(No Model.) 3 Sheets—Sheet 1.

S. ST. CLAIR.

COMPOUND COMPRESSING ENGINE.

No. 480,527. Patented Aug. 9, 1892.

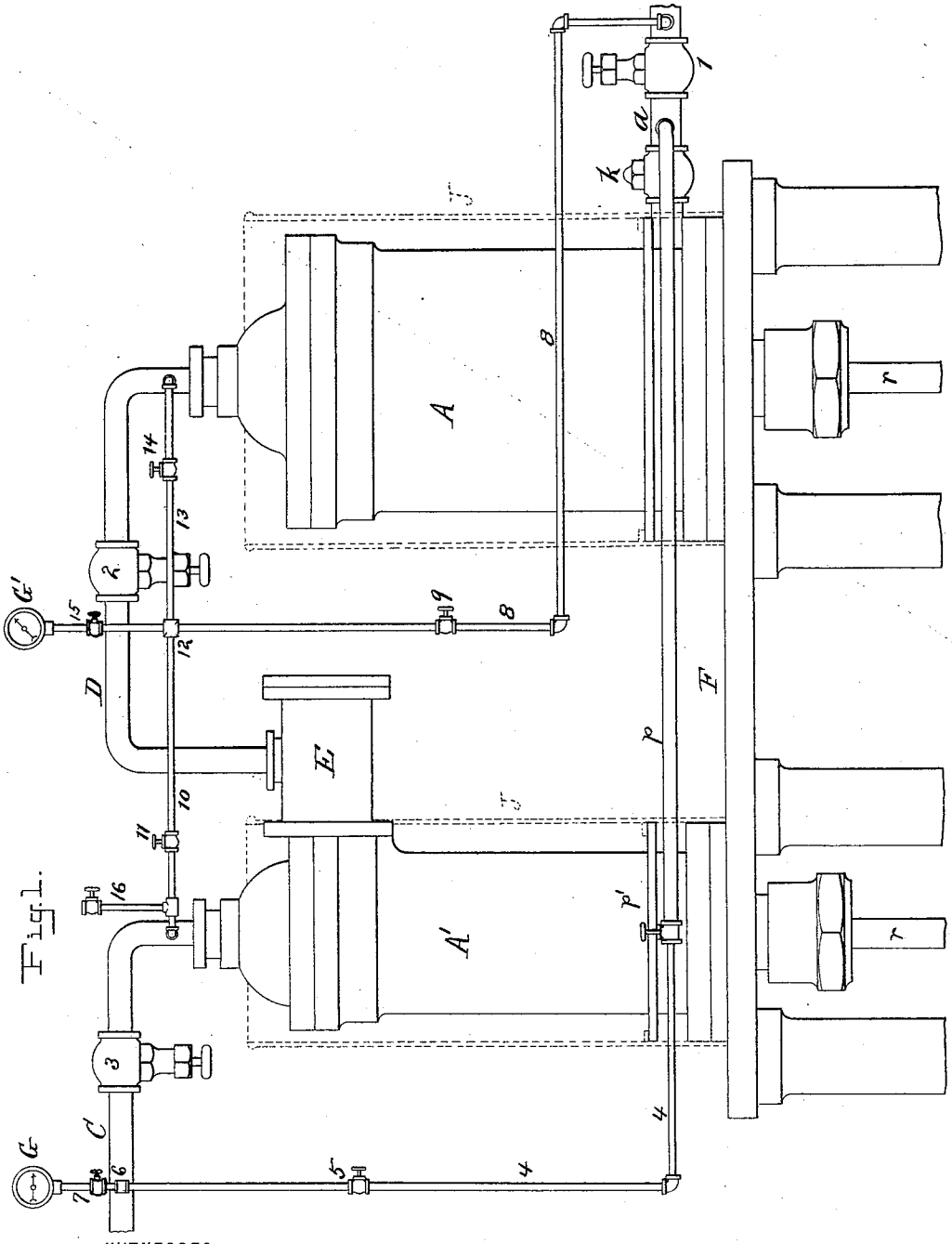

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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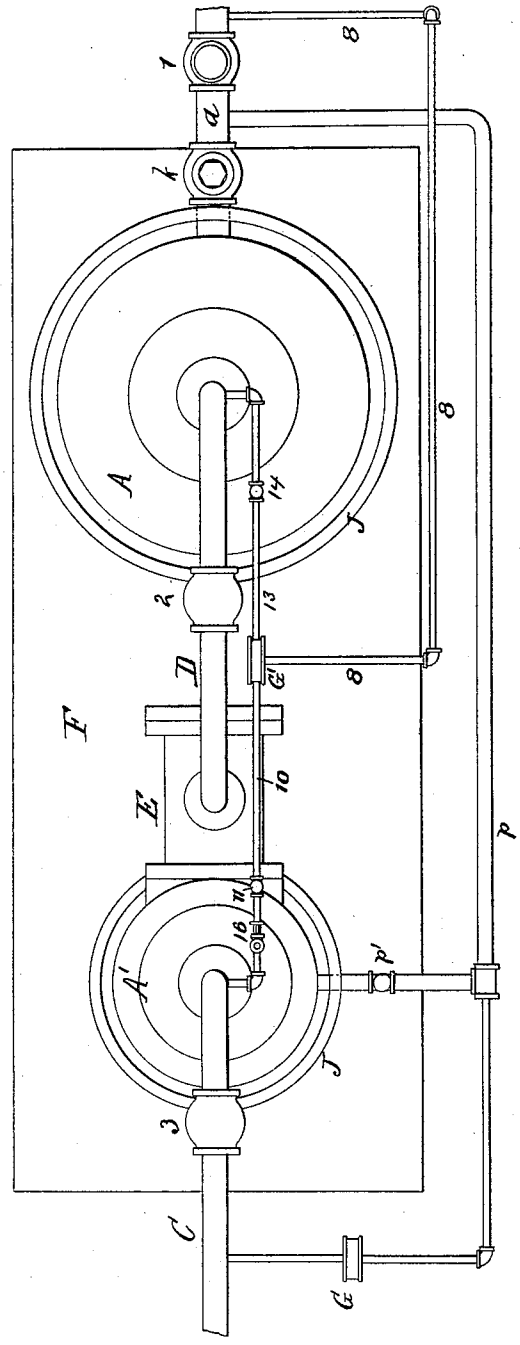

Fig. 2.

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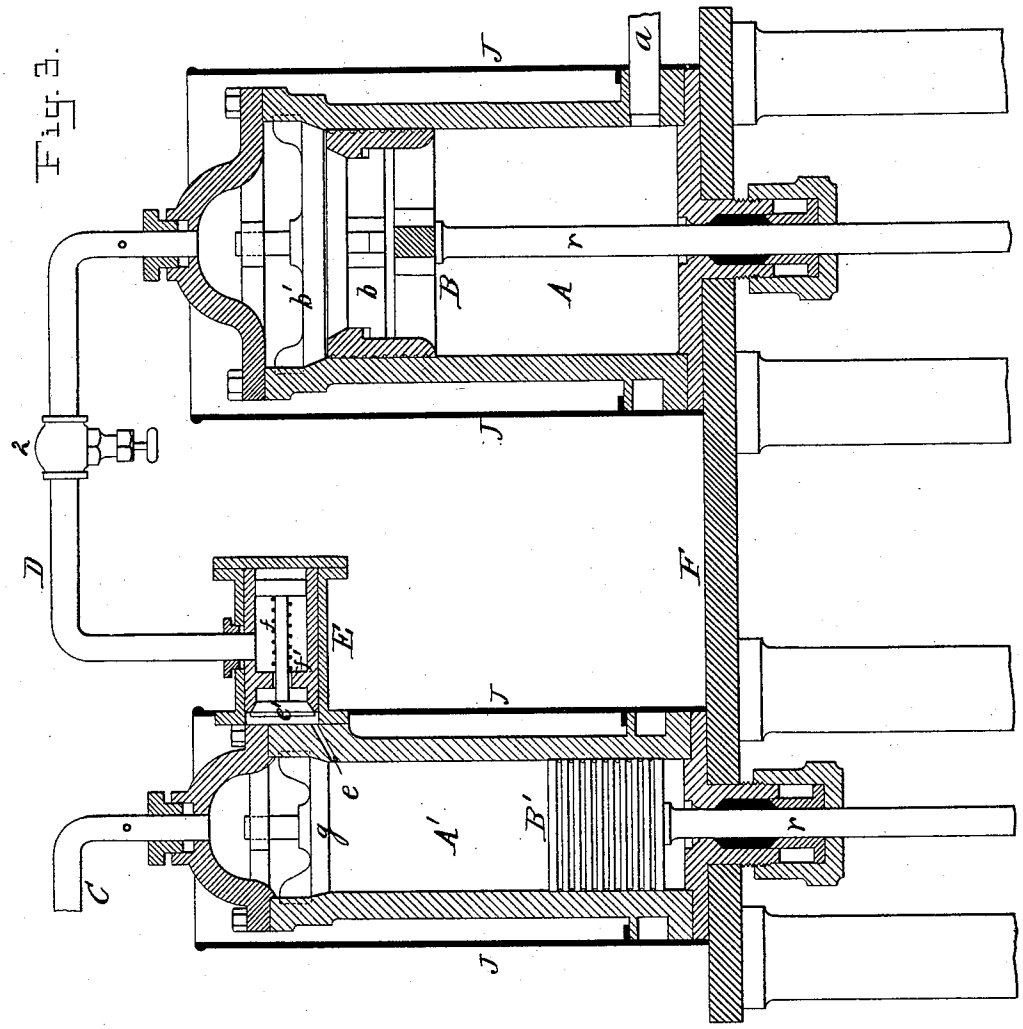
Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

STUART ST. CLAIR, OF YORK, PENNSYLVANIA, ASSIGNOR TO THE YORK MANUFACTURING COMPANY, LIMITED, OF SAME PLACE.

COMPOUND COMPRESSING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 480,527, dated August 9, 1892.

Application filed December 29, 1890. Serial No. 376,052. (No model.)

To all whom it may concern:

Be it known that I, STUART ST. CLAIR, a citizen of the United States, and a resident of York, York county, Pennsylvania, have invented an Improved Compound Compressing-Engine, of which the following is a specification.

My invention consists of an improved compound compressing-engine for the compression of air or gas, and more particularly having reference to compressors of that class which are designed for the compression of ammoniacal gas as used in artificial refrigerating apparatus.

In the accompanying drawings, Figure 1 is a front elevation of my compound compressor. Fig. 2 is a plan view of the same. Fig. 3 is a vertical section of the same.

Some features of my invention may be applied to various forms of compressors, whether single-acting or double-acting compressing-engines, and in any case the compressing-cylinders may be arranged horizontally or vertically. In the example shown in the drawings I have illustrated an upright single-acting compressing-engine as constructed in accordance with my invention.

In this construction A is the large low-pressure cylinder, and A′ the smaller high-pressure cylinder, independent of each other and having independent pistons B and B′, whose rods *r* pass through stuffing-boxes in the ends of the cylinders. The latter are in this case mounted on the same framework F. It has not been thought necessary to show the mechanism by which motion is transmitted from the motive-power engine to the reciprocating pistons of the compressing-cylinders, as any convenient form of driving mechanism may be employed.

The low-pressure cylinder A has an inlet or supply pipe at *a* for the admission of the air or the gas—as, for instance, from the refrigerating-coils where the compressor is used for ice-making or refrigerating apparatus. The piston B of this low-pressure cylinder is hollow and carries a valve *b*, which opens on the downward or return movement of the piston and closes on its upward or forward movement. The discharge or outlet end of the cylinder is provided with a valve *b*′, which opens on the forward movement of the piston and closes on its return movement. The discharge or outlet from this low-pressure cylinder is connected by a suitable pipe D with the inlet end of the smaller or high-pressure compressing-cylinder A′. The piston B′ of this high-pressure cylinder is solid, and the inlet-opening *e* to the high-pressure cylinder is in this instance at its upper end, and a valve-box E is placed between the pipe D and this high-pressure cylinder. This valve-box may be of any convenient construction, but should be arranged as close as possible to the admission end of the high-pressure cylinder. In this instance I have illustrated a convenient construction more fully in Fig. 3. This box contains a valve *e*′, and to assist in closing this valve *e*′ on the forward movement of the piston B′, I prefer to use a spring *f*, acting on a guide *f*′ at the rear end of the stem of the valve. The piston B′ in its return movement opens the valve *e*′ by suction. As soon as the piston begins its forward movement again the valve is instantly closed again. At the same time the valve *g* at the upper part of the high-pressure cylinder is raised from its seat and the contents of the cylinder are compressed into the outlet or delivery pipe C.

In order to avoid trouble from leakage to the back of the piston B′ in the high-pressure cylinder, more particularly in gas-compressors, and at the same time to avoid the working of the piston against a vacuum, I connect by means of a pipe *p* the cylinder-space behind the piston B′ with the supply-pipe *a*, a suitable check-valve *k* being preferably arranged between that connection and the low-pressure cylinder.

The high and low pressure cylinders A and A′ may be provided with suitable jackets J, as usual, for the circulation of water to keep them cool.

When the compressor is to be used for compressing ammoniacal gas for refrigerating and ice-making plants, it is desirable to provide means whereby access may be had to the condenser or the compressor-cylinders for repairs without loss of ammonia. For this purpose I provide the system of by-passes, which I will

now describe in its preferred form. The pipes *a*, D, and C are respectively provided with suitable stop-valves 1, 2, and 3. The pipe *p*, before referred to, is connected to the inlet-pipe *a* between the check-valve *k* and the stop-valve 1, and the said pipe *p* communicates through the pipe 4, having a valve 5 and a union 6, with the high-pressure delivery-pipe C, leading to the condenser. A valved pipe 7 leads from the union 6 to a gage G for indicating the pressure in the delivery-pipe. The pipe *p* has a stop-valve *p'* between the high-pressure cylinder and the connection with the pipe 4. The high-pressure delivery-pipe C between the high-pressure cylinder and stop-valve 3 has opening into it a by-pass pipe 10, with a valve 11 and a valved purge-pipe 16. The pipe 10 leads through a four-way union 12 and pipe 8, having a valve 9, to the inlet-pipe *a* from the refrigerating-coils. A pipe 13, having a valve 14, connects the low-pressure pipe D with the union 12, and to the latter is also connected the valved pipe 15, leading to the low-pressure gage G'. Normally the cock 9 is open and the cocks 11 and 14 are closed, the gage G' being used to indicate the pressure in the inlet-pipe. By closing the cock 9 and opening the cock 14 the gage G' may be temporarily employed to show what is the pressure in the pipe D.

In case of leakage in the condenser or whenever from other cause it is desired to have the gas removed from the high-pressure side of the machine the stop-valves 1 and 3 are closed and the cocks 5, 9, and 11 are opened. The continued working of the machine will then draw the ammonia from the condenser and delivery-pipe C beyond the valve 3 through the piping 4, the high-pressure cylinder A', and piping 10 and 8 back into the pipe *a* from the refrigerating-coils. The cock 14 in the pipe 13 may or may not be closed, as desired. When the gas has thus been removed from the high-pressure side of the machine, the compressor is stopped and cock 5 closed, so that access may be had to the interior of the condenser or piping on that side without danger and without loss of ammonia.

When it is desired to get access to the cylinders, they are worked until a vacuum is obtained in the pipe *a* from the refrigerating-coils, and the stop-valve 1 is then closed, the machine stopped, and the cock 11 opened. The cylinders will then discharge more or less completely into the inlet-pipe *a* and refrigerating-coils, and the cock 11 is then closed, so that access can now be conveniently had to either compressor-cylinder without danger or material loss of ammonia.

In starting the compressor when the cylinders contain air the purge-pipe 16 is temporarily opened to allow the air to be driven off.

I claim as my invention—

1. The combination of the low-pressure cylinder and piston of a compound compressor with an inlet, a high-pressure cylinder having a solid piston, a pipe connecting the discharge from the low-pressure cylinder with the inlet to the high-pressure cylinder, and a pipe connecting the space back of the high-pressure piston with the supply to the low-pressure cylinder, and a check-valve between said connection and the low-pressure cylinder, substantially as described.

2. The cylinders of a compressor, having a valved inlet-pipe and valved delivery-pipe, in combination with valved piping connecting the delivery-pipe beyond its valve with the inlet-pipe between the valve of the latter and the cylinders, and in combination with valved piping connecting the delivery-pipe between its valve and the cylinders with the inlet-pipe in front of the valve of the latter, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

STUART ST. CLAIR.

Witnesses:
EDITH J. GRISWOLD,
HUBERT HOWSON.