To all whom it may concern:

Be it known that I, John G. Callan, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Governing Mechanism for Centrifugal Apparatus, of which the following is a specification.

A centrifugal air compressor or pump having a relatively high speed impeller is well adapted for many kinds of service, since it is very efficient, simple and reliable in construction, and gives a practically constant pressure at the point of discharge when running at a substantially uniform speed. It has this drawback, however, for some purposes, viz., the volume of air delivered changes with load conditions. For pneumatic tube service, blast furnace work, and many other commercial uses to which compressors may be applied, it is desirable to vary the pressure of the air delivered by the compressor as the load varies and keep the volume of air delivered substantially constant. For example, assume a pneumatic tube service between a post office and a railroad station wherein the carriers must have a minimum speed of not less than thirty miles per hour, and a maximum speed not materially in excess thereof. Obviously as the number of carriers in service in any one tube increases or decreases, the load on the compressor changes. If a constant discharge pressure is maintained at all times it is evident that when a large number of carriers are in service their rate of movement in the tubes will be less than normal, and that when fewer carriers are in service that their rate of movement will be in excess of normal and by an amount dependent upon said number.

The object of my invention is to provide an improved governing mechanism for centrifugal air compressors which will automatically vary the discharge pressure as the amount of work to be performed varies, i.e., increase the pressure as the load comes on and decrease it as the load falls off and regulate the volume of air delivered.

For a better understanding of my invention attention is directed to the following description and the claims appended thereto.

In the accompanying drawings which are illustrative of my invention, Figure 1 is a view in side elevation of a turbine driven air compressor; Fig. 2 is a similar view showing a main trunk line with branch tubes or conduits leading therefrom; and Fig. 3 is a detail view showing carriers in one of the tubes or conduits.

1 indicates a steam turbine of any suitable construction, for example, of the Curtis type. The casing is bolted to a pillow-block 2 in which is journaled the shaft of the turbine and that of the centrifugal air compressor 3. The latter shaft is supported on the left hand side by said pillow-block, and on the right hand side by a bearing carried by a standard or foot that is attached to the head 4. The said foot and pillow-block are mounted upon a base 5. The compressor may be of any approved construction, the one shown, see Fig. 2, comprising an impeller having blades or vanes 6 thereon which receive air or other fluid to be pumped or compressed near the center and discharge it outwardly through a suitable velocity reducing nozzle 7 into an annular chamber 8 in the casing 6, from which it flows into and through the conduit 9.

The steam turbine is provided with a centrifugal speed governor 8 and the movements thereof are transmitted by the connecting rod 9 to the lever 10. To this lever is attached the stem of the throttle valve 11 in the supply pipe 12 which may be taken as typical of any suitable form of regulator for regulating the supply of energy to the turbine or other motor. Assuming the pivot 13 of the governor lever to be fixed, as the speed of the turbine increases above normal the valve will decrease the opening admitting steam, and thus reduce its power. Conversely, if the speed of the turbine decreases below normal, the valve will open and admit more steam.

In order that the speed of the turbine and consequently the pressure of the compressor discharge may be varied in accordance with the volume of air delivered by the compressor as distinguished from its pressure, a second or auxiliary governing means is provided that depends for its action upon the volume of air delivered to the service conduit, or the one containing the mail carriers. This mechanism is arranged to change the position of the fulcrum 13 of the governor lever, and thus modify the action of the regulator on the turbine or other motor. From this it will be seen that...
each governor can change the position of the regulating valve independently of the other, or both governors can act simultaneously to adjust the valve.

Located within the conduit 7 is a disk 14 containing a plurality of orifices 15 through which the air is free to pass. Mounted in the disk is a tubular shaft 16 for the free running turbine wheel 17, also located within the conduit. This shaft is provided with bearings at opposite ends. The wheel is provided with suitably shaped vanes or buckets 18 that are acted upon by the air discharged from the orifices 15 to rotate the wheel at a speed proportionate to the volumetric delivery of the compressor. It will be noted that the turbine wheel runs free except for the negligible load imposed by the speed governor driven thereby. The speed at which this wheel runs is independent of the pressure of the air acting upon it. Fast on the shaft 16 of the turbine wheel 18 is a centrifugal governor or speed responsive device 19 which may control the admission of steam to the turbine 1, directly or through a suitable relay. As the speed of the turbine wheel 18 changes, the governor balls move toward or away from the spindle 20, and in so doing impart movement to the lever 21 through said spindle. The upper end of the lever is forked and embraces a collar on the spindle 20. The lower end of the lever is connected by a rod 22, suitably packed at 23, with one end of the governor lever 10 of the steam turbine. In other words, this connection forms a support for the pivot 12. Hence as the load conditions change, the position of this pivot is moved toward or away from the compressor and in this manner the action of the secondary governor or speed responsive device 19 modifies the action of the main steam turbine governor 8.

Referring to Fig. 2, I have shown an arrangement whereby a number of branch tubes or conduits 25 arranged in multiple may be supplied with air from a main or a trunk line pipe 7, the latter being connected to and receiving air from the centrifugal compressor 3. In each of the branch conduits 25 is a free running turbine wheel 17, a speed responsive device or governor 19 and a butterfly valve 27. The valve is fast on a spindle 28 that is supported in bearings carried by the conduit. On the spindle is an arm 29 that is connected by a rod 30 with the movable abutment 31 of the speed governor. Between the rod and the abutment is a slip-joint 32 which may have advantage be of the ball-and-socket type. Between the movable abutment and a fixed part or collar is a compression spring 33 that opposes the centrifugal force of the governor weights and tends at all times to move them inward. In the present arrangement, each of the butterfly valves acts as a throttle valve to regulate the supply of air passing from the main trunk line pipe 7 into and through the tubes containing the carriers. In this manner each governor automatically takes care of the volume of air passing through its conduit, and this independently of the volume of air that is passing through the other conduits. From this it follows that each tube will take the necessary volume of air at all times, and this independent of the pressure of the air at the compressor.

In Fig. 3 is shown one of the branch tubes 25 containing carriers 34 for mail or merchandise of any character. These carriers may be of any suitable construction and are so arranged as to make a fairly close fit with the walls of the tubes, so that as they are inserted into the tubes one after the other through suitable air locks, the air from the compressor will move them forward at the desired rate of speed.

I may and preferably would utilize the turbine governing arrangement of Fig. 1 in connection with the volumetric governing mechanism illustrated in Fig. 2, for the reason that should the governing devices in the tubes 25 decrease the volume of air passing therethrough it would be desirable in order to avoid too great a pressure in the trunk line or main and for the purposes of economy to decrease the speed of the compressor. Conversely, when the service tubes contain a large number of carriers it would be desirable to have all the air necessary and hence the speed of the compressor should be increased.

In some cases it may be desirable for each tube to have its own compressor, in which case the valves 27 and their governing mechanism may be omitted because the governors 8 and 19 shown in Fig. 1 will suffice.

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. In combination, a centrifugal apparatus, a motor for driving it, a regulator for the motor, a means driven by the motor for actuating the regulator, and a speed-responsive device driven by the fluid that passes through said apparatus for modifying the action of the regulator.

2. In combination, a centrifugal apparatus, a motor for driving it, a regulator for the motor, a primary means driven by the motor for controlling the action of the regul
lator, and a secondary means acted upon by the flowing fluid after it has passed through and been discharged from the said apparatus which coöperates with the primary means to determine the effective action of the regulator.

3. In combination, a centrifugal air compressor, a motor for driving it, a regulator for the motor, a speed governor driven by the motor which acts on the regulator, a rotating volumetric governor, the speed and volumetric governors acting together to determine the position of the regulator, and a free running rotor for driving the volumetric governor which is driven by the air that passes through the compressor.

4. In combination, a centrifugal apparatus, a motor for driving it, a regulator for the motor, a conduit receiving fluid discharged by said apparatus, a speed-responsive device located in said conduit, a means for rotating the device, and means for transmitting movements of the said device to the regulator.

5. In combination, a centrifugal apparatus, a motor for driving it, a speed governor driven by the motor, a regulator for the motor that is actuated by the governor, a conduit receiving fluid from said apparatus, a speed-responsive device in said conduit, and means actuated by said device which modifies the action of the governor on the regulator.

6. In combination, a centrifugal apparatus, a motor for driving it, a regulator for the motor, a governor for actuating the regulator, a conduit receiving fluid from said apparatus, a speed-responsive device in said conduit, a bucket-wheel for rotating said device which is actuated by the fluid flowing through the conduit, and a connection between the said device and the regulator whereby it modifies the action of the governor on the regulator.

7. In combination, a centrifugal apparatus, a motor for driving it, a regulator for the motor, a governor, a pivoted member for transmitting the motions of the governor to the regulator, a conduit through which the fluid from said apparatus flows, a speed-responsive device located in the conduit, and a means actuated by the speed-responsive device for shifting the pivot of said member to modify the action of the governor on the regulator.

8. In combination, a centrifugal apparatus, a motor for driving it, a regulator for the motor, a governor, a lever for transmitting movements of the governor to the regulator, a conduit through which fluid acts upon the said apparatus, a speed-responsive device located therein, a wheel for rotating the device which in turn is driven by the fluid flowing through the conduit, and a rod connecting the fulcrum of the lever and the speed responsive device for transmitting movements of the device to the fulcrum.

In witness whereof, I have hereunto set my hand this 17th day of May, 1909.

JOHN G. CALLAN.

Witnesses:  
JOHN A. McMANUS, JR.,  
CHARLES A. BARNARD.