No. 815,025. PATENTED MAR. 13, 1906.

F. VAN D. LONGACRE.

MEANS FOR OPERATING THE ELECTRIC UNLOADERS OF AIR COMPRESSORS.

APPLICATION FILED NOV. 20, 1903.

3 SHEETS—SHEET 1.

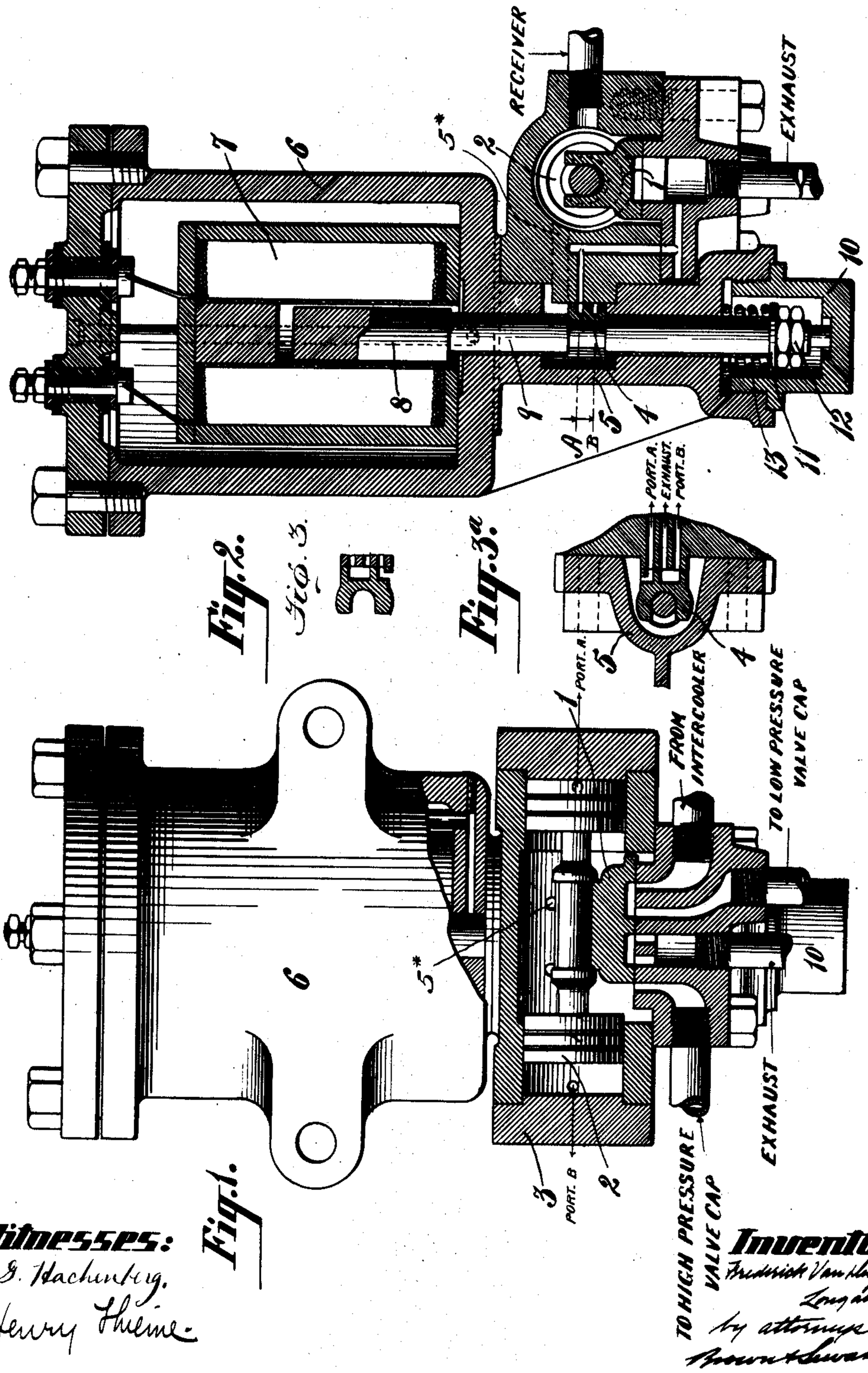

Fig. 2.

Fig. 3.

Fig. 3a.

Fig. 1.

Witnesses:
F. G. Hachenberg.
Henry Theine.

Inventor:
Frederick Van Duyn Longacre
by attorneys
Brown & Seward

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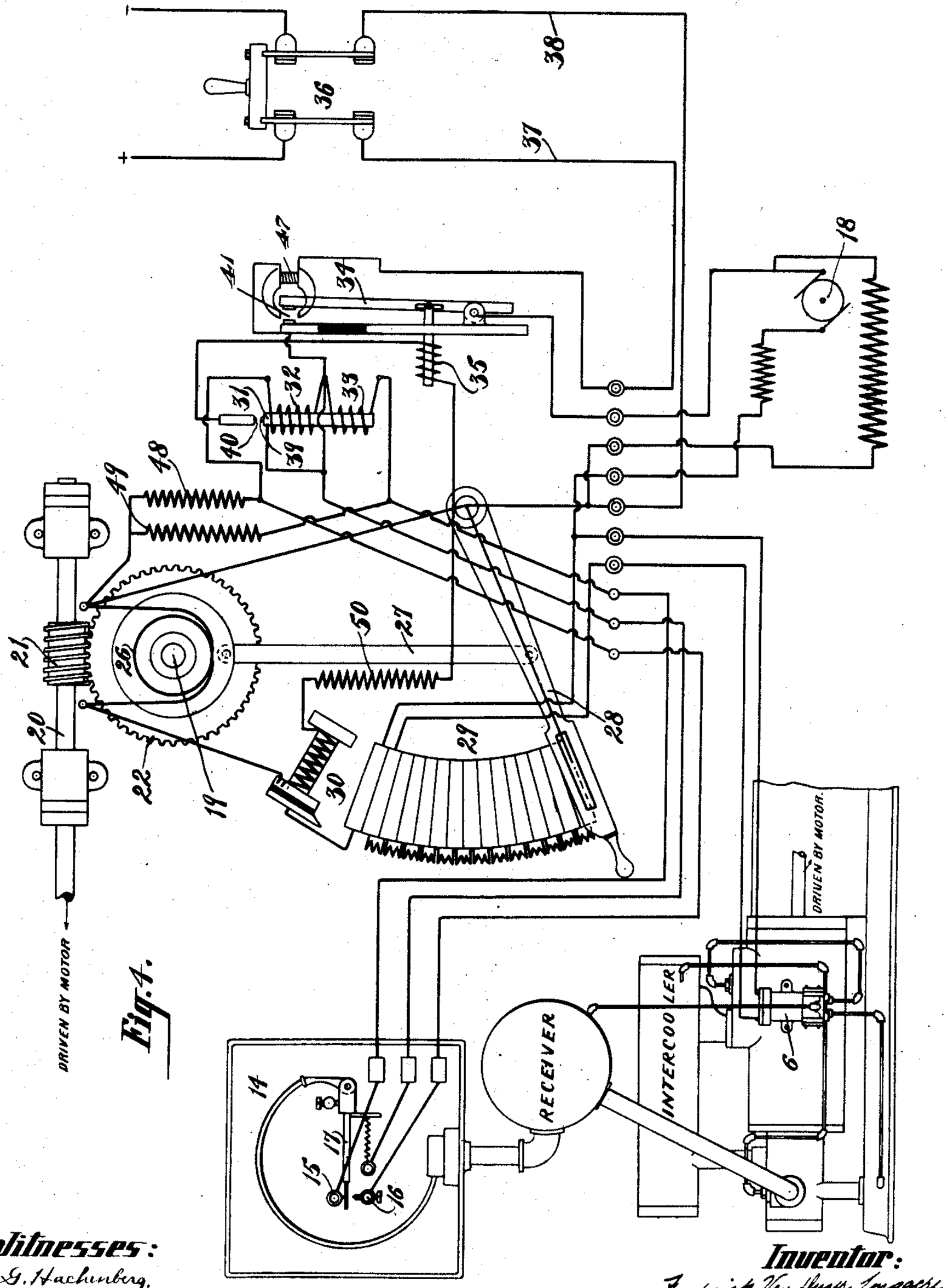

Fig. 4.

Witnesses:
F. G. Hachenberg.
Henry Thieme.

Inventor:
Frederick Van Duyn Longacre
by attorneys
Bonnell & Brand

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3 SHEETS—SHEET 3.

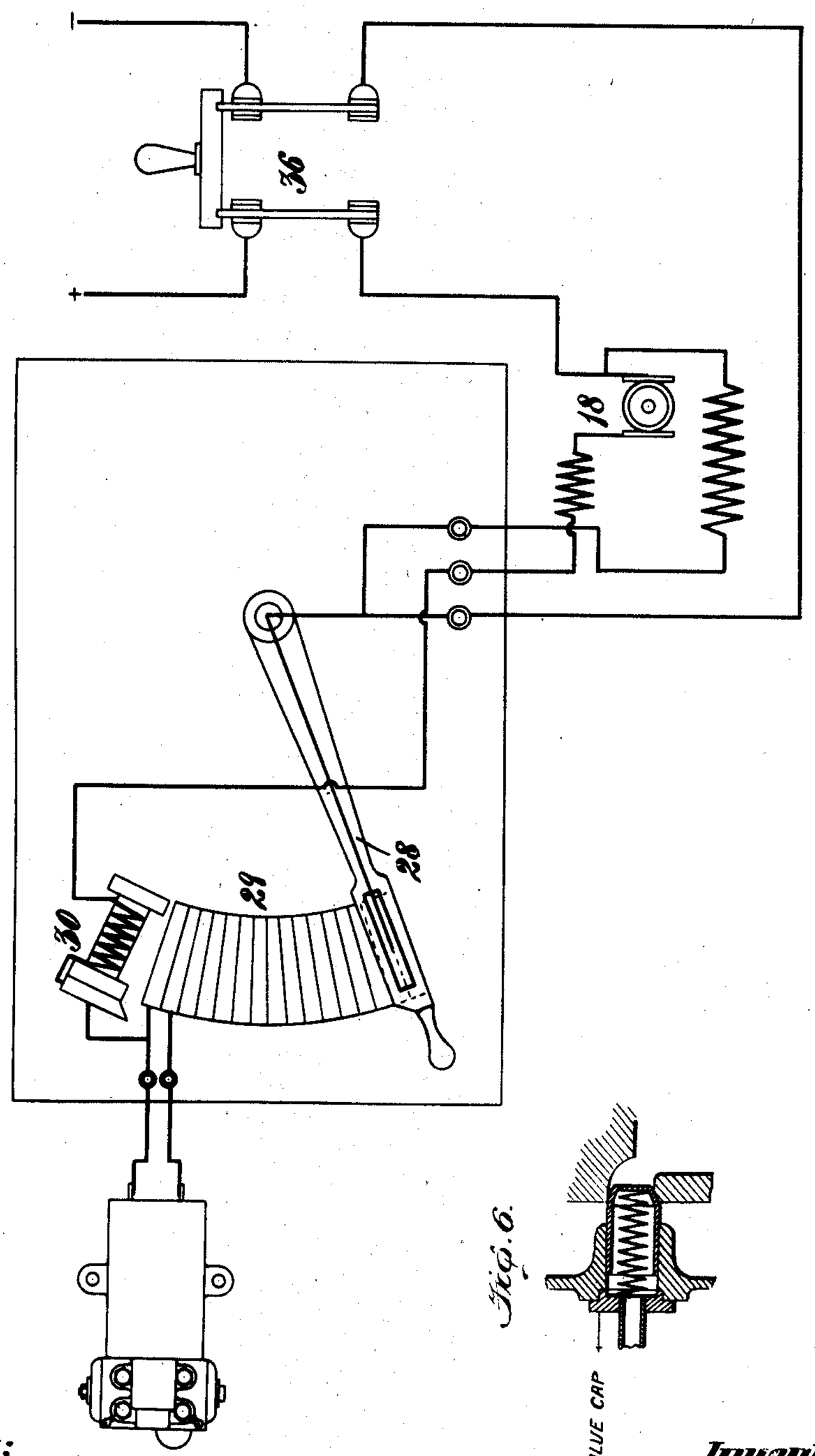

Fig. 6.

Fig. 6.

Witnesses:

F. G. Hachenberg.

Henry Theine.

Inventor:

Friedrich Van Duyn Longacre

by attorneys

Brownell & Howard

UNITED STATES PATENT OFFICE.

FREDERICK VAN DUZER LONGACRE, OF NEW YORK, N. Y., ASSIGNOR TO THE INGERSOLL-SERGEANT DRILL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF WEST VIRGINIA.

MEANS FOR OPERATING THE ELECTRIC UNLOADERS OF AIR-COMPRESSORS.

No. 815,025. Specification of Letters Patent. Patented March 13, 1906.

Application filed November 20, 1903. Serial No. 181,985.

To all whom it may concern:

Be it known that I, FREDERICK VAN DUZER LONGACRE, a citizen of the United States, and a resident of the borough of Manhattan, in the city and State of New York, have invented a new and useful Means for Operating the Electric Unloaders of Air-Compressors, of which the following is a specification.

My invention consists in means for operating the electric unloader of an air-compressor.

My invention contemplates the provision of means for controlling the unloading of an air-compressor before starting, so that the in-rush-current necessary for starting the compressor shall be reduced to as small an amount as possible for practical operation.

A further object is to provide means for operating the unloader so that the load is thrown on when the motor and compressor reach a predetermined speed, the point being determined by the connection of the unloader with the rheostat resistance, forming part of my invention, so that the unloader will be cut out by the rheostat-arm at the point desired.

In the accompanying drawings, Figure 1 represents the electric unloader in connection with which my means for operating it is used, the main valve and its adjacent parts being shown in section. Fig. 2 is a transverse vertical section through the unloader and valve, the parts being in the position which they assume when the current is off the unloader-magnet. Fig. 3 is a detail cross-section taken in the plane of the line A of Fig. 2 looking in the direction of the arrow. Fig. 3ª is a similar view on the line B. Fig. 4 is a diagrammatic view showing the automatic means which I have provided for operating the unloader. Fig. 5 is a diagrammatic view showing the manually-operated means which I have shown for operating the unloader, and Fig. 6 is a detail sectional view of one of the valve-caps.

The main valve of the air-compressor regulator, which controls the opening and closing of the spaces back of the discharge-valves to the atmosphere, is denoted by 1, its piston by 2, and its box by 3. The auxiliary slide-valve is denoted by 4 and is located in a box 5 at one side of the valve-box 3. The supply-port to the auxiliary valve-box 5 is denoted by 5*. This auxiliary valve 4 controls the movement of the main valve 1 as follows: When the auxiliary slide-valve is at the limit of its downward movement, it will admit pressure to the proper side of the piston 2 of the main valve 1 to cause it to move the main valve into position to open communication from the intercooler to the back of the low-pressure valve-cap of the compressor. When the auxiliary slide-valve 4 is raised to the limit of its upward movement, it will admit pressure to the other side of the piston 2 of the main valve 1, thus sliding the main valve into position to open the backs of the high-pressure valve-cap and low-pressure valve-cap to the exhaust or atmosphere.

The unloading-casing 6 surmounts the valve-box 5 and has located therein an electromagnet 7 of the solenoid type. The armature 8 of the electromagnet 7 is provided with a bar 9, which is connected to and fitted to operate the auxiliary valve 4. The lower end of the bar 9 extends through the bottom of the valve-box 5 and is inclosed by a hollow cap 10. A collar 11 is adjustably secured upon the lower end of the bar 9 by nuts 12, between which collar and the bottom of the valve-box 5 a spring 13 is interposed, which serves to normally hold the bar 9, and thereby the auxiliary valve 4, at the limit of their downward movements.

The means which I have devised for automatically energizing and deënergizing the electromagnet 7 for controlling the operation of the auxiliary valve 4, and thereby the movements of the main valve 1, is constructed, arranged, and operated as follows: I provide an air-pressure-governed electric contactor 14, having the usual contacts 15 16 and oscillating finger 17. The motor is shown diagrammatically at 18. I provide a magnetic clutch 19, which is positively driven from any suitable source of power—as, for instance, the motor—through connections not shown herein by a worm and gear connection 21 22 and shaft 20. The coil of the magnetic clutch 19 is denoted conventionally by 26, which coil when energized serves to operate a link 27, connected to the swinging arm 28 of a rheostat 29. A holding-magnet 30 is provided for the swinging arm 28 of the rheostat. I provide a magnetic-controlled contactor 31 with the usual coils 32 33, adapted to be short-circuited by the air-pressure-

governed electric contactor 14. I also provide a magnetic switch 34, its controlling-coil being denoted by 35. When both coils 32 33 are energized, the core 31 will not be moved, but will remain in either extreme position, depending upon which coil was energized last. The main-line switch is denoted by 36 and the line-wires leading therethrough by 37 38. The coil of an electric blow-out magnet for preventing sparking in the magnetic switch 34 is herein denoted by 47. Resistances 48 49 are located between the negative side of the main current at the magnetic clutch 19 and the coils 32 and 33, respectively, of the magnetic-controlled contactor 31. A resistance 50 is also shown between the magnetic switch-controlling coil 35 and the holding-magnet 30.

The electric unloader is operated as follows: Let it be assumed that the air-compressor has stopped at a predetermined high pressure. As the air-pressure in the receiver falls the air-pressure-governed electric contactor 14 will cause the oscillating finger 17 to engage the contact 15. This will short-circuit the coil 33 of the magnetic-controlled contactor 31 because of greater resistance in the coil 33 over a connection through point 15, thus allowing its core 39 to be drawn up by the coil 32 into engagement with the contact 40, thus completing the circuit through the controlling-coil 35, magnetic clutch-coil 26, and holding-magnet 30. Immediately upon contact being made in the magnetic-controlled contactor 31 the main circuit will be thrown in by the magnetic switch 34 at the point 41. As soon as this main contact is made at 41 the current is thrown onto the motor through the rheostat 29, and consequently through the electromagnet 7 of the unloader, which electromagnet is part of the rheostat resistance. The energization of the electromagnet 7 raises the armature 8, and thereby the bar 9, thus moving the auxiliary valve 4 into position to cause the main valve to be operated to open the spaces back of the high and low pressure valve-caps to the atmosphere, and thus unload the compressor. Sufficient current is provided through the first point of resistance in the rheostat 29 to allow the motor 18 to start. Upon the starting of the motor, and thereby the compressor, the magnetic clutch 19 is operated, it being mechanically driven from the motor 18, as hereinbefore set forth. The operation of the magnetic clutch 19 serves to lift the link 27, and thereby swing the arm 28 of the rheostat, over the resistance-coils, thus cutting out the resistance in the rheostat and permitting the motor and compressor to gain speed. The arm 28 of the rheostat will finally be drawn into contact with the holding-magnet 30, thereby cutting out all of the resistance of the rheostat. As soon as the rheostat-arm 28 comes in contact with the holding-magnet 30 the magnetic clutch-coil 26 is deënergized because less resistance is presented through the arm 28 to the opposite pole of the circuit than through the magnetic clutch-coil. This deënergization of the clutch-coil 26 will release the link 27 and permit the arm 28 of the rheostat to drop as soon as the circuit is broken through the holding-magnet 30. The electromagnet 7 of the unloader is connected in series with the rheostat resistance at some point—as, for instance, at the last point of resistance—so that when the arm 28 of the rheostat reaches this point the electromagnet 7 of the unloader is cut out, and thereby deënergized. As soon as the electromagnet 7 is deënergized the auxiliary valve 4 will be moved back to its normal position at the limit of its downward movement, thus moving the main valve into position to throw the load onto the compressor. In the accompanying drawings the relation of the parts is such that the motor and compressor are permitted to reach practically full speed before the load is thrown onto the compressor. After the load has been thrown onto the compressor and the air-pressure in the receiver has risen to a predetermined high-pressure point the oscillating finger 17 of the air-pressure-governed electric contact will engage the contact 16, and thereby short-circuit the coil 32 in the magnetic-controlled contactor 31, thus breaking the circuit through the core 39 and contact 40. This will immediately release the magnetic switch 34 and break the main circuit through the motor at the point 41, thereby releasing the entire apparatus. The current through the holding-magnet 30 is also broken by the breaking of the circuit between the core 39 and contact 40, thus permitting the arm 28 of the rheostat to fall to its normal position. The compressor will thereby remain loaded until the means for operating the electric unloader is again brought into use.

In Fig. 5 I have shown a diagrammatic view illustrating a hand starting device for operating the electric unloader. In this instance when the main switch 36 is closed a circuit will be established through the rheostat 29, and thereby through the electromagnet 7 of the unloader. The arm 28 of the rheostat may then be moved by hand to successively cut out the resistance-coils of the rheostat. As the arm 28 reaches the holding-magnet 30 the motor, and thereby the compressor, will have attained full speed and the electromagnet 7 of the unloader is cut out, thus throwing the load onto the compressor.

What I claim is—

1. An air-compressor, a discharge-valve therefor, a main regulator-valve for controlling the pressure behind the discharge-valve, an auxiliary valve for controlling the movements of the main regulator-valve, an electromagnet for operating the auxiliary valve

and means for energizing and deënergizing the electromagnet.

2. A main regulator-valve for an air-compressor, an auxiliary valve for controlling the movements of the same, an electromagnet for operating the auxiliary valve and air-pressure-controlled means for permitting the energization and deënergization of the electromagnet.

3. An unloader for an air-compressor and electrically-controlled means for operating the unloader comprising a rheostat, an electromagnet connected in series therewith and arranged to be deënergized when the rheostat-arm reaches a predetermined point.

4. An unloader for an air-compressor and electrically-controlled means for operating the unloader comprising a rheostat, an electromagnet connected in series therewith and a holding-magnet for the rheostat-arm.

5. An unloader for an air-compressor and electrically-controlled means for operating the unloader comprising a rheostat, an electromagnet connected in series therewith, a magnetic clutch for controlling the movement of the rheostat-arm, a motor for operating the magnetic clutch when the circuit is completed therethrough and air-pressure-controlled means for making and breaking the circuit.

6. An unloader for an air-compressor and electrically-controlled means for operating the unloader comprising a rheostat, a holding-magnet, a magnetic clutch, a motor for operating it, a magnetic switch and an air-pressure-governed electric contactor controlling the circuit through the magnetic switch, the magnetic clutch and the holding-magnet.

7. An unloader for an air-compressor and electrically-controlled means for operating the unloader comprising a rheostat, an electromagnet connected in series therewith, a magnetic clutch, a motor for driving the same, a magnetic-controlled contactor, a magnetic switch and an air-pressure-governed electric contactor for making and breaking the circuit through the several parts.

8. An unloader for an air-compressor and electrically-controlled means for operating it comprising a rheostat, a holding-magnet for the rheostat-arm, a magnetic clutch for moving the arm, a motor connected to the magnetic clutch, a magnetic-controlled contactor, a magnetic switch and an air-pressure-governed electric contactor for controlling the operation of the several parts.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 21st day of October, 1903.

FREDERICK VAN DUZER LONGACRE.

Witnesses:

FREDK. HAYNES,

HENRY THIEME.