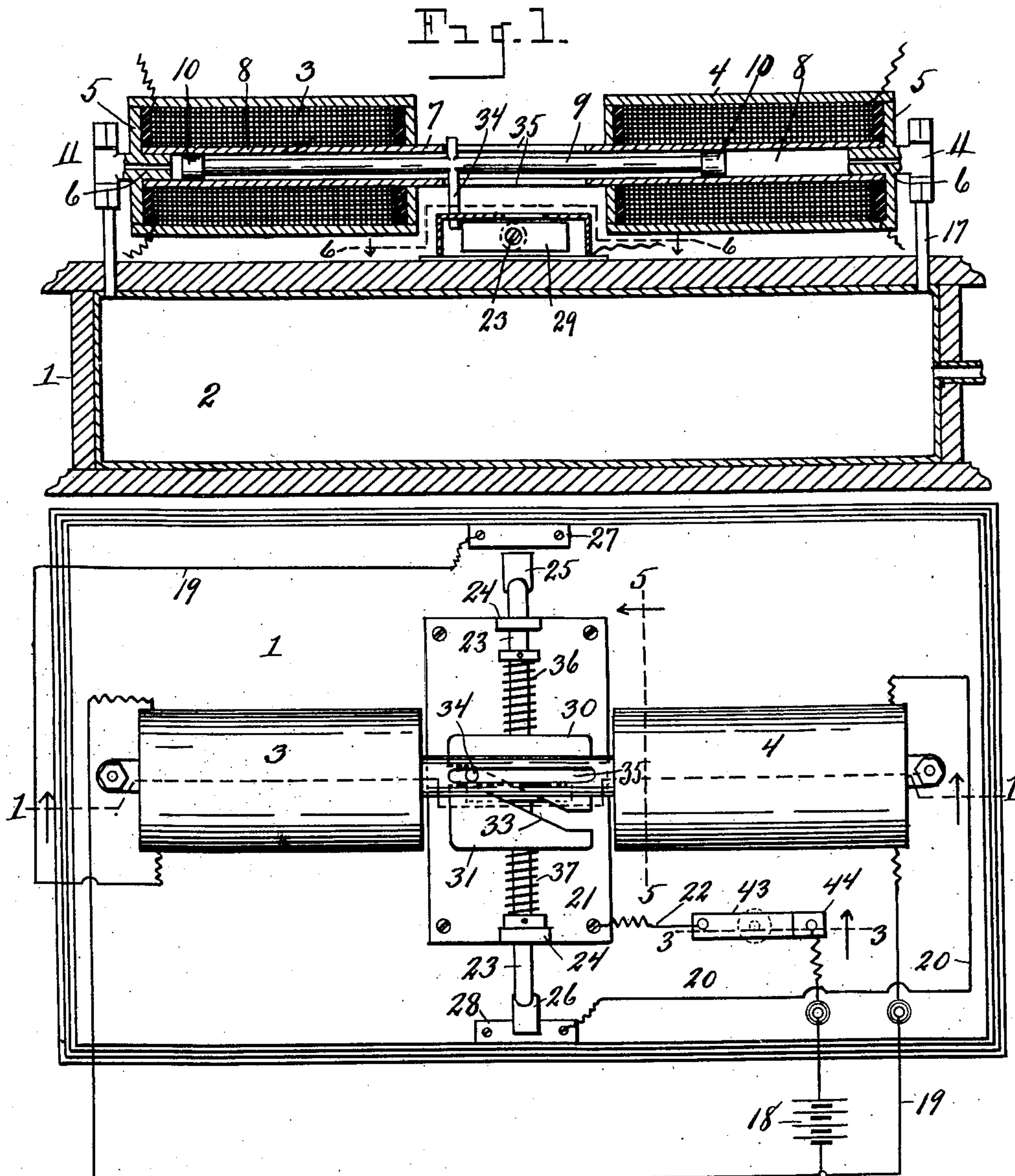


Fig. 1.

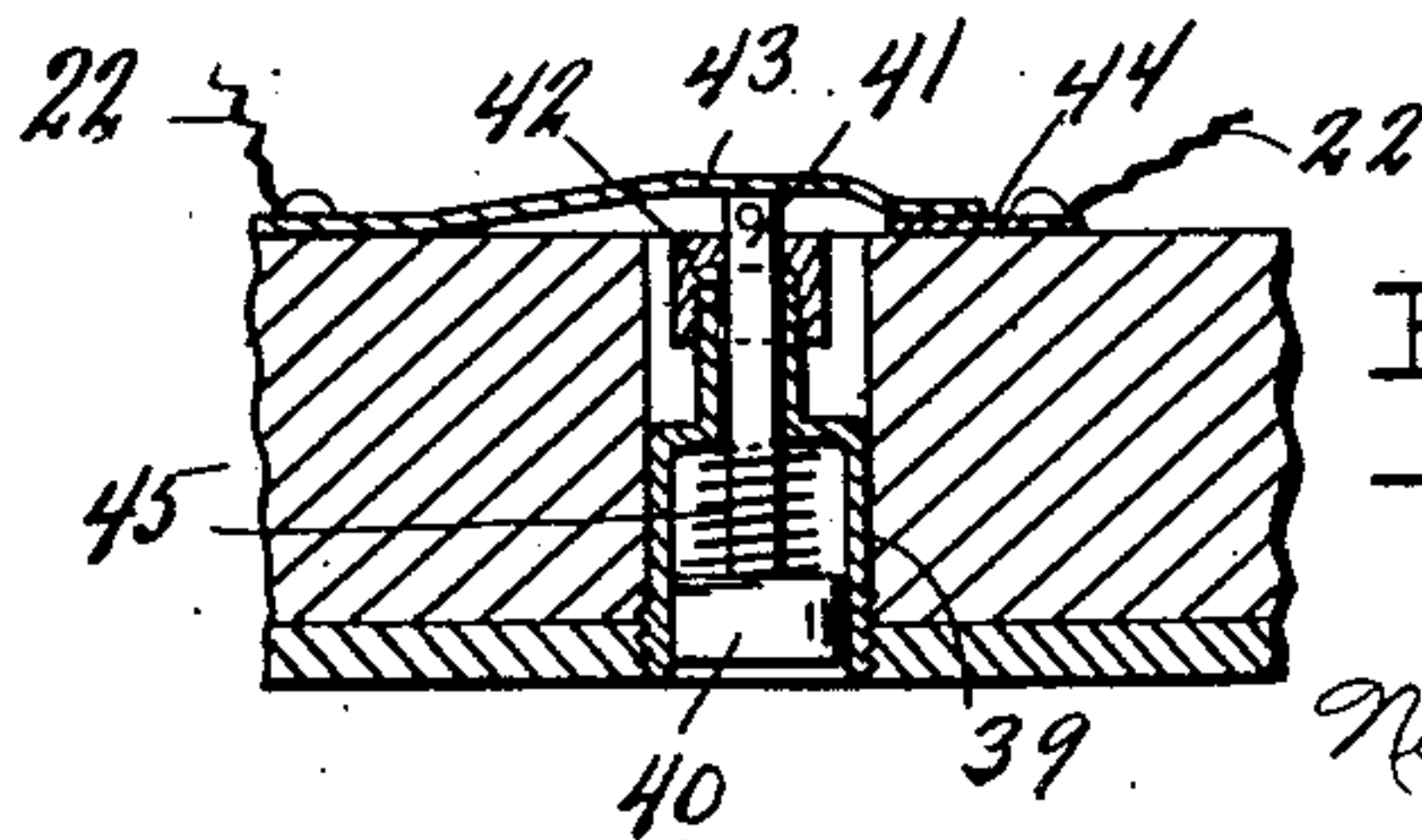


Fig. 2.

-Witnesses-
O. B. Baenziger.
J. G. Howlett.

-Inventor-
Nelson M. Watson

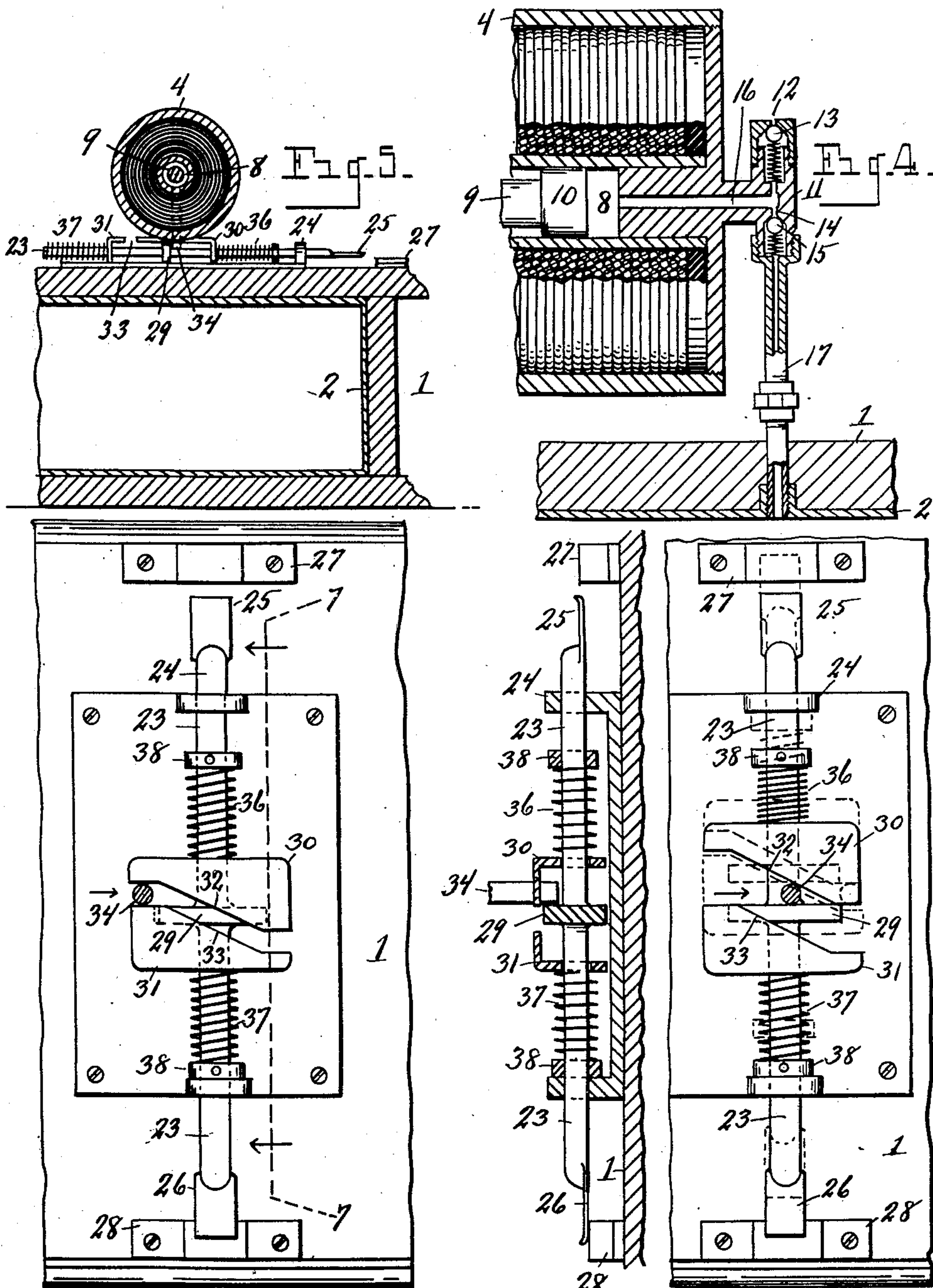
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2 SHEETS—SHEET 2.



Witnesses Fig. 6.
O. B. Baenziger
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Fig. 7. Fig. 8. Inventor.
Nelson M. Watson.
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UNITED STATES PATENT OFFICE.

NELSON M. WATSON, OF DETROIT, MICHIGAN.

ELECTRIC AIR-COMPRESSOR.

No. 878,260.

Specification of Letters Patent.

Patented Feb. 4, 1908.

Application filed April 23, 1906. Serial No. 313,138.

To all whom it may concern:

Be it known that I, NELSON M. WATSON, a citizen of the United States, residing at Detroit, in the county of Wayne, State of Michigan, have invented certain new and useful Improvements in Electric Air-Compressors; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates to an electric pump or air compressor, and consists in the construction and arrangement of parts hereinafter fully set forth and pointed out particularly in the claims.

The object of the invention is to provide simple and efficient means for compressing air by alternately energizing magnetic coils which operate differentially upon a plunger lying within the axial apertures of the coils, the arrangement being such as to cause the reciprocation of the plunger to compress air within the axial apertures of the coils, which serve as cylinders for the pistons on the opposite ends of said plunger.

A further arrangement provides for automatically shifting the current from one coil to the other to cause a continual reciprocation of the plunger and a still further arrangement provides for automatically cutting off the current from the coils when the pressure in the air reservoir shall have reached a predetermined point.

The above object is attained by the structure illustrated in the accompanying drawings, in which:—

Figure 1 is a longitudinal section through an apparatus embodying my invention, as taken on line 1—1 of Fig. 2. Fig. 2 is a plan view of the apparatus. Fig. 3 is an enlarged vertical section in detail, as on line 3—3 of Fig. 2. Fig. 4 is an enlarged vertical section through one of the coils and a portion of the reservoir or case, as well as the air pipe connecting the cylinder within the coil with the air reservoir. Fig. 5 is a transverse section as on line 5—5 of Fig. 2. Fig. 6 is a fragmentary view in section as on line 6—6 of Fig. 1. Fig. 7 is a sectional view on line 7—7 of Fig. 6. Fig. 8 is a view similar to Fig. 7, showing the position of parts during the movement of the plunger in one direction,

and by dotted lines the completion of said movement.

Referring to the characters of reference, 1 designates a suitable case within which is formed an air reservoir 2. Upon the top of the case are the magnetic coils 3 and 4 respectively, having the iron heads 5 provided with the inwardly extending core pieces 6, forming the poles of the magnets which core pieces lie in the opposite ends of the tube 7, whose opposite end portions fill the axial openings of the coils, forming the cylinders 8 of the air compressor. Lying within the tube 7 and extending into said air cylinders is a plunger 9 having the pistons 10 upon the opposite ends thereof. By a reciprocation of said plunger, said pistons are caused to work in their respective cylinders.

Connected with the projecting ends of the cores of the coils are the couplings 11, shown more clearly in Fig. 4, having an air intake port 12 controlled by a spring-pressed valve 13 and an air educt port 14 controlled by a spring-pressed valve 15. Communicating with said air intake and educt ports is an air passage way 16 formed in each of the cores of the coils which communicate with the respective cylinders thereof. The position of the valves is such that when a piston recedes, air is drawn into the cylinder through the intake port 12, and upon the return of the piston is discharged through the educt port 14. Connecting said educt port with the air reservoir 2 is a pipe 17. By this arrangement a reciprocation of the plunger will cause the pistons 10 to successively force the air from their respective cylinders through the connecting pipes 17 into the air reservoir.

The reciprocation of the plunger 9 is accomplished by alternately energizing the magnets 3 and 4 whose windings are such as to cause the plunger to be drawn inwardly when energized. The coils of said magnets are in circuit with the battery 18 through the circuit wires 19 and 20 respectively and through the base plate 21, said base plate being connected with the battery through a circuit wire 22 in which is located a circuit breaker, hereinafter explained.

To shift the current from the battery 18 alternately through the coils of the magnets 3 and 4, a reciprocatory bar 23 is employed mounted to slide longitudinally through the bearing blocks 24 upon the plate 21, and having at its opposite ends the contact brushes 25 and 26 which are adapted to make electrical

contact with the plates 27 and 28 in the circuits 19 and 20. The bar 23 is provided at its center with a disk 29 and mounted to slide upon said bar are the angle plates 30 and 31 whose opposed edges are beveled for a portion of their distance in opposite relation as shown at 32 and 33 and lie approximately parallel, forming a way into which extends the lower end of the pin 34 carried by the plunger 9, said pin being guided by the slots 35 formed in the opposite walls of the tube 7, within which said plunger reciprocates. The plates 30 and 31 are normally retained in position by the coiled springs 36 and 37 which embrace the bar 23 and are confined between said plates and the collars 38 fixed to said bar 23, which arrangement permits each of the plates to be moved longitudinally upon the bar against the action of its spring.

With the parts in the position shown in Fig. 2, the circuit will be closed through the magnet 4, thereby energizing said magnet and drawing the plunger longitudinally into it to force the air from the cylinder into the air reservoir, at the same time causing the pin 34 to engage the beveled face 32 of the plate 30 and crowd said plate longitudinally upon the bar 23 against the action of the spring 36, said bar being held from movement owing to the fact that the pin 34 of the plunger 9 is in engagement with the face of the disk 29, as clearly shown in Fig. 8, in which position said parts remain during said movement of the plunger until said pin shall have passed from engagement with said disk at the completion of the stroke of the plunger, when the force of said spring 36 will move the bar 23 longitudinally so as to carry the brush 26 from contact with the plate 28 and cause the brush 25 at the opposite end of said bar to make electrical contact with the plate 27, thereby cutting out the magnet 4 and immediately energizing magnet 3, when the plunger will be moved in the opposite direction. During said movement of the plunger the engagement of the pin 34 with the beveled face 33 of the plate 31 will move said plate and compress the opposite spring 37, thereby placing a tension upon said spring, which, when the pin 34 shall have passed from engagement with the face of the disk 29 upon said return movement, will quickly move the bar 23 longitudinally to cut out the magnet 3 and again place in circuit the magnet 4, the operation of successively energizing the magnets and causing the longitudinal reciprocation of the plunger continuing as long as the battery circuit 22 shall remain closed. The rapid reciprocation of the plunger induced by the alternate energizing of the magnets causes the pistons upon the ends of said plunger to pump air into the air reservoir until the pressure therein shall have reached a predetermined point.

To provide for cutting out the magnets

when the required degree of pressure in the reservoir shall have been attained, a cylinder 39 is placed in the top of the reservoir communicating therewith and having therein a piston 40 whose stem 41 passes upwardly through the top and through a suitable stuffing box 42, the end of said stem engaging a spring 43 which forms a part of the circuit 22 and whose free end normally lies in electrical contact with a plate 44 also forming a part of said circuit. The piston 40 within the cylinder 39 is held down against the action of the pressure within the reservoir by a coiled spring 45. When the pressure within the reservoir exceeds the required amount, the piston 40 will be raised against the force of the spring 45, thereby lifting the spring 43 from contact with the plate 44 and opening the battery circuit 22, in which position said parts remain until the pressure within the reservoir shall have been reduced sufficiently to enable the spring 45 to restore the piston 40 and permit the circuit 22 to again close when the magnets will again be alternately energized and the operation of pumping air into the reservoir will be resumed.

By the employment of the springs 36 and 37 upon the reciprocatory cross bar which serves to switch the current alternately from one magnet to the other, the movement of said cross bar at the terminal of the stroke of the plunger in either direction is made rapid, thereby obviating the forming of an arc between the contact plates and brushes and quickly placing the parts in position for a return stroke of the plunger.

Having thus fully set forth my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In an electric air compressor, the combination of the reciprocatory plunger, the air cylinder within which said plunger works, an air reservoir, means connecting said reservoir with said cylinder to afford a passage for the air, an electric circuit including an electro magnet for reciprocating said plunger, means actuated by the plunger in its movement for cutting said magnet into and out of circuit, and means connected with the cylinder and actuated by fluid pressure for opening said electric circuit.

2. In an air compressor, the combination of the opposed electro-magnets, said magnets having air cylinders arranged axially therein, a plunger having its ends lying within said cylinders and provided with suitable pistons, said plunger forming the armatures of said magnets being adapted to be reciprocated by the alternate energization thereof, a source of electricity with which said magnets are connected by independent circuits, circuit openers and closers operatively associated with said plunger and actuated by the movement thereof to shift the current from one magnet to the other in

reciprocal succession at the terminal of the stroke of the plunger in either direction, and means connecting the air cylinders with an air reservoir.

5 3. In an electric air pump, the combination of the opposed electro-magnets arranged in axial alinement, an air cylinder in each of said magnets, a reciprocatory plunger having pistons at its ends lying in said air
10 cylinders, a source of electricity, an independent circuit connecting each of the magnets with said source of electricity, a reciprocatory cross bar having a contact at each end adapted to successively close the circuits
15 through the magnets, and means for actuating said bar by a reciprocation of said plunger.

4. In an air compressor, the combination of the opposed electro-magnets arranged in
20 axial alinement, an air cylinder in each of said magnets centrally disposed, a reciprocatory plunger having a piston at each end, said pistons lying in said air cylinders, a source of electricity connected by independent lines with said magnets, a reciprocatory cross bar, a base plate on which said
25 bar is mounted connected electrically with said source of electricity, the ends of said cross bar carrying contact brushes adapted
30 to successively close the circuits through said magnets, a member on said bar for shifting it longitudinally and a pin upon the plunger engaging said member.

5. In an air compressor, the combination
35 of an electro-magnet having an air cylinder therein, a plunger adapted to reciprocate in said cylinder, an air reservoir, a valve controlled air pipe connecting the cylinder with said reservoir, a reciprocatory plunger
40 adapted to move in the air cylinder actuated by successively energizing said magnet, a source of electricity included in the electric circuit with said magnet, a circuit opener in

said circuit, and means actuated by the air pressure in the reservoir for opening said circuit. 45

6. In an electric pump, the combination of the opposed solenoid-magnets, opposed cylinders therein, a reciprocatory plunger forming the armatures of said magnets having
50 pistons working in said cylinders, a source of electricity, a circuit connecting each magnet independently with said source of electricity, a reciprocatory member carrying contacts adapted to successively close the
55 circuits through said magnets, and means for actuating said member by a reciprocation of said plunger.

7. In an electric pump, the combination of the electro-magnets, the cylinders, a reciprocatory plunger having pistons working
60 in said cylinders, a source of electricity, a circuit connecting each magnet independently with said source of electricity, means operatively associated with said plunger for
65 successively closing the circuits through said magnets as the plunger reciprocates, and means connected with the cylinders and operated by fluid pressure for opening said
70 circuits.

8. In an electric pump, the combination of the magnets, the cylinders, a plunger having pistons working in said cylinders, a
75 source of electricity, a circuit connecting each magnet independently with said source of electricity, a reciprocatory bar, means on said bar for successively closing said circuits, springs for throwing said bar, and means
80 operatively associated with said plunger for compressing said springs.

In testimony whereof, I sign this specification in the presence of two witnesses.

NELSON M. WATSON.

Witnesses:

E. S. WHEELER,
I. G. HOWLETT.