W. PRELLWITZ.

FLUID COMPRESSOR.

APPLICATION FILED SEPT. 15, 1908.

1,069,287.

Patented Aug. 5, 1913.

5 SHEETS—SHEET 1.

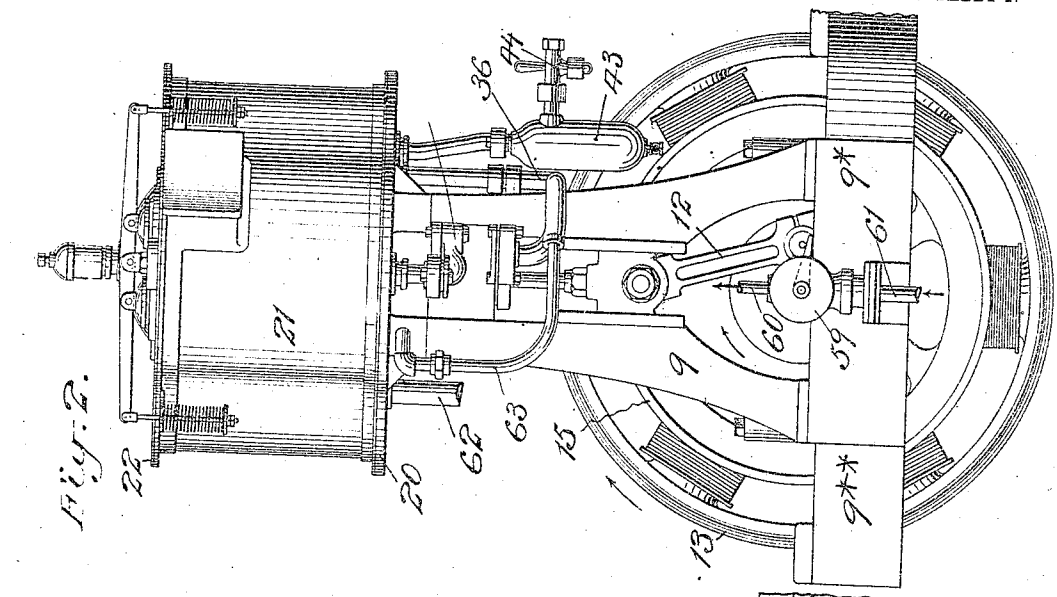

Fig. 2.

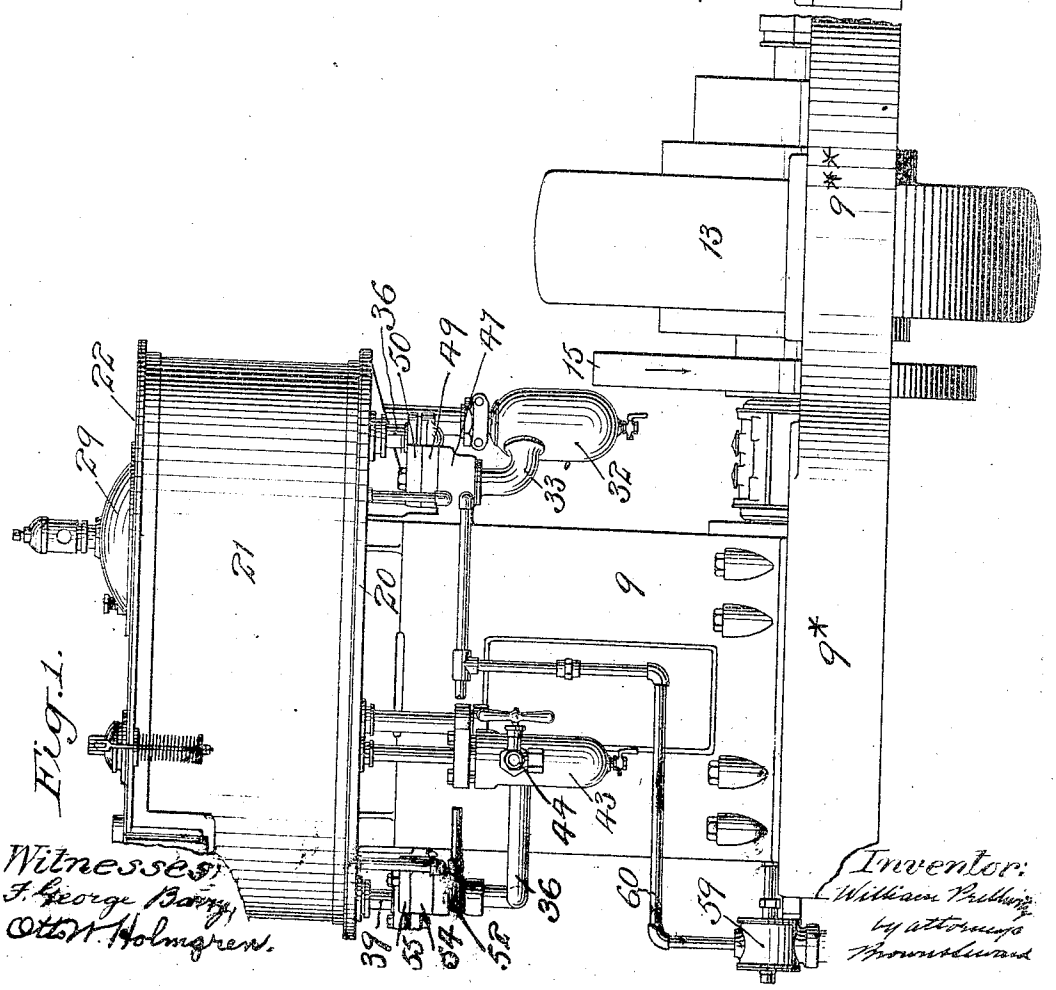

Fig. 1.

Witnesses:
F. George Barry,
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Inventor:
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by attorneys
Brownell & Brownell

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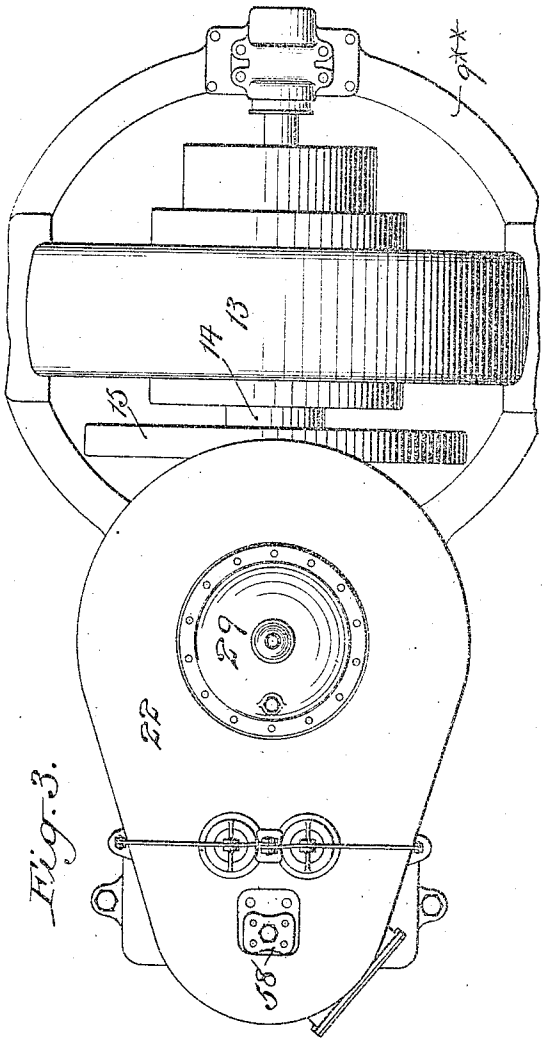

Fig. 3.

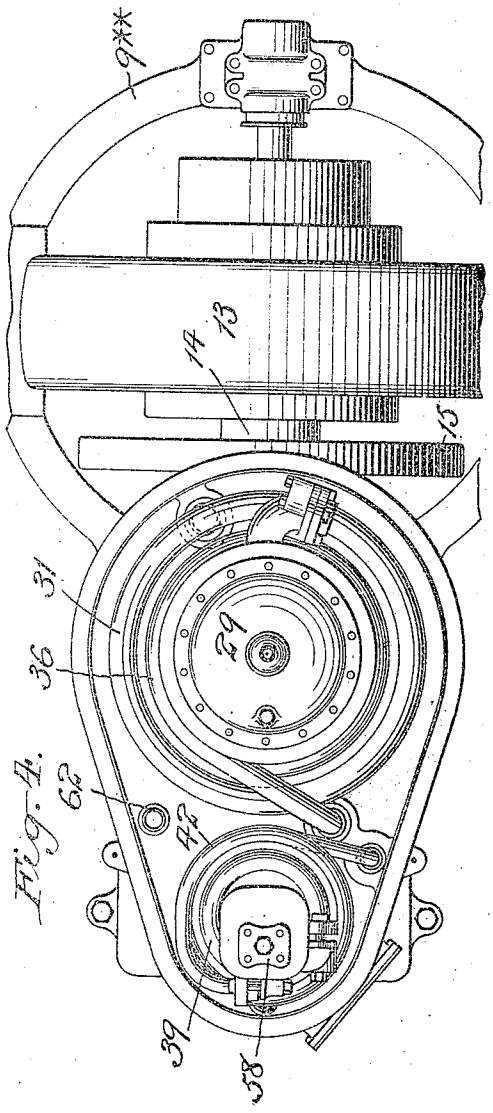

Fig. 4.

Witnesses:-
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5 SHEETS—SHEET 3.

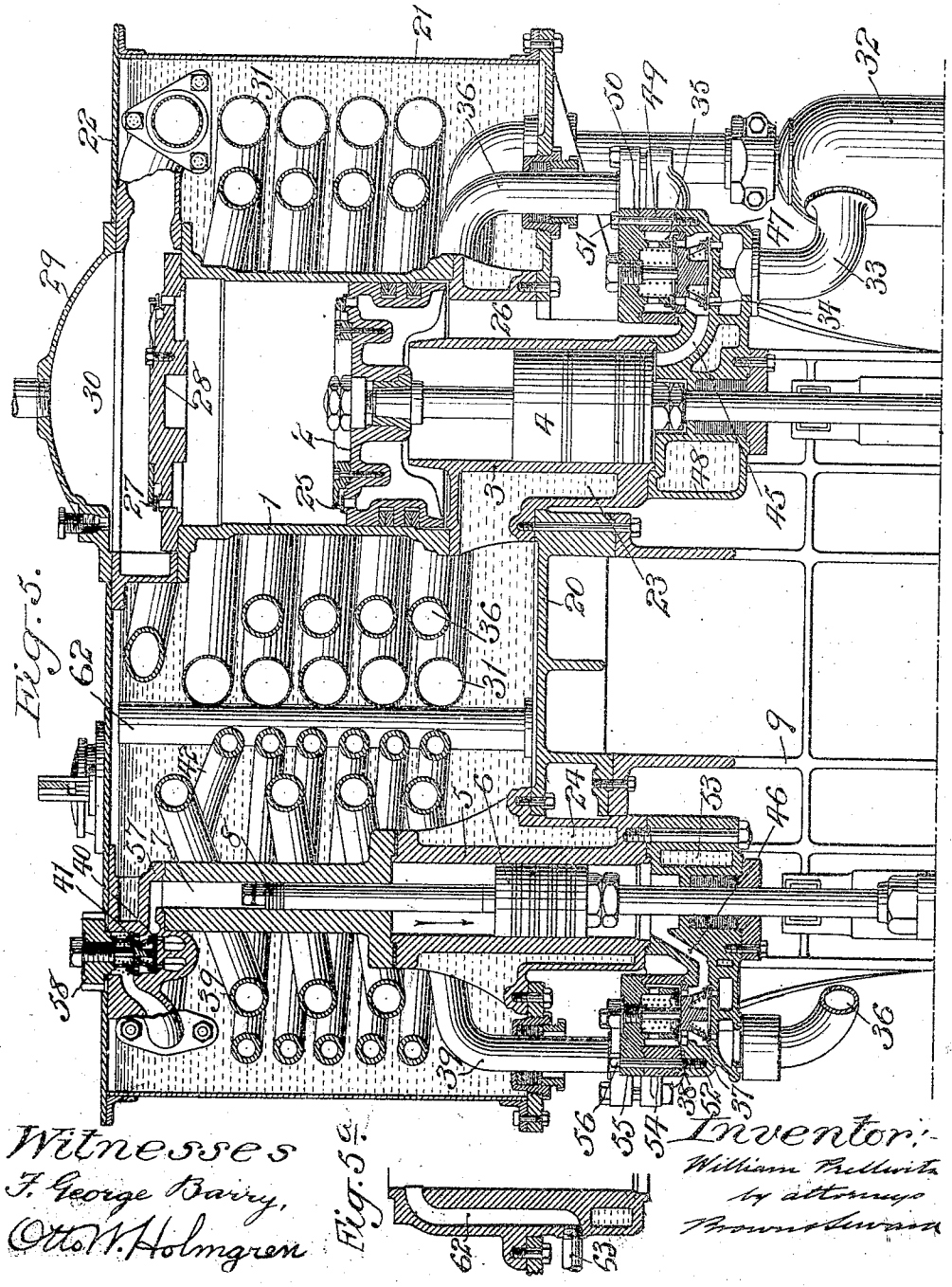

Fig. 5.

Fig. 5a.

Witnesses

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5 SHEETS—SHEET 4.

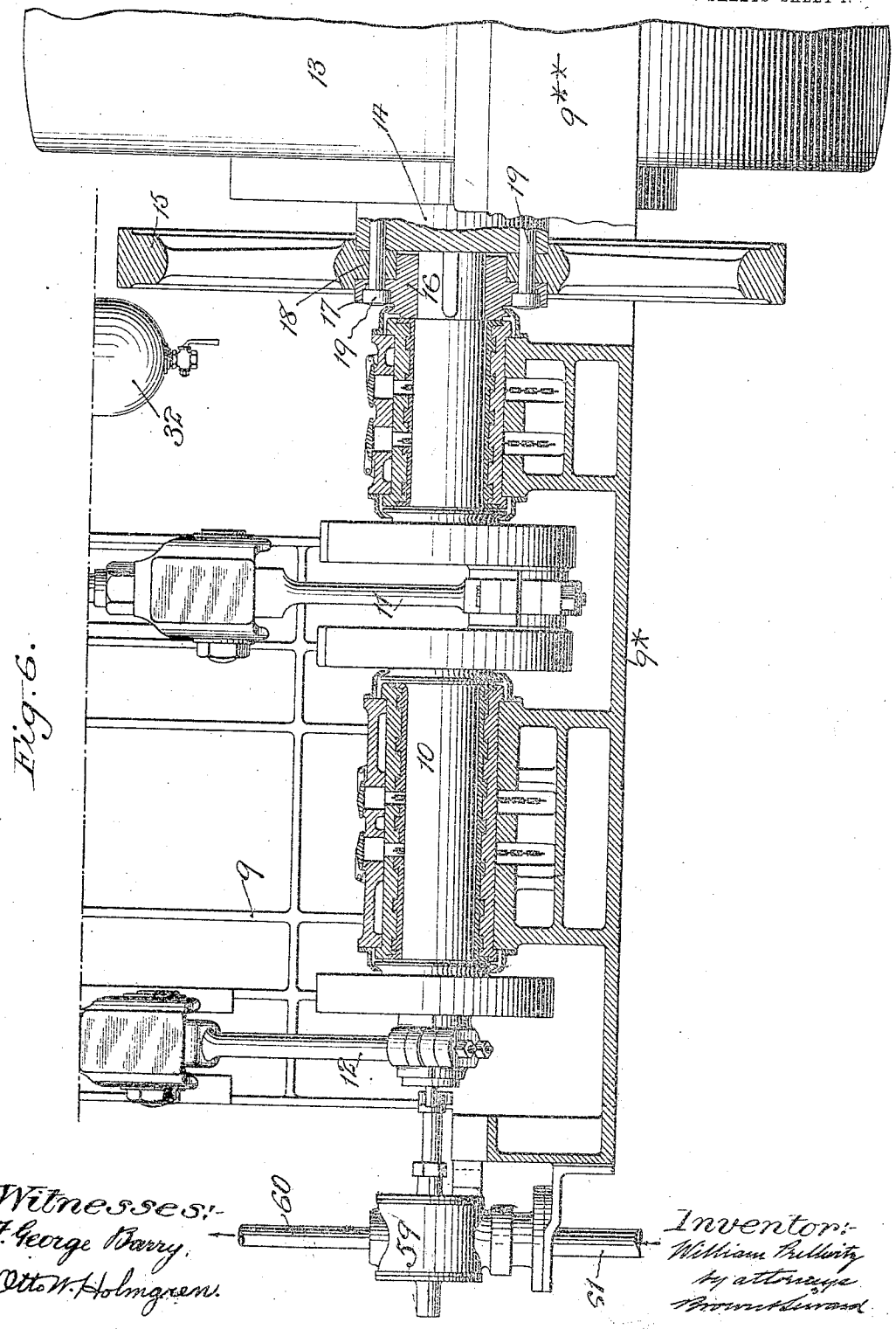

Fig. 6.

Witnesses:-
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APPLICATION FILED SEPT. 15, 1908.

1,069,287.

Patented Aug. 5, 1913.

5 SHEETS—SHEET 5.

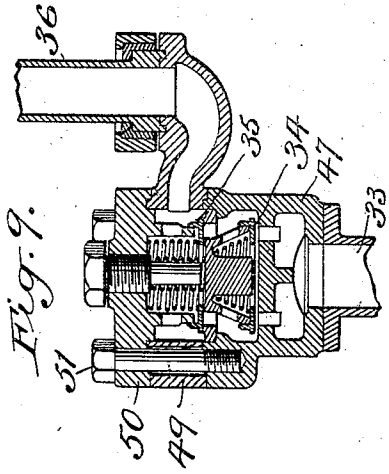

Fig. 9.

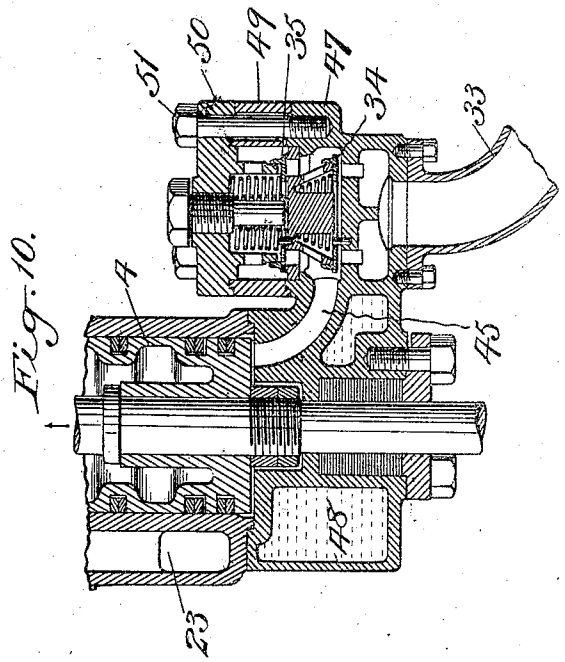

Fig. 10.

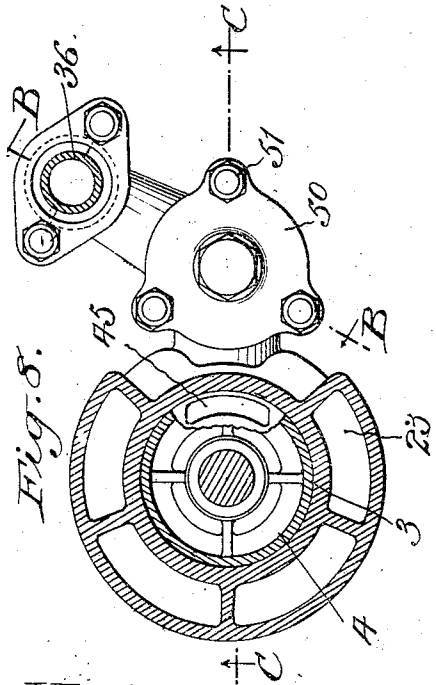

Fig. 8.

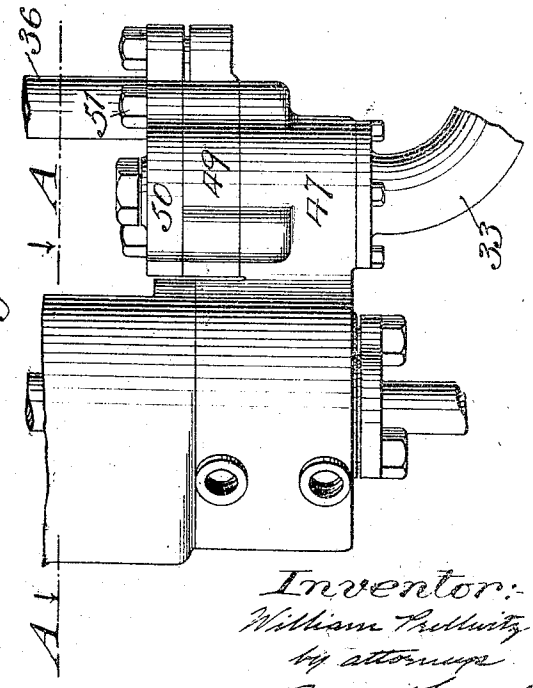

Fig. 7.

Witnesses:-
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UNITED STATES PATENT OFFICE.

WILLIAM PRELLWITZ, OF EASTON, PENNSYLVANIA, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

FLUID-COMPRESSOR.

1,069,287. Specification of Letters Patent. Patented Aug. 5, 1913.

Application filed September 15, 1906. Serial No. 453,156.

To all whom it may concern:

Be it known that I, WILLIAM PRELLWITZ, a citizen of the United States, and a resident of Easton, in the county of Northampton and State of Pennsylvania, have invented a new and useful Improvement in Fluid-Compressors, of which the following is a specification.

My invention relates to fluid compressors, such, for instance, as air compressors, and has for its object to provide certain improvements in the construction, form and arrangement of the several parts of the compressor whereby a very simple and compact machine may be produced which is in every way suitable for raising air to a high pressure in an economical manner and in which the several parts of the machine are readily accessible.

In the accompanying drawings, Figure 1 is a view in side elevation of the air compressor embodying my improvements, certain of the parts being broken away, Fig. 2 is an end view of the same, Fig. 3 is a top plan view, Fig. 4 is a similar view with the top of the water tank removed to more clearly show the parts within the tank, Fig. 5 is an enlarged longitudinal vertical section through the upper portion of the compressor, Fig. 5ª is a detail section through the wall of the second intermediate cylinder, taken at another angle to that of the cylinder in Fig. 5, showing the passage leading to the back side of the second intermediate cylinder piston, Fig. 6 is an enlarged longitudinal vertical section through the lower portion of the compressor, Fig. 7 is a detail view in side elevation on an enlarged scale of the first intermediate compressor cylinder and its inlet and discharge valve castings, Fig. 8 is a horizontal section taken in the plane of the line A—A of Fig. 7, looking in the direction of the arrows, Fig. 9 is a section taken in the plane of the line B—B of Fig. 8, looking in the direction of the arrows, and Fig. 10 is a detail section taken in the plane of the line C—C of Fig. 8, looking in the direction of the arrows.

The compound air compressor herein shown and described is of the single-acting four stage type, the low pressure cylinder being denoted by 1, its piston by 2; the first intermediate cylinder by 3, its piston by 4; the second intermediate cylinder by 5, its piston by 6; and the high pressure cylinder by 7 and its piston by 8. The low and first intermediate cylinders are in alinement and the high and second intermediate cylinders are in alinement with the low pressure cylinder arranged above the first intermediate cylinder and the high pressure cylinder arranged above the second intermediate cylinder. These cylinders are rigidly supported upon a suitable frame 9 uprising from a base 9*, which base forms a bearing support for the crank shaft 10 of the compressor. To this crank shaft 10 the pistons of the low and first intermediate cylinders are connected by a pitman rod 11 and the pistons of the high and second intermediate cylinders are connected by a pitman rod 12, the connections of these rods 11 and 12 with the crank shaft 10 being such that as the low pressure and first intermediate compressor pistons start from the limit of their movement, the high and second intermediate compressor pistons are about half way on their downward movement.

The motor which is herein shown for driving the crank shaft 10 of the compressor is denoted by 13 and its shaft 14 is connected to the crank shaft 10 through a fly wheel 15, as follows: A sleeve 16 is keyed on to the end of the crank shaft 10, which sleeve is provided with a flange 17 overlapping the central portion 18 of the fly wheel 15. Bolts 19 pass through the flange 17 of the sleeve 16 and the central portion 18 into the motor shaft 14.

A water tank is provided for cooling the compressor cylinders and their pipe connections, the bottom of which tank is denoted by 20, its side walls by 21 and its top by 22. The lower portions of the first and second intermediate cylinders project below the bottom 20 of the tank but the walls of the said cylinders are water-jacketed as shown at 23, 24. A piston inlet valve 25 is provided for the low pressure cylinder 1, the air being admitted from the exterior through a passage 26 leading along the wall of the first intermediate cylinder 3.

The discharge valve for the low pressure cylinder is denoted by 27 and is located in the inner plate 28 of the air head 30 of the said cylinder. The outer plate of this low pressure discharge air head is denoted by 29 and projects through the top 22 of the water tank. The air head of the low pressure cylinder 1 is made in the shape of a flat re-

ceiver and its capacity is sufficient to take all of the fluid compressed in the low pressure cylinder, thus forming a low pressure air receiver.

Four cooling coils, one for the discharge of each cylinder, are provided within the water tank. The coil 31 surrounds the low pressure cylinder 1 and leads from the low pressure air head 30 downwardly through the bottom of the water tank into a moisture collecting tank 32. A pipe 33 leads from this tank 32 to the under side of the inlet valve 34 of the first intermediate cylinder 3. The discharge valve for this first intermediate cylinder is denoted by 35. The coil 36 surrounds the low pressure cylinder 1 within the coil 31 and leads from the discharge valve 35 of the first intermediate cylinder to the under side of the inlet valve 37 of the second intermediate cylinder 5. The discharge valve of this second intermediate cylinder is denoted by 38 and the coil 39 leads from this discharge valve 38 to the under side of the inlet valve 40 of the high pressure cylinder 7, which pipe coil surrounds the said high pressure cylinder. The discharge valve for the high pressure cylinder is denoted by 41 and the coil 42 leads therefrom to a moisture collecting tank 43 located below the water tank. This coil 42 surrounds the high pressure cylinder exterior to the coil 39 and acts as an after cooler. A pipe 44 leads from the high pressure moisture collecting tank 43 to the receiver, not shown herein.

All of the valves herein described are of the ring type and the parts are so arranged that these valves work vertically. The inlet and outlet valves 34, 35, of the first intermediate cylinder 3 are provided with a common passage 45 leading to the under side of the piston 4 and the inlet and discharge valves 37, 38 of the second intermediate cylinder are similarly provided with a common passage 46 leading to the under side of the piston 6. The casing for the valves 34, 35 comprises a lower member 47 forming part of the first intermediate cylinder head 48, an intermediate member 49 and an upper member 50, which members are rigidly secured together by bolts 51. Similarly the casing for the valves 37, 38, comprises a lower member 52 forming part of the second intermediate cylinder head 53, an intermediate member 54 and an upper member 55, all of which members are secured rigidly together by bolts 56. The intermediate members 49 and 54 have a limited rotary adjustment with respect to the lower and upper members so that the said intermediate members may be accurately adjusted into position to be combined with the fixed lower ends of the coils 36 and 39.

The casing for the valves 40, 41, consists of the head 57 of the high pressure cylinder 7, the outer plate 58 of which is removable through the top 22 of the water tank. The casings for the inlet and discharge valves of the first and second intermediate cylinders are offset from and located exterior to the water tank where access to the said valves may be readily obtained. Access to the discharge valve 27 may be obtained by removing the outer plate 29 and access to the piston inlet valve 25 may be obtained by removing the outer plate 29 and inner plate 28 of the low pressure discharge head. Access to the valves 34, 35, may be readily obtained by removing the upper member 50; to the valves 37, 38 by removing the upper member 55, and to the valves 40, 41 by removing the outer plate 58. It will thus be seen that access to the several valves may be obtained in a very simple manner without interfering with the assembly of the other parts of the machine.

A circulation of water is insured within the water tank by providing a circulating pump 59 driven directly from the crank shaft 10 of the compressor. This pump has an inlet pipe 61 leading from any suitable source of water supply, not shown herein, and a discharge pipe 60 leading through several branches to the water tank. The tank is further provided with an overflow pipe 62 therein. The base 9* is extended, as shown at 9**, forming a support for the motor 13. The bottom 20 of the water tank is rigidly fixed to the frame 9, the frame 9 is rigidly fixed to its base 9* and the first and second intermediate cylinders are fixed rigidly to the bottom 20 of the tank. This arrangement of the parts serves to produce a very strong and compact machine capable of successfully withstanding the great strain to which it is subjected when raising air to higher pressures.

In operation, the air as it passes into the low pressure cylinder 1 through the piston inlet valve 25, is cooled as it travels along the passage 26 at the side of the first intermediate cylinder for the reason that the walls of the passage are exposed to the water within the tank. On the compression stroke, the air within the low pressure cylinder is forced past the discharge valve 27 into the low pressure head 30. This air head is made of large capacity and is located within the water tank so as to permit the coil 31 to be made sufficiently small in diameter to secure a more effective cooling surface. As has heretofore been stated, this low pressure air head is of sufficient capacity to take all of the air compressed in the low pressure cylinder, thus giving the coil 31 the complete time of a revolution to carry the air to the first intermediate cylinder. This will avoid the necessity of an excess of air pressure to force the air through the said coil. The air passes from the coil 31 into the moisture col-

lecting tank 32 where it deposits its moisture so that dry air may be taken into the first intermediate cylinder 3. The air then passes from the tank 32 through the pipe 33, inlet valve 47 and passage 45 into the first intermediate cylinder. On the compression stroke, the air is forced from this cylinder through the passage 45 past the discharge valve 49 into the coil 36 and from thence it passes through the inlet valve 37 and passage 46 into the second intermediate cylinder 5. On the compression stroke, the air is forced through the port 46 past the discharge valve 38 into the coil 39 and from thence past the inlet valve 40 into the discharge head 57 of the high pressure cylinder 7. On the compression stroke the air is forced from the cylinder through the discharge valve 41 into the coil 42 and from thence it passes into the high pressure moisture collecting tank 43. From this tank the air passes to any suitable receiver, not shown herein. Communication is established between the back of the second intermediate cylinder 5 and the coil 36 through the passage 62 and pipe 63, so that any air which may leak past the pistons in the second intermediate cylinder and high pressure cylinder passes into the said coil 36.

It will be seen that in the construction and arrangement of the parts as herein shown and described, the low pressure and high pressure discharge heads are located within the water tank where they may be effectively cooled. It will also be seen that the outer plate 58 of the high pressure discharge head and the outer plate 29 of the low pressure discharge head may be removed without removing the top 22 of the tank or in any way disturbing the other parts of the machine. It will also be seen that by locating the discharge heads for the first and second intermediate cylinders below the water tank and by offsetting the valve casings, access to the inlet and discharge valves of both of these cylinders may be readily obtained without disturbing the other parts of the apparatus.

While I have shown and described an air compressor, it is to be understood that the machine may be used for compressing any other fluid without departing from the spirit and scope of my invention.

What I claim is:

1. A compound compressor comprising high, low and intermediate vertically arranged cylinders and their pistons, coils connecting the cylinders and an inclosed water tank surrounding the coils and cylinders, the low pressure discharge head being located within the tank and an outer plate for said low pressure discharge head, said plate being exposed through the cover of the tank.

2. A compound compressor comprising high, low and intermediate vertically arranged cylinders and their pistons, coils connecting the cylinders and an inclosed water tank surrounding the coils and cylinders, the high pressure discharge head being located within the tank and an outer plate for said high pressure discharge head, said plate being exposed through the cover of the tank.

3. A compound compressor comprising high, low and intermediate vertically arranged cylinders and their pistons, coils connecting the cylinders and an inclosed water tank surrounding the coils and cylinders, the high and low pressure discharge heads being located within the tank and outer plates for said high and low pressure discharge heads, said plates being exposed through the cover of the tank.

4. A four-stage compound compressor comprising high, low and first and second intermediate vertically arranged cylinders and their pistons, coils connecting the cylinders, and an inclosed water tank surrounding the coils and cylinders, the lower heads of the first and second intermediate cylinders being located exterior to said tank.

5. A four-stage compound compressor comprising high, low and first and second intermediate vertically arranged cylinders and their pistons, coils connecting the cylinders, and an inclosed water tank surrounding the coils and cylinders, the lower heads of the first and second intermediate cylinders being located exterior to said tank and the upper heads of the high and low pressure cylinders being located within the tank.

6. A four-stage compound compressor comprising high, low and first and second intermediate vertically arranged cylinders and their pistons, the low and first intermediate cylinders being located in alinement and the high and second intermediate cylinders being located in alinement, coils connecting the cylinders, an inclosed water tank surrounding the coils and cylinders and a separate passage leading from the back side of the second intermediate piston to the coil connecting the first and second intermediate cylinders for taking care of all leakage past the second intermediate and high pressure pistons.

7. A four-stage compound compressor comprising high, low and first and second intermediate cylinders and their pistons, a coil surrounding the low pressure cylinder and leading therefrom to the first intermediate cylinder, a second coil surrounding the low pressure cylinder and leading from the first intermediate cylinder to the second intermediate cylinder, a third coil surrounding the high pressure cylinder and leading from the second intermediate cylinder to the high pressure cylinder, a fourth coil surrounding the high pressure cylinder and leading therefrom to the point of discharge and an

inclosed water tank surrounding the coils and cylinders.

8. A four-stage compound compressor comprising high, low and first and second intermediate cylinders and their pistons, a coil surrounding the low pressure cylinder and leading therefrom to the first intermediate cylinder, a second coil surrounding the low pressure cylinder and leading from the first intermediate cylinder to the second intermediate cylinder, a third coil surrounding the high pressure cylinder and leading from the second intermediate cylinder to the high pressure cylinder, a fourth coil surrounding the high pressure cylinder and leading therefrom to the point of discharge, an inclosed water tank surrounding the coils and cylinders, and a passage leading from the back of the second intermediate cylinder to the first intermediate cylinder coil for taking care of all leakage past the second intermediate and high pressure pistons.

9. A compound compressor comprising high, low and intermediate vertically arranged cylinders, their pistons and a common crank shaft, coils connecting the cylinders, an inclosed water tank surrounding the coils and cylinders, a base and a frame rigidly attached thereto, the bottom of the water tank being rigidly attached to said frame and the first and second intermediate cylinders being rigidly attached to said bottom.

10. A compound compressor comprising high, low and intermediate vertically arranged cylinders, coils connecting the cylinders, an inclosed water tank surrounding the coils and cylinders, one of said cylinders having its head provided with a combined inlet and discharge valve chest offset therefrom and located exterior to said water tank.

11. A compound compressor comprising high, low and intermediate vertically arranged cylinders and their pistons, coils connecting the cylinders and an inclosed water tank surrounding the coils and cylinders, the said intermediate cylinders having combined inlet and discharge valve chests offset therefrom exterior to said tank.

12. A compound compressor comprising high, low and intermediate vertically arranged cylinders and their pistons, coils connecting the cylinders and an inclosed water tank surrounding the coils and cylinders, the said intermediate cylinders having combined inlet and discharge valve chests offset therefrom exterior to said tank, each of said valve chests being provided with an outlet port member having a limited rotary adjustment for connecting the same to the fixed ends of their corresponding coils.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this fourth day of September, 1908.

WILLIAM PRELLWITZ.

Witnesses:
F. GEORGE BARRY,
OTTO W. HOLMGREN.