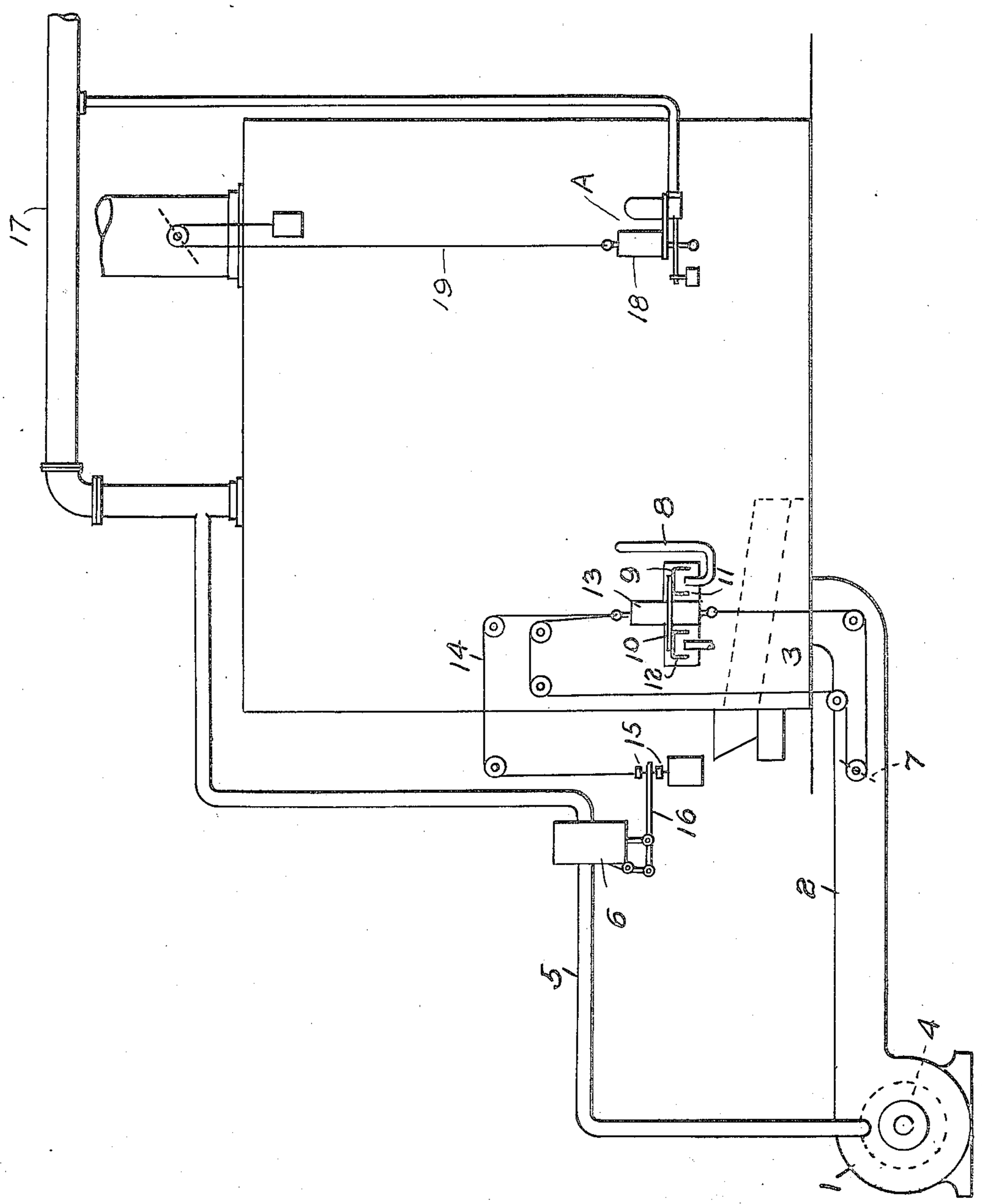
Nov. 18, 1924. 1,516,424

R. R. DONALDSON, JR

REGULATING COMBUSTION IN FURNACES

Filed Aug. 27, 1923



WITNESSES

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Patented Nov. 18, 1924. 1,516,424

UNITED STATES PATENT OFFICE.

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REGULATING COMBUSTION IN FURNACES.

Application filed August 27, 1923. Serial No. 659,444.

To all whom it may concern:

Be it known that I, ROBERT R. DONALDSON, Jr., residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Regulating Combustion in Furnaces, of which improvements the following is a specification.

Two methods are in general use for the automatic regulation of the feed of air under pressure to furnaces. In one the regulation is effected by means of a damper arranged in a pipe or conduit connecting the furnace with the source of supply of air under pressure, as for example, a fan. In some cases the fan must be operated at such a rate as to uniformly supply the air at a maximum pressure or sufficient for peak loads. Hence, there is a waste of power for intermediate loads. The second method consists in changing the speed of the fan as the demand for air for combustion changes, but on account of the inertia of the moving parts of the fan and its motor, a considerable time always intervenes between the change in the furnace requiring a change in the rate of supply of the air, and the increase or retardation of the speed of the fan, and there will be a "hunting" of the air supplying means before the fan will deliver air uniformly at the desired pressure.

The invention described herein has for its object the provision of means whereby the delivery of air is first regulated in accordance with conditions in the furnace, followed by a regulation of the air supply in consonance with such change in the rate of delivery. The invention is hereinafter more fully described and claimed.

In the accompanying drawings forming a part of this specification, is shown diagrammatically the application of the improvement claimed herein to a vapor generator.

In the practice of the invention the air for combustion is supplied by a fan 1 or other suitable means whereby the rate of supply to a conduit 2 extending to the ash pit 3 of the furnace of a vapor generator may be varied. Any suitable form or construction of motor may be employed for operating the fan as for example a steam turbine indicated at 4 and connected to the vapor generator or other source of fluid under pressure by a pipe 5. When employing a fluid pressure motor, the operation of the motor is controlled by a suitable valve mechanism 6 preferably of the roto-reciprocating type shown and described in Letters Patent No. 1,247,217, granted November 20, 1917, to Brown and Reeser. In the conduit 2 and at a point intermediate the fan and the ash pit of the furnace is arranged a damper 7 adapted to regulate the rate of delivery of air to the furnace. The damper 7 and fan regulating means 6 are adapted to be operated in sequence in accordance with changes in demand on the vapor generator, such changes causing variations in the pressure of vapor in or the rate of flow of vapor from the generator. In the construction shown, suitable means are employed whereby changes in the demand on the generator will cause changes of pressure of gases in the furnace of the generator and mechanism is employed whereby the delivery and supply of air for combustion may be regulated by and in accordance with such changes of pressure in the furnace. While any suitable mechanism operative by and in accordance with pressure of gases in the furnace may be employed for shifting the damper and motor regulator in due sequence, it is preferred to employ mechanism of the type described and shown at the right in Figs. 3, 4, and 5 of Patent No. 1,338,923, granted May 20, 1920, to John M. Hopwood. As shown herein a pipe 8 extending from the furnace of the generator projects up into an inverted cup 9 on one end of a lever 10, and partially immersed in a liquid in a tank 11. A similar cup 12 is attached to the opposite end of the lever, said cup being subjected internally to atmospheric or other predetermined pressure. As described in said patent the lever is connected to a valve mechanism controlling the flow of fluid under pressure to opposite ends of a cylinder 13 dependent upon variations of pressure in the furnace. The piston rod of this cylinder is connected by a cord 14 to the movable elements of the valve mechanism 6 in such manner that there will be a substantial movement of the piston of the cylinder 13 before the movable elements of the valve mechanism are shifted. In the construction shown herein such end is attained by arranging tappets 15 on the cord on opposite sides of the lever 16 of the valve mechanism, 6. These tappets are spaced such

distances apart that the piston of the cylinder may move the desired distance before a tappet will engage the lever.

The piston rod of the cylinder 13 is also operatively connected to the damper 7 in the conduit 2 in such manner that the damper will be shifted immediately on the movement of the piston rod, such movement of the damper being proportional to the movement of the piston rod. As described in the patent referred to, the movement of the piston rod is incremental and proportional to changes of pressure in the furnace.

It will be readily understood by those skilled in the art that immediately on any change of pressure in the furnace the damper will be shifted to vary the rate of delivery of air to the furnace, and that any adjustment of the damper producing a material change of pressure across the damper, will be followed by a shifting of the valve mechanism 6 to increase or decrease the rate of supply of air by the fan to the conduit 2.

The pressure of gases in the furnace is varied in accordance with the demand on the generator by a master regulator A which is preferably of the type and construction shown and described in Letters Patent No. 1,371,243, granted March 15, 1921, to John M. Hopwood, and is connected to the steam outlet pipe 17 of the vapor generator. The piston rod of the cylinder 18 of the master regulator is operatively connected by a cord 19 or other suitable means to the stack damper.

I claim herein as my invention:

1. The combination of a furnace, means for supplying air for combustion to the furnace, means for regulating the delivery of air to the furnace and means for controlling the air supplying and delivery regulating means by and in accordance with changes of pressure of gases in the furnace.

2. The combination of a furnace, means for supplying air for combustion to the furnace, means for regulating the delivery of air to the furnace, means operative by and in accordance with changes of pressure of gases in the furnace for regulating the air supplying means, and means for shifting the air delivery regulating means prior to the regulation of the air supplying means.

3. The combination of a furnace, a fan for supplying air for combustion to the furnace, a damper for regulating the delivery of such air to the furnace, and means operative by and in accordance with the pressure of gases in the furnace for shifting the damper and changing the speed of the fan in sequence.

In testimony whereof, I have hereunto set my hand.

ROBERT R. DONALDSON, JR.