(No Model.) 2 Sheets—Sheet 1.

# T. J. BARBOUR & C. M. HANSEN.

## REGULATING APPARATUS FOR AIR COMPRESSING ENGINES.

No. 591,583. Patented Oct. 12, 1897.

*Fig. 1.*

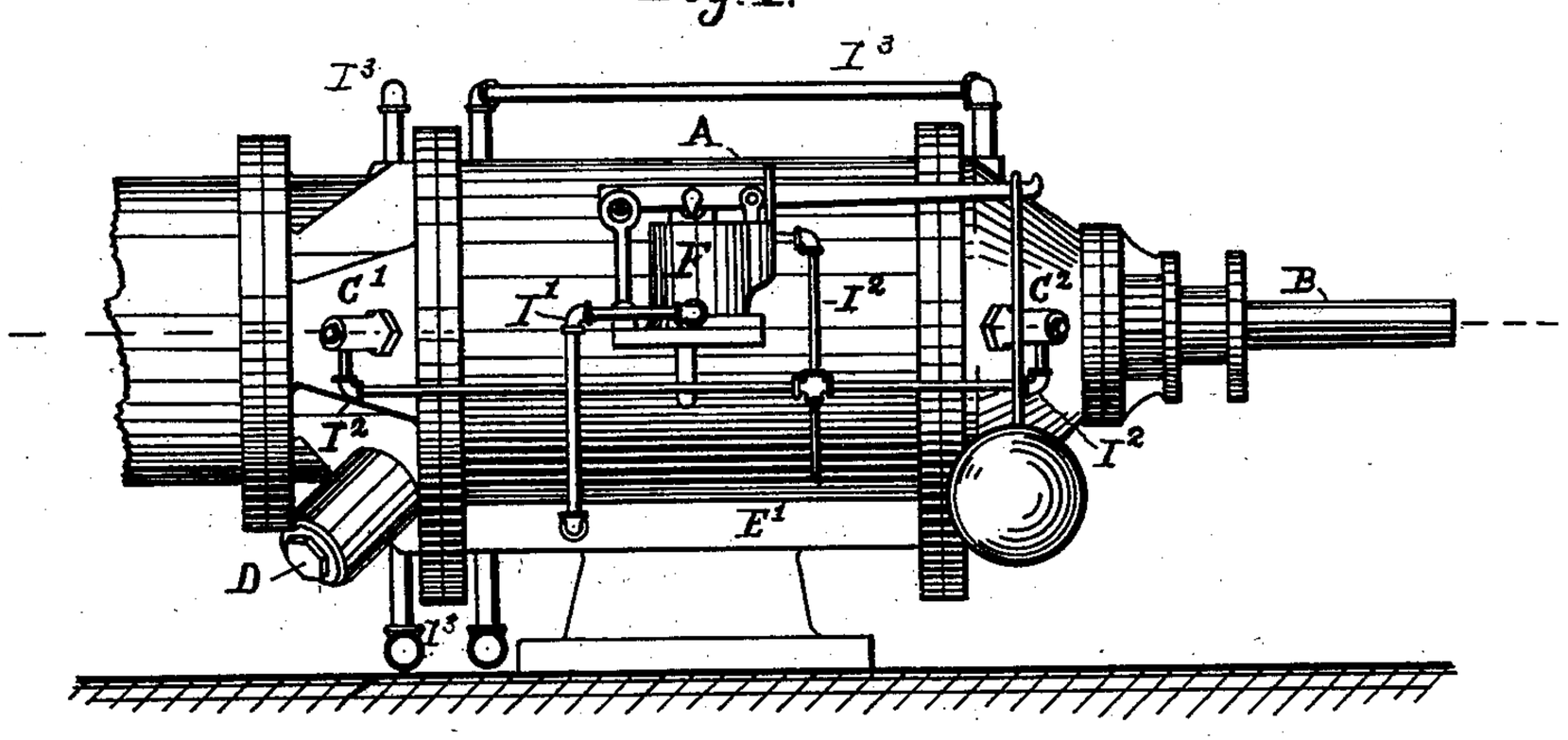
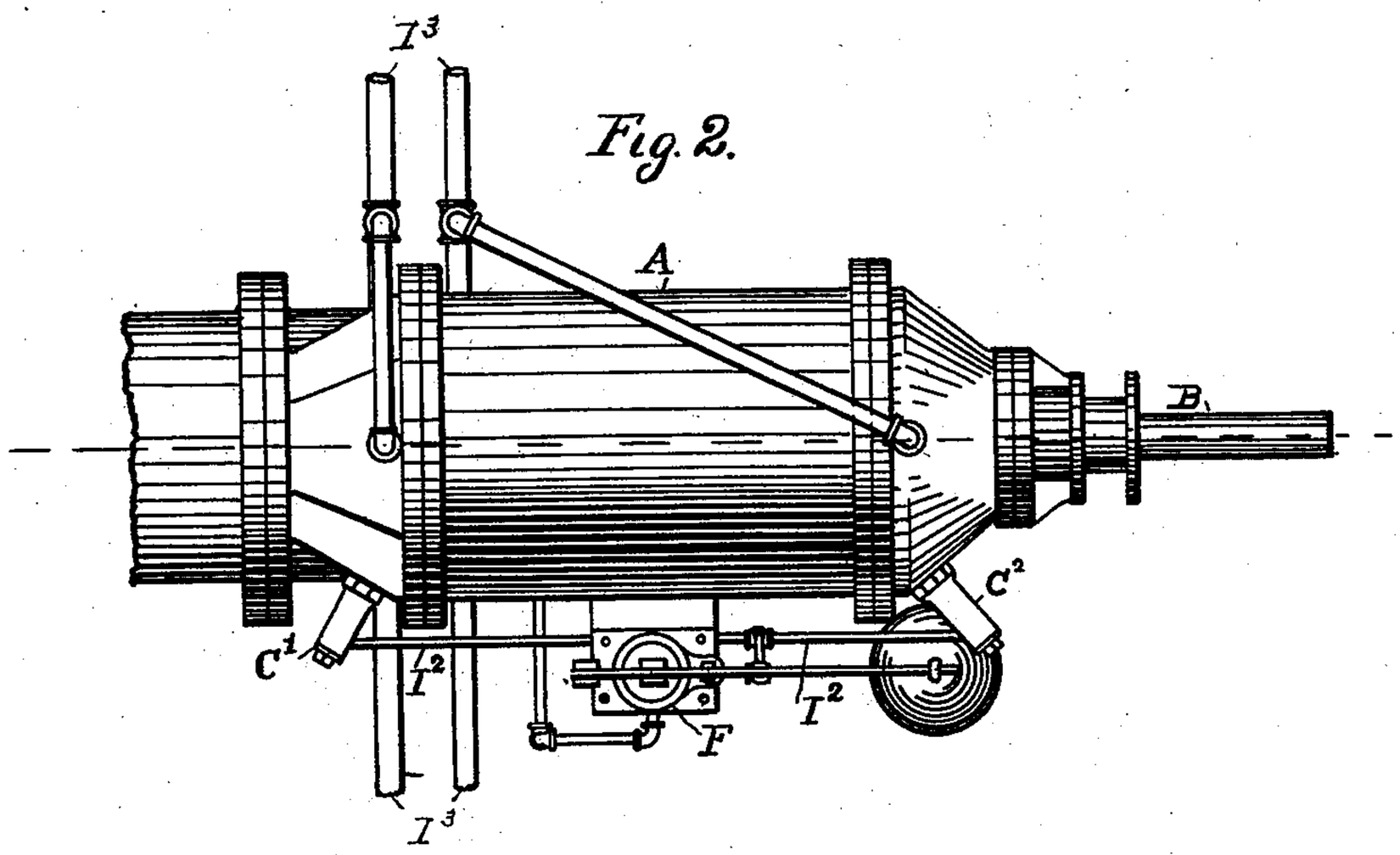



*Fig. 2.*

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(No Model.) 2 Sheets—Sheet 2.

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## REGULATING APPARATUS FOR AIR COMPRESSING ENGINES.

No. 591,583. Patented Oct. 12, 1897.

Fig. 3.

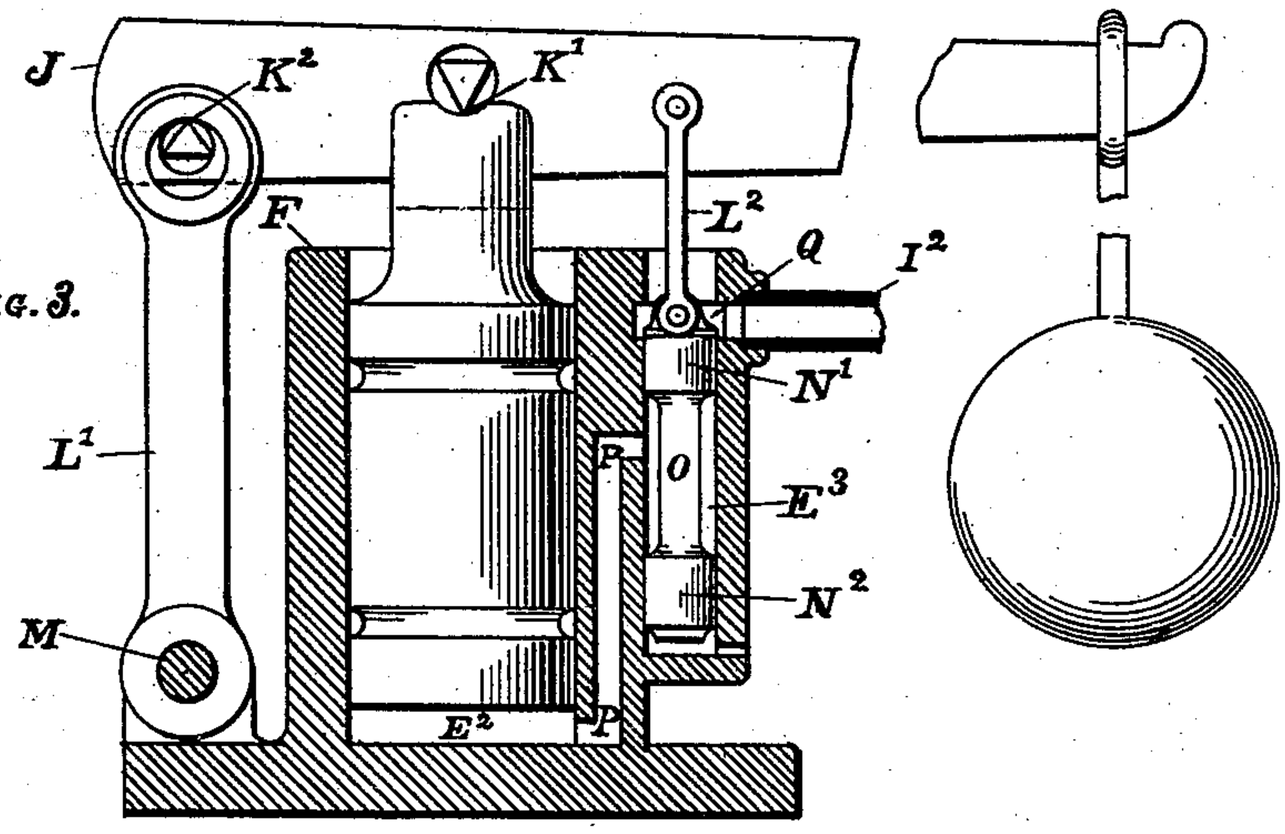



Fig. 4.

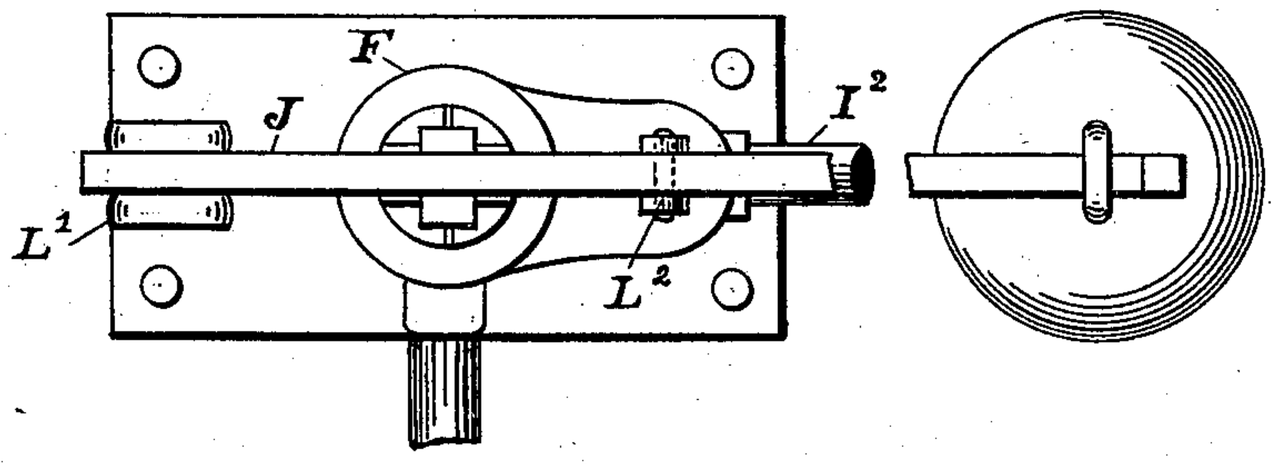



Fig. 5.

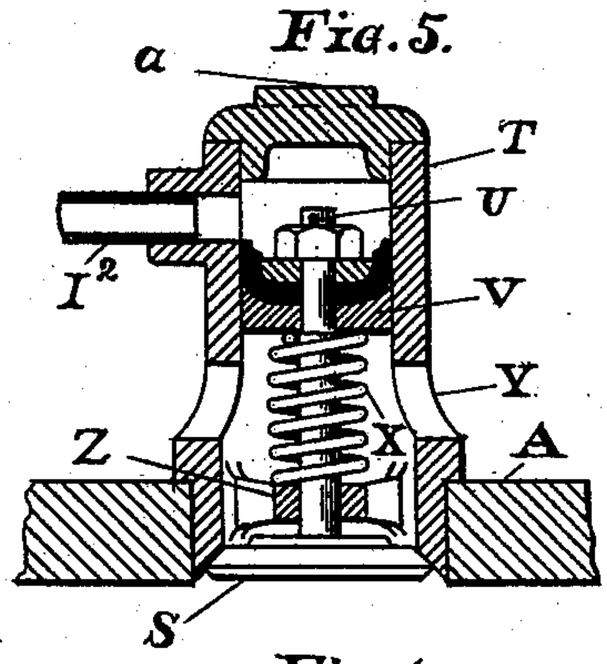
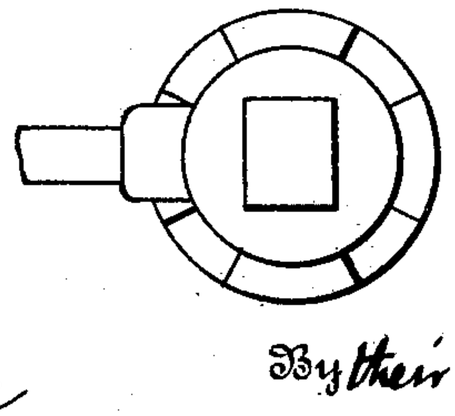



Fig. 6.



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# UNITED STATES PATENT OFFICE.

THOMAS J. BARBOUR AND CHRISTIAN M. HANSEN, OF SAN FRANCISCO, CALIFORNIA, ASSIGNORS TO THE RISDON IRON AND LOCOMOTIVE WORKS, OF SAME PLACE.

## REGULATING APPARATUS FOR AIR-COMPRESSING ENGINES.

SPECIFICATION forming part of Letters Patent No. 591,583, dated October 12, 1897.

Application filed April 30, 1896. Serial No. 589,645. (No model.)

*To all whom it may concern:*

Be it known that we, THOMAS J. BARBOUR and CHRISTIAN M. HANSEN, citizens of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Regulating Apparatus for Air-Compressing Engines, of which the following is a specification.

Our invention relates to what are called "air-compressors" and to devices to relieve the compressing-pistons from resistance or work and open them to the external atmosphere when the pressure and volume of the air compressed has attained some predetermined point.

Our invention consists of a supplementary piston operating a controlling-valve actuating other pistons connected directly to relief-valves on the main compressing-engine, so these latter will be held open at some predetermined pressure, opening communication between both sides of the main compressing-piston and the external air.

The objects of our invention are to save power that would otherwise be lost by over-pressure or an excess of volume, to avoid changing the speed of the compressing-engine, and to cool the cylinders, piston, and accessories by means of the cold external air drawn in and expelled during the period in which the relief-valves are held open.

Referring to the drawings herewith, Figure 1 is a side elevation of the cylinder and connected details of an air-compressing engine provided with our improvements. Fig. 2 is a plan view of the same. Fig. 3 is a section through the supplemental or controlling piston and the air-distributing valve therefor. Fig. 4 is a plan view of Fig. 3. Fig. 5 is a section through one of the relief-valves of the main compressing-cylinder. Fig. 6 is a plan view of Fig. 5.

Corresponding parts are designated by like letters of reference.

The main cylinder A is of the usual construction, containing a piston operated by the piston-rod B and provided with inlet-valves at each end, also discharge-valves D, in the usual manner, the latter communicating with a chamber E′ beneath the cylinder A, from where the compressed air is conducted through suitable pipes to a receiver and places of application.

At the side of the cylinder A or other convenient position we mount a supplementary cylinder F, (shown in section in Fig. 3,) having a piston G, subjected to the same pressure as exists in the chamber E′, by means of a pipe I′, communicating from this chamber to the one, $E^2$, beneath this piston G.

The upward pressure on the piston G is resisted by a scale beam or lever J, resting on edge pivots at K′ and $K^2$, the latter bearing in the eye of a link L′, pivoted at M, as seen in Fig. 3. This scale beam or lever J is provided with a movable weight X, that balances the required pressure in the chamber E or upon the piston G and is connected by a link $L^2$ to a piston-valve having cylindrical end sections N′ and $N^2$, the former performing air distribution and the latter acting to balance the valve.

The central portion of this piston-valve at O is reduced in diameter to form a chamber $E^3$, which communicates with the passage Q and the pipe $I^2$ when the piston G and the beam J rises and the section N′ of the piston-valve passes above the passage or port Q, permitting air to flow from the chambers E′, $E^2$, and $E^3$ right and left through the pipes $I^2$ to the relief-valves C′ $C^2$, now to be described. One of these is shown in section in Fig. 5, S being the valve proper, shutting outward against the end of the cage or casing T.

On the stem U of the valve S is a piston V, sliding in a chamber W, connecting by the pipe $I^2$ with the chamber E′ in Fig. 1 through the various passages heretofore described and as indicated by pipes I′ and $I^2$ in Figs. 1 and 2.

Beneath the piston V is a coil-spring X, resting on the bearing Z, attached to or formed integrally with the chamber T. This spring X as soon as air-pressure is relieved in the chamber W causes the piston V to rise and close the valve S.

The cages or shells T of the relief-valves C′ $C^2$ are provided with passages Y for the circulation of air, and are closed at the top by a plug *a*, as seen in Fig. 5.

The pipes $I^3$ are to conduct and circulate cooling-water in the usual manner and need not be described here.

The manner of operation and action of the several parts is as follows: The weight X is moved to a point on the lever J that will balance some required pressure in the chamber $E^2$ beneath the piston G, and consequently in the chamber E′ and in the receiver or system being supplied. If the consumption of air is less than the volume compressed by the main engine A, the pressure will rise accordingly and the piston G will be thrust upward, raising the lever or beam J and the piston-valve N′, so the compressed air from the chamber E′ will flow through the passage Q and pipes $I^2$ into the chamber W, depressing the pistons V and the valves S at C′ $C^2$, thus opening communication between the main compressing-piston and the external air. This relieves the engine A of resistance except friction and it can go on at its regular speed, drawing in and expelling cool air through the relief-valves C′ $C^2$ until the pressure in the chamber E′ has fallen to the desired point. Then the piston G and the lever or beam J will descend, so the piston-valve N′ will cut off communication from the pipes $I^2$ and open communication to the external air through the chamber Q, relieving the piston V of pressure, so the valves S at C′ $C^2$ will close by action of the spring X and the engine A resume its normal work of compressing. It will be understood that the air flowing through the pipes $I^2$ and to the piston V can also be conveyed to apparatus for controlling the speed of steam-engines or water-wheels that drive the compressing-engine, such arrangement being desirable when cessation of work extends over considerable periods of time.

Having thus described the nature and objects of our invention and the manner of constructing and applying the same, what we claim is—

1. In an air-compressing engine, the supplementary cylinder F, piston G, weighted lever J, and balanced valve N′ $N^2$, in combination with relief-valves C′ $C^2$, one at each end of the compression-cylinder, and pipes $I^2$ establishing communication between said balanced valve and the relief-valves, substantially as shown and described.

2. In an air-compressing engine, the supplementary cylinder F, piston G, weighted lever J, links L′ $L^2$, edge pivots K′ $K^2$, balanced valve N′ $N^2$, and pipes $I^2$, in combination with the relief-valves C′ $C^2$, comprising valve-disk S, piston W, coil-spring X, and provided with openings Y, all substantially as shown and described.

In testimony whereof we have hereunto affixed our signatures in the presence of two witnesses.

THOS. J. BARBOUR,
CHRISTIAN M. HANSEN.

Witnesses:
W. E. CARROLL,
R. H. MOORE.