(No Model.)

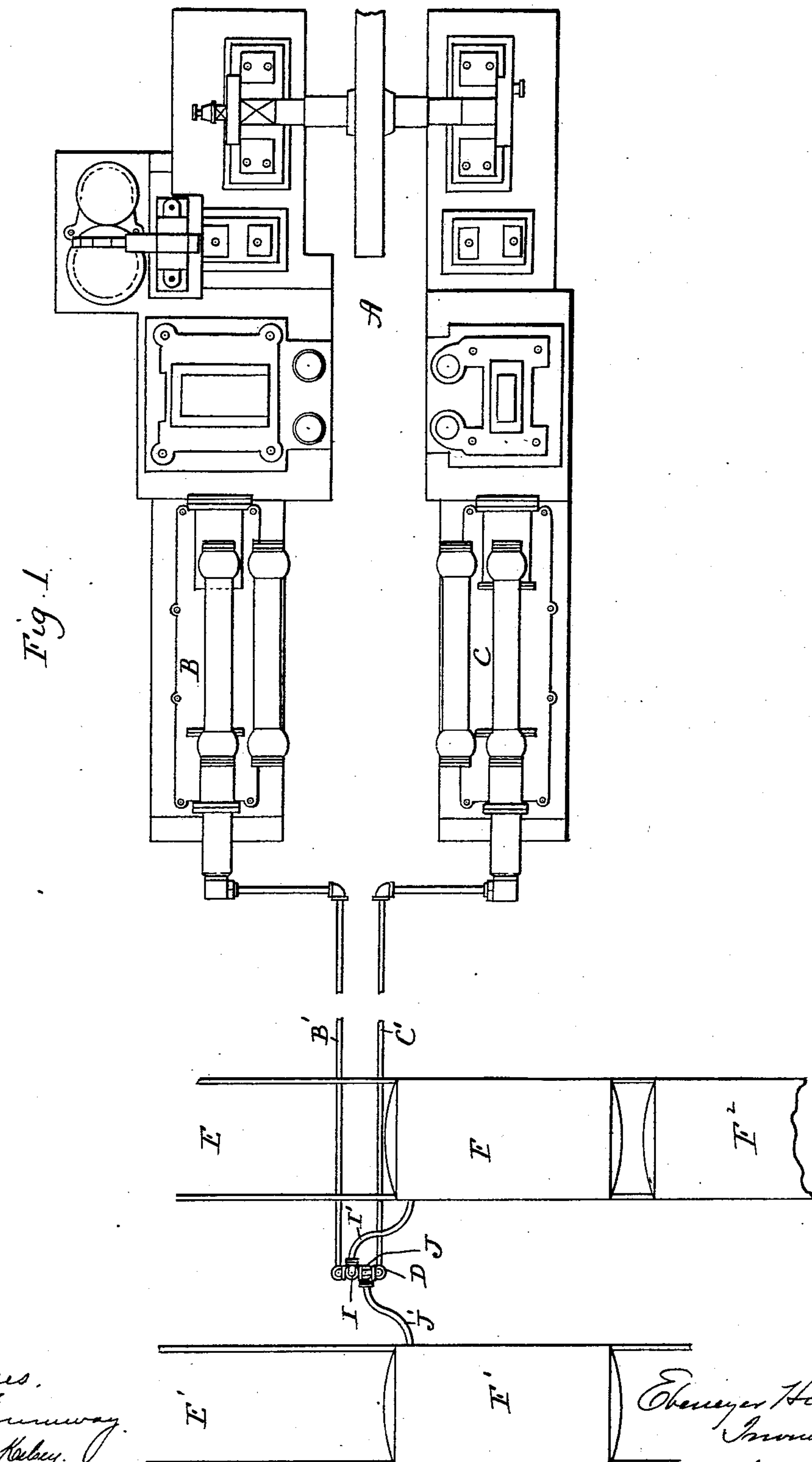
4 Sheets—Sheet 1.

E. HILL.

AIR COMPRESSOR.

No. 571,971.

Patented Nov. 24, 1896.



Witnesses.
J. H. Shumway.
Lillian D. Kelsey.

Ebenezer Hill,
Inventor.
By atty's Earle & Seymour

(No Model.) 4 Sheets—Sheet 2.

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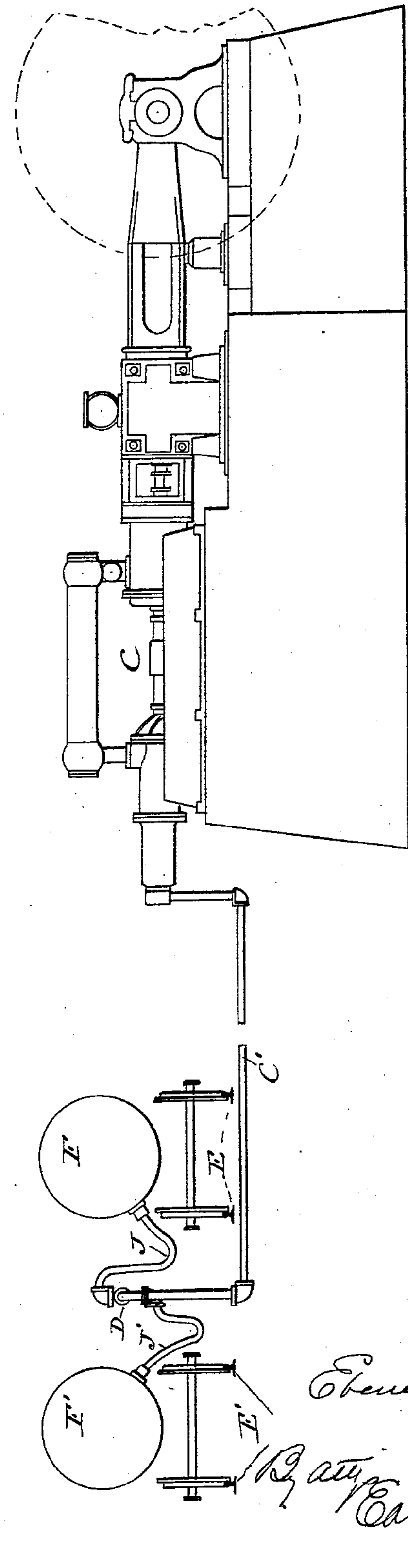

Fig. 2

Witnesses
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Ebenezer Hill.
Inventor.
By atty
Earle Seymour

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

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Fig. 4

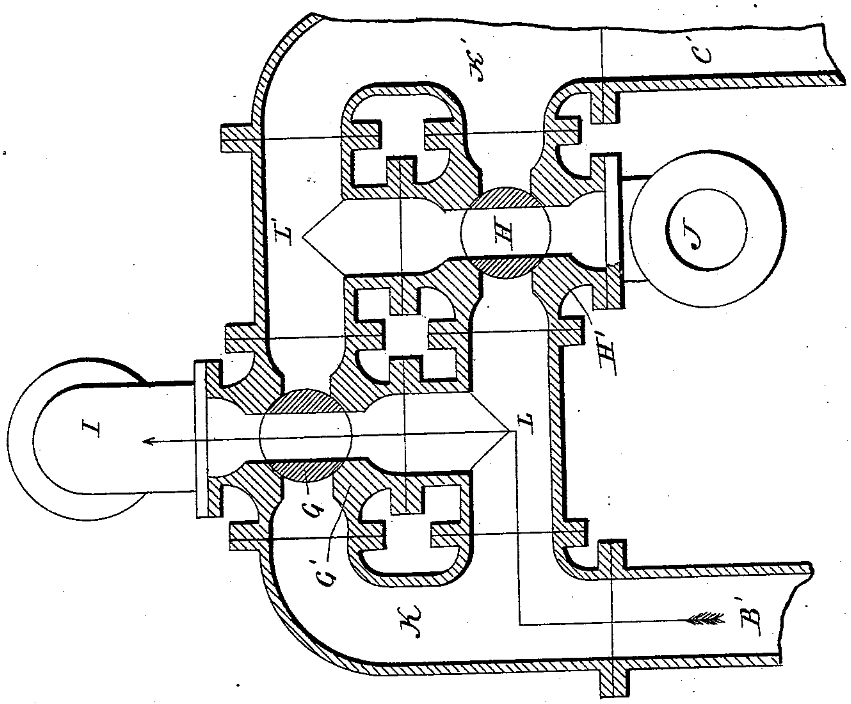
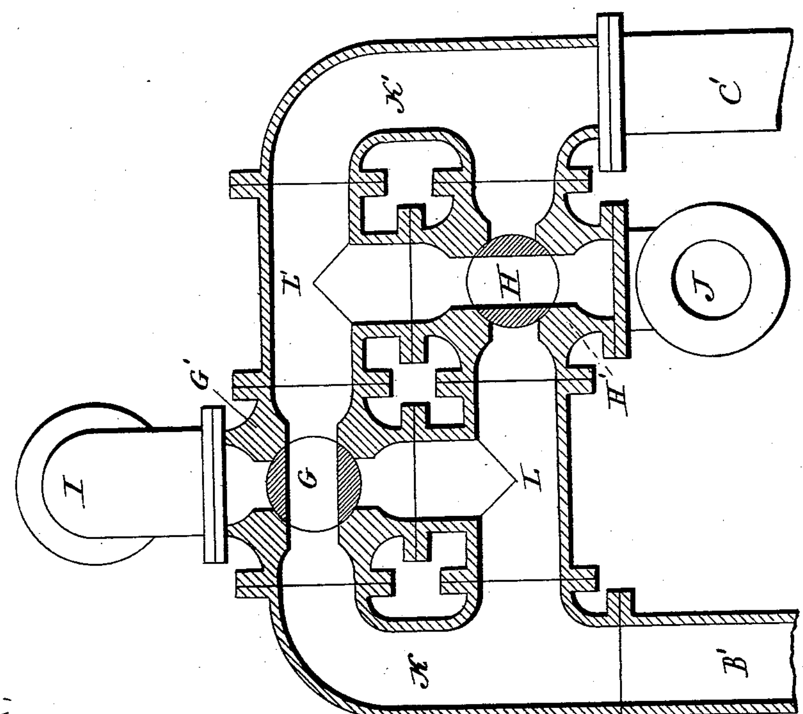


Fig. 3



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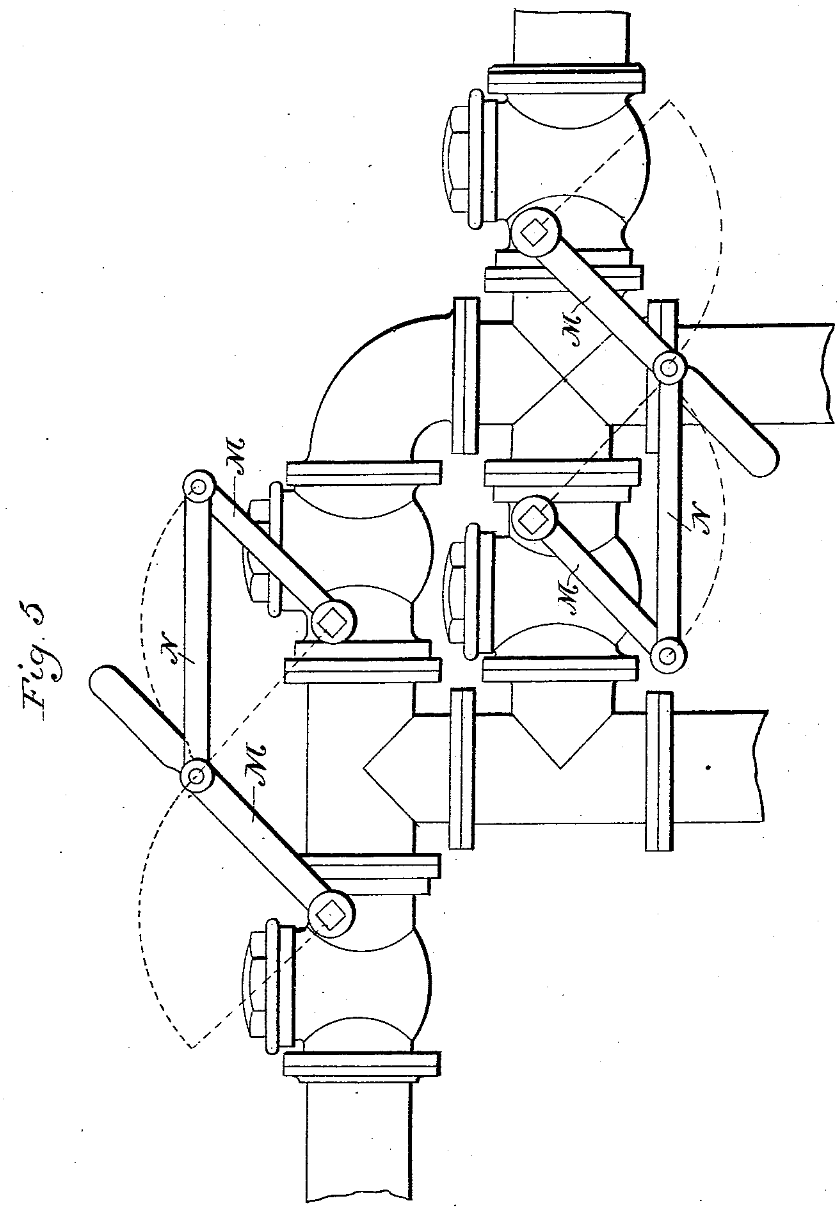

Witnesses.

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Ebenezer Hill.

Inventor

By atty's

Earle & Seymour.

UNITED STATES PATENT OFFICE.

EBENEZER HILL, OF SOUTH NORWALK, CONNECTICUT.

AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 571,971, dated November 24, 1896.

Application filed June 19, 1896. Serial No. 596,128. (No model.)

To all whom it may concern:

Be it known that I, EBENEZER HILL, of South Norwalk, in the county of Fairfield and State of Connecticut, have invented a new Improvement in Air-Compressors; and I do hereby declare the following, when taken in connection with the accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a plan view of one form which an apparatus constructed in accordance with my invention may have; Fig. 2, a view thereof in side elevation; Figs. 3 and 4, enlarged sectional views of the charging-stand; Fig. 5, a view in side elevation of one of the modified forms which the charging-stand may assume.

My invention relates to an improved apparatus for compressing air and gases, the object being to provide for the economical charging of tanks with compressed air or gas.

With this end in view my invention consists in an apparatus having certain details of construction and combinations of parts, as will be hereinafter described, and pointed out in the claim, the said apparatus being constructed so that in its operation the prime motor may be caused to work under a practically constant load, which is approximately the ideal load, or the load under which the motor may be run to the greatest advantage as to power and economy.

Although my apparatus is adapted for the charging of tanks of whatever description, as, for instance, charging steel bottles with carbonic-acid gas or other gases, it is particularly well designed for the charging of the tanks of pneumatic locomotives with air under pressure, and I have chosen to illustrate and describe my invention in that application of it.

Before proceeding to a detailed description of the construction and operation of the apparatus illustrated by the drawings it may be well to state that a pneumatic locomotive is quite similar to the ordinary steam-locomotive, with the exception that instead of having a steam-boiler it has an air-tank for compressed air, which is used from the tank much after the manner that steam is used from a steam-boiler. When the pressure in the tank is exhausted, or nearly so, the tank must be recharged. A common method of recharging the air-tank of a pneumatic locomotive is to connect it with a large reservoir filled with air compressed to a higher degree than that required in the tank. Then the connection between the tank and reservoir is opened to allow the pressure in the reservoir and tank to equalize, whereby the pressure in the tank will be raised. I may also call attention to United States Patent No. 247,915, granted to me under date of October 4, 1881, setting forth a method of charging the tank of a pneumatic locomotive by successively connecting it with a series of charged reservoirs, each of which raises the pressure in the tank higher than the last, one or more of which reservoirs contain air compressed to a higher point than required in the tank. Another way has been to partially charge a tank by connecting it with one or more charged reservoirs, and then to finish the charging operation by connecting the tank directly to an air compressor or pump, by which the pressure in the tank is raised to the degree required.

Still another way is to connect the exhausted tank directly to an air-compressor and to raise the pressure in the tank continuously to the pressure required. In this way no air is compressed to a pressure higher than is finally needed in the locomotive. The method last mentioned, however, is objectionable because it is a slow process, for the reason that no compressed air is stored at the charging-station for immediate use on the arrival of the locomotive. To save time, therefore, an air-compressor of large size is needed. This will be run with little or no load while the locomotive is absent. When the locomotive is first attached to it, the load upon it will be light or *nil* and gradually grow heavier until it reaches perhaps the heaviest load under which the compressor can work. It is well known that these extreme variations of load, from practically nothing to the very heaviest load, are very prejudicial to the economical working of any prime motor. The steam-engine, for instance, has a particular point or ideal load at which or under which it does its most effective and economical work, and wide variations on either side of that point or from that load are prejudicial to economy and wasteful of power.

It will be clear from the foregoing that an apparatus for compressing gas and air will be most economical, so far as the utilization of power is concerned, when constructed and arranged so that its prime motor may be caused to work under an approximately constant ideal load.

With these prefatory remarks regarding the prior art and the conditions under which a prime motor may be most economically worked, I will proceed to the description of the apparatus illustrated by the drawings.

The prime motor A may be an engine of any approved construction. It is not shown in detail, nor will a detailed description of it be necessary. It may be remarked that in Fig. 1 it is only partially shown, the drawing chiefly representing its foundation or bed. Attached to this prime motor are two air compressors or pumps B and C. These may be of any approved construction, and as air-compressors are well known in the art their particular construction and operation will not be set forth. The said air-compressors are respectively connected by pipes B′ and C′ with a charging-stand D, located between two parallel railway-tracks E and E′, on which locomotives are brought into position for connection with the charging-stand, to which the pipes B′ and C′ are led under the track E, as clearly shown in Fig. 2.

For convenience of description I have chosen to show three locomotives F, F′, and F^2, of which the locomotives F and F^2 are on the track E and the locomotive F′ on the track E′. The charging-stand comprises an arrangement of valves whereby the compressors may be used separately and collectively, or, in other words, whereby each compressor may be connected with a separate locomotive or whereby both compressors may be connected with one locomotive. These valves may assume a great variety of forms. As shown in Figs. 3 and 4 the charging-stand contains two so-called "four-way cocks" with suitable connections for their coöperation. The respective four-way cocks are provided with plug-cocks G and H, located in four-way-valve bodies G′ and H′, the plug-cocks being adapted to be manually operated and each of the four-way-valve bodies having four ports. An elbow I, connected with the four-way-valve body G′, is adapted to have coupled with it a hose connection I′, Fig. 1, leading to it from the locomotive F on the track E, while the elbow J, connected with the four-way-valve body H′, is adapted to have connected with it a hose connection J′, Fig. 1, leading from the locomotive F′ on the track E′. An elbow K connects the pipe B′ with the four-way-valve body G′ and also opens into a T connection L, which connects the four-way-valve bodies G′ and H′. A corresponding elbow K′ connects the pipe connection C′ with the four-way-valve body H′ and also opens into a T connection L′, which also connects the valve-bodies H′ G′.

It will be apparent from an inspection of Figs. 3 and 4 that when the plug-cocks G and H are turned, as shown in Fig. 3, the compressed air flowing from both of the compressors B and C will pass through the valves of the charging-stand and out through the elbow J into the connection J′ to the locomotive F upon the track E′. On the other hand, when the valves are set, as shown in Fig. 4, the compressed air flowing from the compressors B and C will respectively be led to the locomotives F and F′. By leaving the plug-cock G in the position in which it is shown in Fig. 4 and turning the plug-cock H a quarter-turn from the position in which it is shown in the said figure it is apparent that the compressed air will flow from both compressors into the elbow I and thence into the hose connection I′, leading to the locomotive F upon the track E.

In illustration of the practical working of my improved apparatus for the charging of the air-tanks of three locomotives let it be supposed that the locomotives F, F′, and F^2 have been run into the charging-station and the locomotives F and F′ have been connected, through the medium of the charging-stand, with the compressors B and C and that the plug-cocks G and H are set, as shown in Fig. 4, so that the compressor B will pump compressed air into the air-tank of the locomotive F and the compressor C into the air-tank of the locomotive F′. It is to be assumed, however, that these locomotives have not arrived from their trips at the same time, but at successive intervals, and that the locomotive F has been connected for several minutes with the compressor B and that the pressure in its air-tank is approaching the limit determined for it. It is to be assumed also that the locomotive F′ has just come in from a trip and just been connected with the compressor C and that the pressure in its air-tank is very low. Under the conditions set forth the compressor B will be working against a very heavy load and the compressor C against a very light load. The combined effect of these two loads is to impose upon the prime motor about the average load, which is the load against which it works with the greatest economy. Now just as soon as the pressure in the locomotive F has been raised to the required point the plug-cock G is turned into the position in which it is shown in Fig. 3, whereby the air-tank of the locomotive F is disconnected from the compressor B and the same thrown onto the air-tank of the locomotive F′ on the track E′. The locomotive F then moves forward out of the way and the locomotive F^2 is brought up to take its place. Both of the compressors B and C are now pumping against the air-pressure in the air-tank of the locomotive F′, but as this locomotive has now been connected for some time to the charging-stand and is now about half charged the pressure in it will stand at a point about intermediate between the low point at which it arrived and the high point to which it is desired to carry it. Therefore in the interval during which the locomotive F is disconnected from the charging-stand and the locomotive F^2, which succeeds it, is connected to the charging-stand both compressors will pump against about an average pressure in the air-tank of the locomotive F′ and about an average load will be imposed upon the prime motor, which will continue to be operated to the best advantage.

When the locomotive F^2, succeeding the locomotive F, has been connected with the charging-stand and the plug-cock E has been turned back into the position in which it is shown in Fig. 4, the compressor B will pump against the lowest pressure in the air-tank of the locomotive F^2, but meanwhile the air-tank of the locomotive F′ has been raised so nearly to its highest pressure that the sum of the pressure in the tanks of the locomotives F and F^2 transmits, through the compressors B and C, about an average load to the prime motor A, which under these conditions operates to the best advantage. It will thus be seen that by employing two compressors joined to one prime motor and connected with a charging-stand having valves adapting the compressors to be alternately connected with separate locomotive and simultaneously connected with the same locomotive alternately the load upon the prime motor will all the time approximate nearly to that average load under which it is found to operate with the greatest economy.

It is apparent, of course, that a third compressor might be connected with the prime motor and the charging-stand correspondingly amplified for the simultaneous charging of three locomotives on the plan hereinbefore set forth for two locomotives. By connecting three compressors with the same prime motor and thus providing for the practical simultaneous charging of three locomotives the valves at the charging-stand might be manipulated to maintain still more nearly the average or ideal load upon the prime motor.

Instead of employing two four-way cocks, as shown in Figs. 3 and 4, I may employ four straightway valves having their handles M M M M joined by links N N. These straightway valves are so well understood in the art that a detailed description of their construction and operation is thought to be quite unnecessary.

In my use of the term "prime motor" I wish it to be interpreted in its broadest sense. For example, if steam-engines are used, the boilers or battery of boilers are by me considered as a part of my prime-motor apparatus.

Two or more compressors may be connected to one engine and used, or two or more compressors each with its own engine but all connected with one battery of boilers may be used. In the first case I secure an approximate average load on both the engines and boilers. In the second arrangement engine economy is sacrificed, but boiler economy is preserved by maintaining an approximate average degree of demand for steam, and an average evaporation of water.

In view of the changes already suggested and of others which may obviously be made, I would have it understood that I do not limit myself to the exact construction herein shown and described, but hold myself at liberty to make such changes and alterations as fairly fall within the spirit and scope of my invention.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

An apparatus for compressing gas or air and charging tanks with the same, consisting in a prime motor, two or more air-compressors connected therewith, and a charging-stand having separate connections with the said air-compressors, and a plurality of delivery-pipes, and containing ports and valves constructed and arranged to enable the air-compressors to be individually or collectively connected with tanks to be charged according to the conditions of pressure, so that the sum of the loads upon the air-compressors may be approximate to the average or ideal load of the prime motor, substantially as set forth.

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

EBENEZER HILL.

Witnesses:
HENRY P. PRICE,
GEORGE S. WOODWARD.