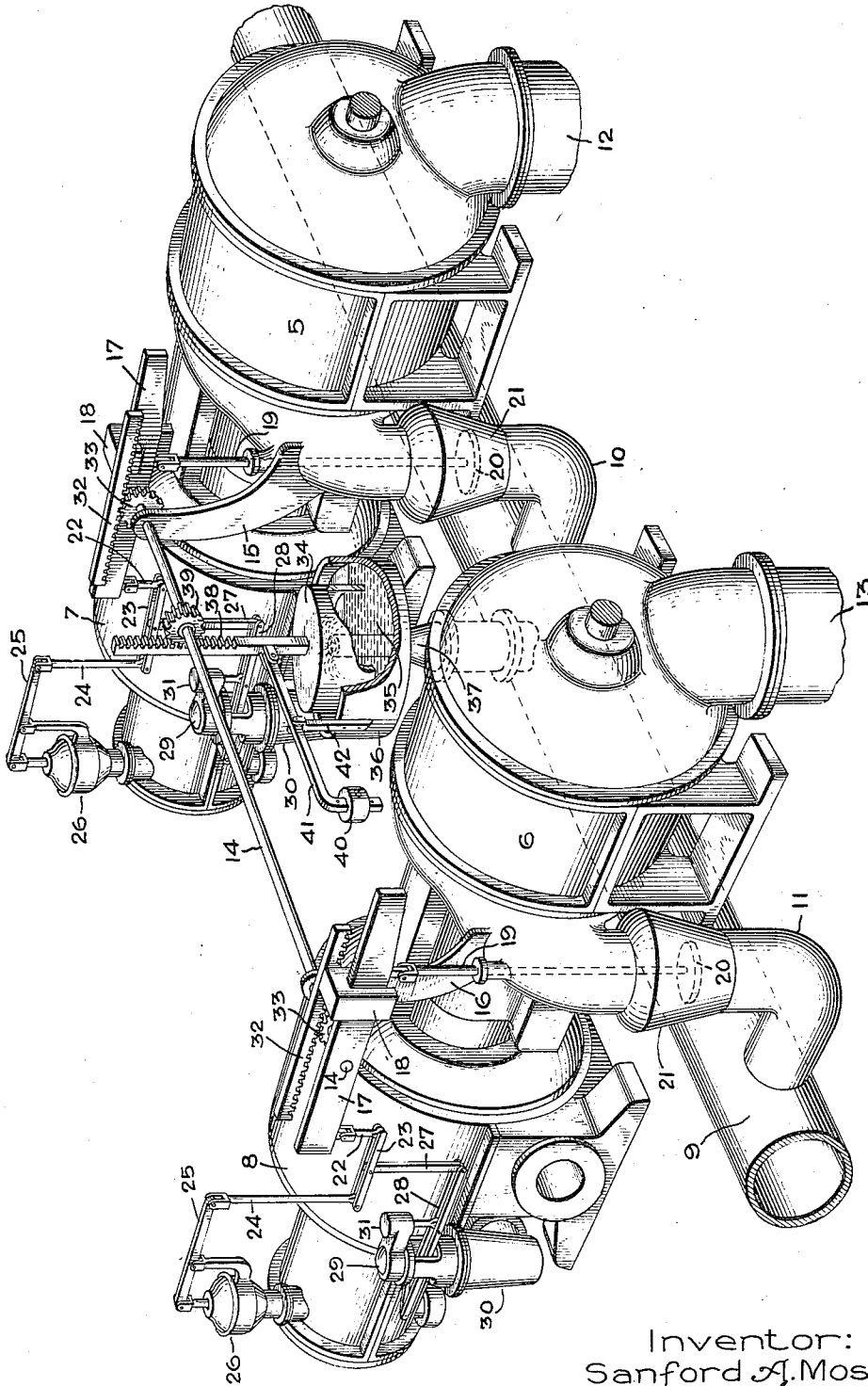


S. A. MOSS.
CENTRIFUGAL COMPRESSOR.
APPLICATION FILED AUG. 23, 1917.

1,281,995.

Patented Oct. 15, 1918.



Inventor:
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UNITED STATES PATENT OFFICE.

SANFORD A. MOSS, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CENTRIFUGAL COMPRESSOR.

1,281,995.

Specification of Letters Patent.

Patented Oct. 15, 1918.

Application filed August 23, 1917. Serial No. 187,745.

To all whom it may concern:

Be it known that I, SANFORD A. MOSS, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Centrifugal Compressors, of which the following is a specification.

The present invention relates to centrifugal compressors and particularly to the regulation of two or more compressors operating in parallel.

When two or more compressors are operated in parallel it is often desirable to apportion the total load among them so that each will carry a certain proportionate part of the total load at all times. For example, it may be desirable in the case of two compressors operating in parallel that each carry one-half the load, or that one carry two-fifths and the other three-fifths of the load; or in the case of three compressors operating in parallel that each carry one-third the load.

The object of the present invention is to provide an improved regulating mechanism for compressors operating in parallel which will maintain the desired apportionment of the total load among the several compressors.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying specification and the claims appended thereto.

In the drawing, the figure is a perspective view of two compressors arranged to operate in parallel, having an embodiment of the improved regulating mechanism applied thereto.

Referring to the drawing, 5 and 6 indicate two centrifugal compressors driven by suitable motors 7 and 8, elastic fluid turbines being illustrated. In the present instance the compressors are shown as being utilized to suck gas from a header 9 in which it is desired to maintain a constant suction. It will be understood, however, that my invention is not limited to this particular application. 10 and 11 indicate the inlet conduits of the compressors and 12 and 13 indicate the discharge conduits. 14 indicates a shaft pivoted in brackets 15 and 16 suitably supported on the respective compressors. Each compressor has a beam 17 which is pivoted on shaft 14 and which carries a weight 18. One

end of each beam is connected by a rod 19 to a float 20 which is located in a conical section 21 of the inlet conduits 10 and 11 and which rides on the fluid flowing into the compressors. The other end of each beam is connected by a link 22 to a floating lever 23 which in turn is connected by a rod 24 and lever 25 to a speed governor 26, and by link 27 and lever 28 to a fluid actuated motor 29 which operates the inlet valve mechanism 30 of the elastic fluid turbine. 31 indicates the pilot valve of the fluid motor. The operation of a fluid motor of this type in connection with the valve mechanism of a turbine is well known and understood and needs no detail description. Fixed to each weight 18 is a rack 32 with which meshes a gear wheel 33 fixed on shaft 14. When the shaft 14 turns, the gear wheels 33 turn and through the racks 32 simultaneously adjust the weights 18 on the beams 17. The shaft 14 is turned by a device responsive to the pressure in the header 9. It is shown as comprising an inverted bell float 34 sealed by a liquid 35 in a container 36, and to the under surface of which the pressure in header 9 is conveyed by a conduit 37. The bell float 34 is connected to turn the shaft 14 through a rack 38 and pinion 39, the latter being fixed on shaft 14. 40 is a counterweight for the bell float 34. It is carried on the depending end of a lever 41, which lever is fulcrumed on a bracket 42 and has its other end pivotally connected to the rack 38.

The action of a float governor, as shown at 20 in connection with each machine, is well understood, such governors being generally termed constant volume governors. The float rides on the fluid passing through the conical section 21. If the fluid flowing increases above normal; i. e., that for which the weight 18 is set, the float will take a higher position thereby tilting the beam 17 and through the fluid motor 29 shutting off the valve mechanism 30 to an extent sufficient to bring the compressor speed down to a point at which the flow will again be normal. On the other hand, if the fluid flowing decreases, then the float will take a lower position thereby tilting the beam 17 in the opposite direction and through the fluid motor 29 opening the valve mechanism 30 to an extent sufficient to increase the speed of the compressor to a point at which

the flow will again be normal. The speed governor 26 is set for a speed higher than that at which the compressor ordinarily operates and is normally inoperative. It is in the nature of an emergency device and only comes into operation in case of excess speed to prevent the set from racing. The governing mechanism can be set for different volumes of flow by adjusting the weight 18 on the beam 17.

With any given setting of the weights 18 each compressor 5 and 6 will take a constant volume of fluid. Assuming the weights are set the same, then each machine will be taking the same volume and such volume will be automatically maintained. Now in the example shown, in case the volume which the machines are pumping is not sufficient to maintain the desired suction in the header 9, the pressure under the bell float 34 will increase, thus lifting it and through rack 38 and pinion 39 turning the shaft 14 in a clockwise direction when looking toward the left hand end of it. This will turn the gear wheels 33 and through racks 32 shift the weights 18 on the beams 17 in a direction to cause the compressors to take larger volumes thereby increasing the suction. The weights 18 will be shifted until the compressors are pumping sufficient volumes to maintain the desired suction. On the other hand, if the suction becomes too great, then the opposite action to that just described takes place, thus reducing the volumes which the compressors are handling and bringing the suction back to the desired value.

In the examples shown, the volumes which the compressors are handling are directly indicative of the load, since the suction pressure is maintained constant and the delivery pressure is constant. The volume governors here shown are, therefore, load governors and indicate the loads on the respective machines. It will, therefore, be seen that with my improved apparatus each governing mechanism is set to cause its associated compressor to take a definite load and that the settings of the various governing mechanisms are varied by a device which is responsive to an operating condition common to all the compressors. And it will be understood that this principle may be applied to compressors operating in parallel under different operating conditions from those just described. For example, instead of holding constant suction, it may be desirable to hold constant pressure on the discharge side of the compressors.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider

to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The combination of a plurality of compressors arranged to operate in parallel, a motor for each compressor for driving it, a volume governing mechanism on each compressor for regulating its driving motor which may be set for a desired volume, and means responsive to variations in an operating condition common to all the compressors for simultaneously modifying the setting of the volume governing mechanism of each compressor.

2. The combination with a plurality of compressors arranged to operate in parallel, of a motor for each compressor for driving it, a regulating means for each motor which is responsive to variations in load on the compressor with which it is associated and which may be set to maintain a constant load on such compressor, and means responsive to variations in an operating condition common to all the compressors for varying the load for which each regulating means is set.

3. The combination with a plurality of compressors arranged to operate in parallel, of a motor for each compressor for driving it, a regulating means for each motor which is responsive to variations in load on the compressor with which it is associated and which may be set to maintain a constant load on such compressor, a common means to which all said compressors are connected in parallel and in which it is desired to maintain a constant pressure, and means responsive to variations in said pressure for adjusting the settings of the regulating means of each motor.

4. The combination of a header from which gas is to be sucked and in which it is desired to maintain a constant suction pressure, a plurality of compressors having their inlet conduits connected in parallel to the header, a volume governing mechanism for each compressor comprising a pivoted beam having a weight thereon and a float which rides on the fluid flowing through the compressor and is connected to the beam, a device responsive to the pressure in the header, and means connecting it to the said weights to adjust them on the beams.

5. The combination of a header from which gas is to be sucked and in which it is desired to maintain a constant suction pressure, a plurality of compressors having their inlet conduits connected in parallel to the header, a turbine for driving each compressor, a regulating valve mechanism for each turbine, a volume governing mechanism for each compressor which is connected to the

regulating valve mechanism of its associated turbine, said volume governing mechanism comprising a pivoted beam having a weight thereon, and a float which rides on the fluid 5 flowing through the compressor and is connected to the beam, a movable abutment which is responsive to the pressure in the header, and means connecting it to said weights to simultaneously adjust them on 10 the beams.

6. The combination of a plurality of compressors arranged to operate in parallel, a motor for each compressor for driving it, a

regulator for each motor, means responsive to the volume of fluid passing through each 15 compressor for operating the regulator of the motor which drives it, and means responsive to an operating condition common to all the compressors for simultaneously 20 modifying the action of each volume responsive means on the regulator with which it is associated.

In witness whereof, I have hereunto set my hand this 18th day of August, 1917.

SANFORD A. MOSS.