

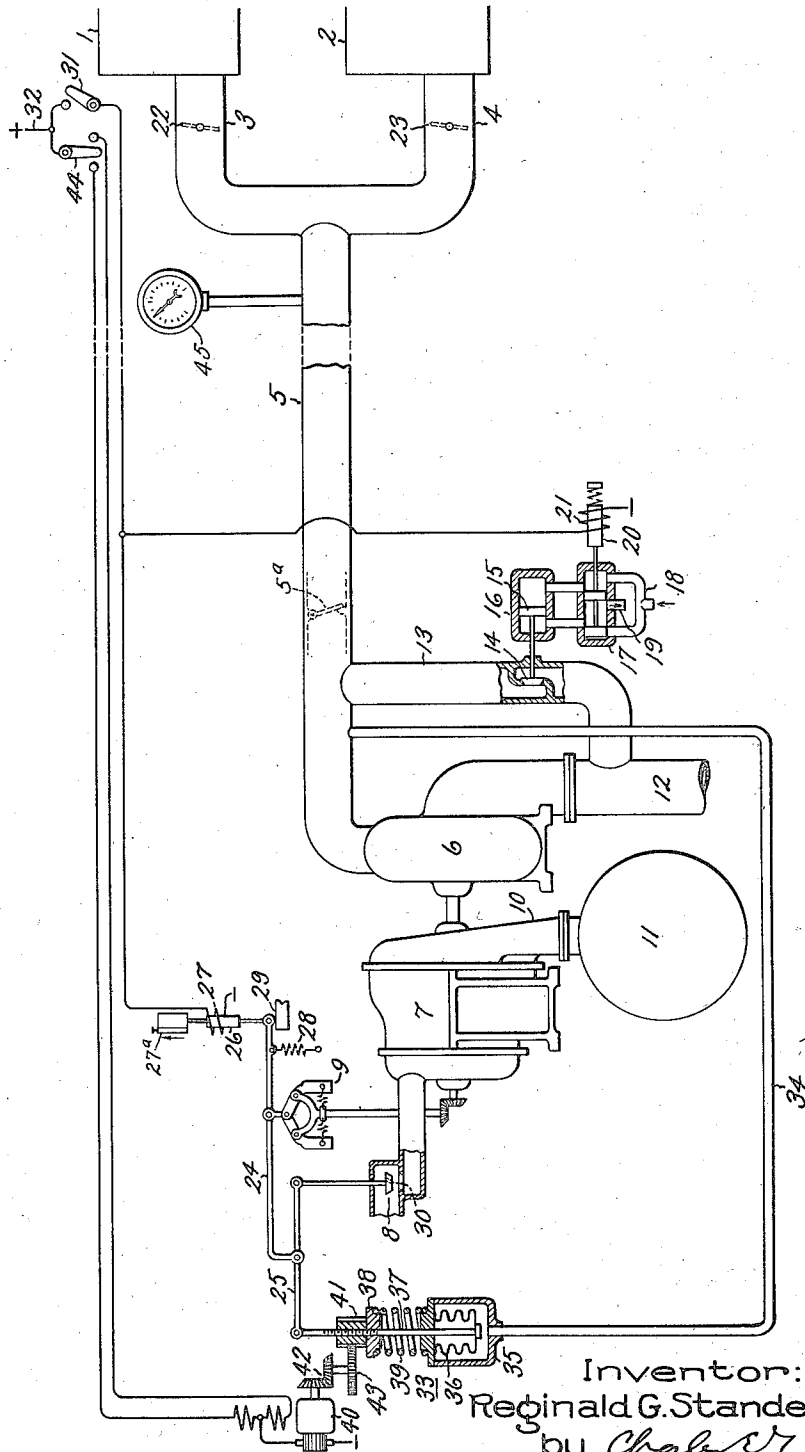
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CONTROL MECHANISM FOR FURNACE BLOWERS

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CONTROL MECHANISM FOR FURNACE
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The present invention relates to furnaces such as Bessemer converters, and like consumers of air or gas wherein air for blowing the furnaces is supplied by a turbine driven centrifugal compressor, and especially to control means for such apparatus. The control of such apparatus offers peculiar difficulties in that the furnace or furnaces are located usually a considerable distance from the turbo-compressor, requiring a long pipe line of relatively large capacity, and in that during the operation of the furnace, the compressor must be shut down and started up again frequently.

The object of my invention is to provide an improved control mechanism for an installation of this type, and for a consideration of what I believe to be novel and my invention, attention is directed to the following specification and the claims appended thereto.

In the drawing, the figure is a diagrammatic view of an installation embodying my invention, it being in the drawing shown applied to two Bessemer converters receiving air from the same turbo-compressor set.

Referring to the drawing, the Bessemer converters 1 and 2 are connected by conduits 3 and 4 to a discharge conduit 5 of centrifugal compressor or blower 6 driven by an elastic fluid turbine or prime mover 7. In conduit 5 is a non-return valve 5a which serves to prevent back blow in conduit 5 toward the compressor. The converters 1 and 2 are indicated as being located a considerable distance from the turbo-compressor set (this being the condition met with usually) which means that the pipe line comprising conduits 3, 4 and 5 is relatively long and has a large volumetric capacity. The turbine 7 is provided with valve means 8 for controlling the supply of elastic fluid to the turbine and with a speed governor 9 driven from the turbine shaft. The exhaust for the turbine is indicated at 10, it being connected to a condenser 11. The compressor is provided with an intake conduit 12.

Connected to an end portion of the discharge conduit 5, that is in the vicinity of the compressor, is a waste conduit or dumping pipe 13, in which is located a blow-off, dumping or waste valve 14. Conduit 13 may discharge directly to atmosphere or, as shown, it may be connected to the compressor inlet conduit 12. Valve 14 has its stem connected to a piston 15 of a hydraulic motor, the cylinder of which is indicated at 16. Admission of actuating fluid to cylinder 16 is controlled by a pilot valve 17, 18 being the supply conduit to the pilot valve and 19 the discharge conduit

therefrom. The stem of pilot valve 17 is connected to a plunger 20 of an electro-magnet, the winding of which is indicated at 21. Pilot valve 17 has only two positions. When winding 21 is deenergized, pilot valve 17 occupies a position to admit actuating fluid to the outer end of the cylinder 16, thereby holding valve 14 closed, and when winding 21 is energized, the position of the pilot valve is reversed, admitting actuating fluid to the inner end of cylinder 16 to force valve 14 to open position and hold it there. In other words, when winding 21 is deenergized, valve 14 is held closed and when winding 21 is energized, valve 14 is held open.

In conduits 3 and 4 are manually controlled valves 22 and 23 by means of which the operator varies the quantity of air required during operation of the converters.

Speed governor 9 has a spindle connected to a governor lever 24. One end of lever 24 is pivotally connected to a lever 25 and the other end is connected to the plunger 26 of an electro-magnet, the winding of which is indicated at 27. Winding 27 is normally deenergized and when deenergized, a spring 28 holds the right hand end of governor lever 24 against a fixed stop 29. One end of lever 25 is connected to valve means 8 and the arrangement is such that when winding 27 is energized, it turns governor lever 24 in a direction to move valve means 8 to closed position, lever 24 pivoting on the spindle of governor 9. It is desirable that this movement be retarded somewhat so that in operation valve 14 will be opened wide before valve means 8 is closed. In the present instance this is effected by a suitable dash pot 27a which serves to retard upward movement of plunger 26.

It is desirable in an installation of this type that even when valve means 8 is closed, sufficient elastic fluid flows by it to keep the turbine turning over at a low speed. For this purpose, the valve means is provided with a small opening 30 through it, although any other suitable arrangement may be used for this purpose.

Electromagnet winding 21 and electromagnet winding 27 are connected in multiple to a remote control mechanism comprising a switch 31, one terminal of which is connected to a suitable source of electrical supply indicated at 32. With this arrangement, it will be seen that when switch 31 is open, which is its normal position, blow-off valve 14 is closed and governor lever 24 is released, its right hand end being held in engagement with the stop 29. When switch 31 is closed, the windings of both electromagnets are

energized, the energization of winding 21 serving to open valve 14 and the energization of winding 27 serving to close valve 8.

The left hand end of lever 25 is connected to a pressure responsive device 33 which in turn is connected by a pipe 34 to discharge conduit 5. In the present instance, the pressure responsive device which forms a part of the turbine governing mechanism is shown as comprising a casing 35 in which is located a corrugated bellows 36 having its stem 37 pivotally connected to lever 25. Pipe 34 connects to the lower end of casing 35. Surrounding stem 37, between the top of casing 35 and an adjustable spring plug 38 on stem 37, is an adjusting spring 39. Spring 39 is a tension spring operating in a direction opposed to the pressure in casing 35. Spring plug 38 is threaded on stem 37 and may be adjusted by turning it manually or by means of an electric motor 40 which is connected to a gear 41, which forms a part of spring plug 38, by means of a bevel gear 42 and a spur gear 43. When motor 40 is operated in one direction or the other, it turns nut 41 to either increase or decrease the tension of the spring 39. The nut and spring plug travel along the threaded rod 37. The two windings of reversing motor 40 are connected to a switch 44. By means of switch 44, the pressure responsive device 33 may be adjusted or set for the desired pressure.

The control switches 31 and 44 and the control means for valves 22 and 23 are located adjacent to the converters and to each other so that the operator at the Bessemer converters can manipulate them conveniently. Adjacent the operator is a pressure gage 45 connected to conduit 5 for indicating the pressure therein.

The operation is as follows:

When the molten stock is being poured into the converters to load the same, switch 31 is closed, thereby energizing windings 21 and 27. This serves to open wide the blow-off or waste valve 14 and to close entirely valve means 8. Closing valve means 8 shuts off the supply of elastic fluid to the turbine except for the amount which leaks through opening 30, this being sufficient to keep the turbine turning over at a relatively low speed. As soon as the converter is loaded, the operator opens switch 31 whereupon waste valve 14 is promptly closed and valve means 8 is thrown wide open. The turbine quickly comes up to maximum speed, this being the speed for which the governor 9 is set. Ordinarily, the speed governor is set for a speed somewhat higher than the normal operating speeds, thus functioning as a pre-emergency governor. The pressure now builds up in conduit 5 although, owing to its capacity, an appreciable amount of time is required to do this. When the pressure reaches a predetermined value, the operator then opens valves 22 and 23 to admit air to the converters. As soon as the pressure reaches the normal operating pressure, pressure responsive device or governor 33 takes control of the turbine, adjusting valve means 8 to obtain the desired pressure in discharge conduit 5. In this connection, it will be seen that when the pressure in conduit 5 increases, the pressure responsive device closes valve means 8 somewhat to bring the pressure back to normal value and when the pressure in conduit 5 decreases below normal value, pressure responsive device 33 serves to open valve means 8 to increase the speed and bring the pressure back to normal value. After the compressor pressure reaches normal value, the operator then

manipulates valves 22 and 23 to supply the desired amount of air to the converters. After the blowing operation is completed, the operator closes the switch 31, thus again bringing the turbine quickly to idling condition with the blow-off valve 14 open and the valve means 8 closed. The cycle of operation can be then repeated.

The provision of dash pot 27^a retards somewhat the closing movement of valve means 8 so that valve 14 will be opened wide prior to the closing of valve means 8. As soon as valve 14 opens, the pressure in conduit 5 in advance of non-return valve 5^a drops, thus effecting a quick closing of the non-return valve. By this arrangement, it is assured that there is a flow of air through waste conduit 13 sufficient to prevent pulsation before the closure of valve means 8 has caused the compressor to drop in speed.

The waste valve 14 serves to prevent pulsation of the compressor at times when the operator in shutting down might close valves 22 and 23 before the turbine has appreciably dropped in speed.

By means of switch 44, pressure responsive device 33 can be adjusted to vary the pressure in conduit 5 or it can be used to slowly shut down the turbine.

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

1. The combination with a gas compressor, of a long conduit connected to the discharge of the compressor, the free conduit end portion including a valve for controlling the flow of gas, and means for dumping gas from the conduit for rapidly interrupting the flow of gas in the conduit to prevent pulsation of the compressor, said means comprising a pipe connected to the conduit end portion adjacent the compressor, a dumping valve in the pipe and means for operating the dumping valve including an actuating member located in proximity of the free conduit end portion.

2. The combination with a gas compressor, of a long conduit connected to the discharge of the compressor, the free conduit end portion including a valve for controlling the flow of gas, and means for dumping gas from the conduit for rapidly interrupting the flow of gas in the conduit to prevent pulsation of the compressor, said means comprising a pipe connected to the conduit end portion adjacent the compressor, a dumping valve in the pipe, means for operating the dumping valve including an actuating member located in proximity of the free conduit end portion, and a non-return valve in the conduit behind its connection with said pipe as regards the direction of flow therein to minimize the pulsation of gas during the dumping operation.

3. The combination with a turbo-compressor of a long conduit connected to the discharge of the compressor, a governing mechanism for controlling the flow of elastic fluid to the turbine including a valve in the turbine inlet and a pressure governor connected to the conduit, means for controlling the flow of gas in the conduit comprising a valve in the free conduit end portion, means for rapidly interrupting the flow of gas in the conduit comprising a pipe connected to the conduit end portion adjacent the compressor and a valve in the pipe for dumping gas from the conduit, and remote control means including a member adjacent the free conduit end portion for actuating the governing mechanism to effect complete closing of the turbine valve.

4. The combination with a blower having a

- discharge conduit of considerable length, of a control valve in the free end of the conduit for controlling the discharge of air from the conduit, a dumping conduit with a valve connected 5 to the conduit adjacent the blower for dumping air from the conduit, and means including an actuating member adjacent the discharge end of the conduit for operating the dumping valve to prevent pulsation of the blower when the control valve is closed.
- 10 5. The combination with a blower having a discharge conduit of considerable length, of a control valve in the free end of the conduit for controlling the discharge of air from the conduit, 15 a dumping conduit with a valve connected to the conduit adjacent the blower for dumping air from the conduit, means including an actuating member adjacent the discharge end of the conduit for operating the dumping valve to prevent pulsation of the blower when the control valve is closed, and a non-return valve in the conduit behind the dumping conduit as regards the flow in the conduit to prevent back flow in the conduit during dumping operation. 5
6. In a turbo-compressor, the combination of a compressor, a turbine for driving the compressor having an inlet valve with an opening in the valve member for by-passing elastic fluid to 10 cause idle running of the turbo-compressor when said valve is shut, and a governing mechanism for normally operating the valve comprising a pressure governor connected to the compressor discharge conduit and remote control means for 15 closing the valve.

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