April 11, 1939. E. C. NIVEN ET AL 2,153,637

MULTIPLE DAMPER CONTROL FOR BOILERS AND THE LIKE

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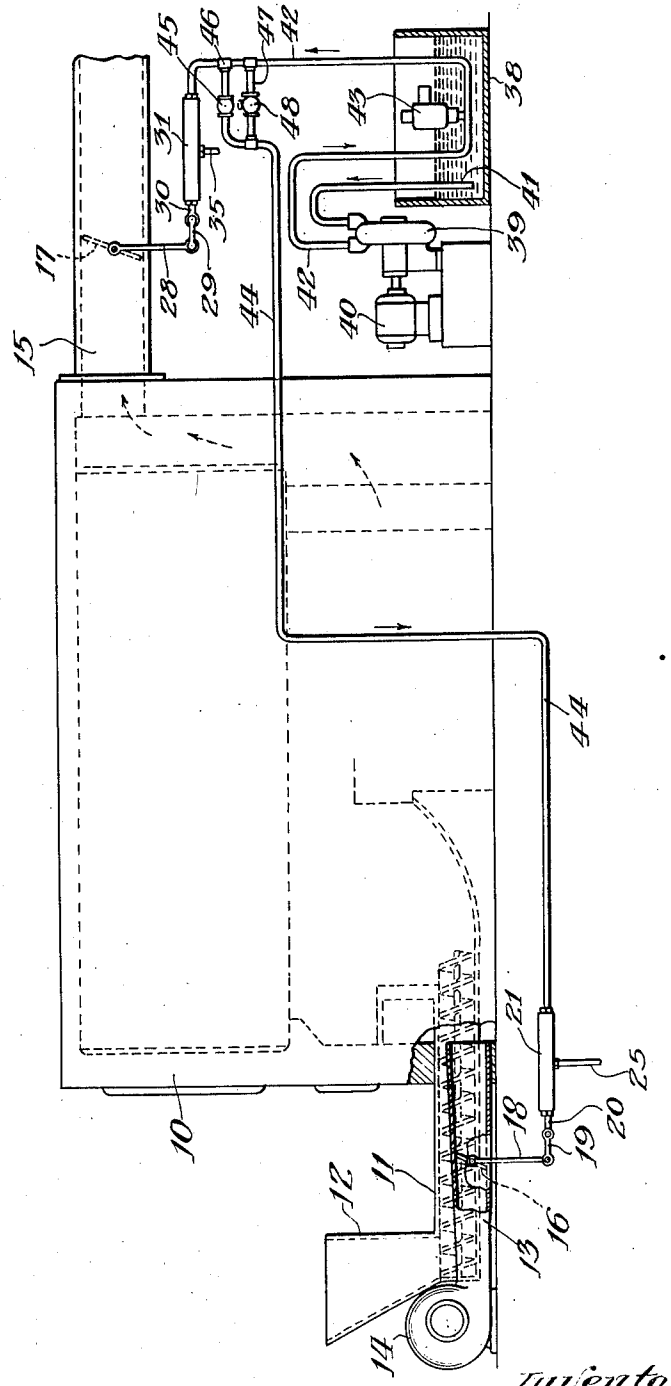



Fig. 1.

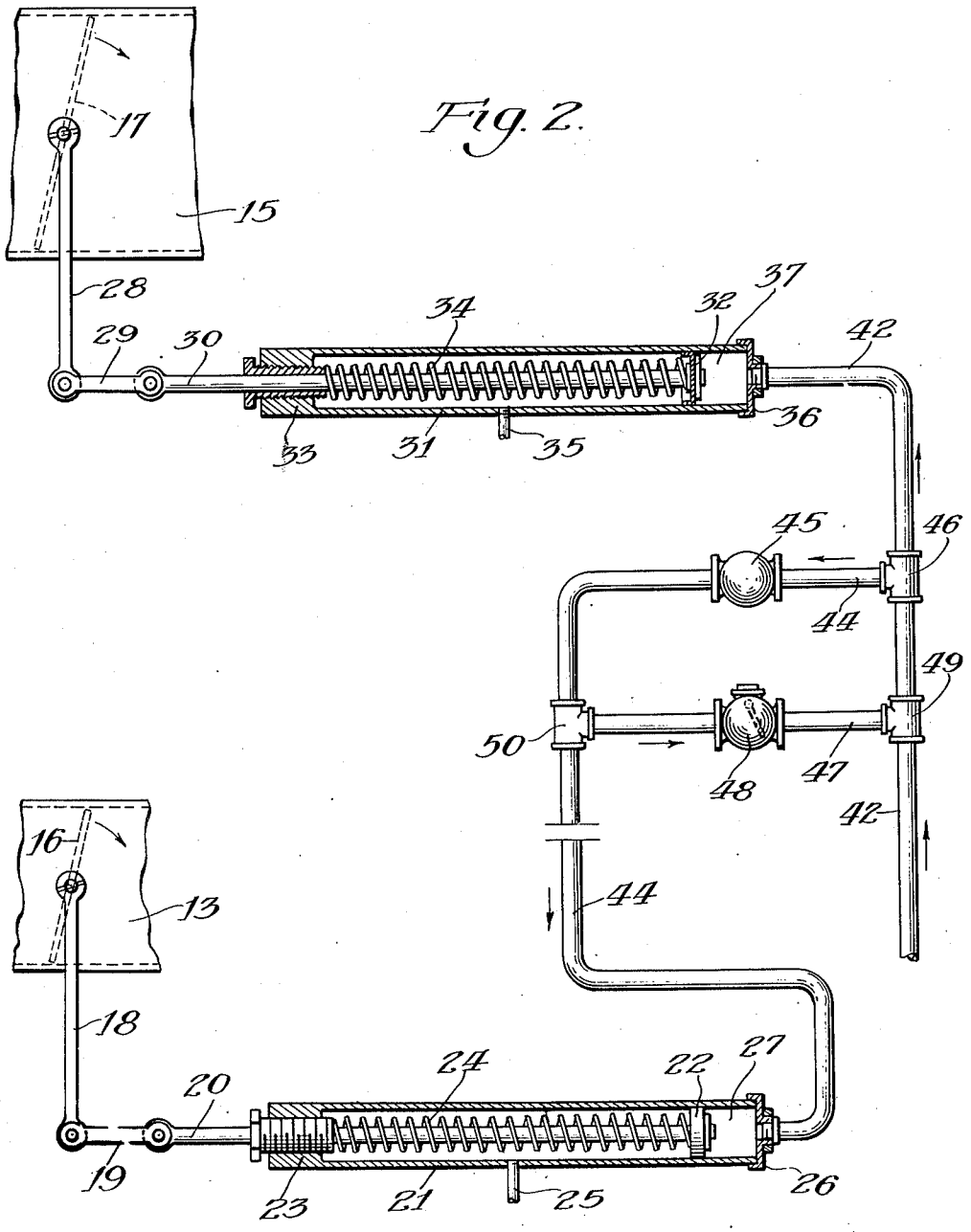
Inventors:
Edward C. Niven,
John H. Niven.
By: Bertha L. MacGregor
Attorney

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Fig. 2.




Inventors:
Edward C. Niven,
John A. Niven.
By: Bertha L. MacGregor
Attorney

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## MULTIPLE DAMPER CONTROL FOR BOILERS AND THE LIKE

Edward C. Niven and John A. Niven,
Chicago, Ill.

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7 Claims. (Cl. 110—163)

This invention relates to multiple damper controls for boilers and furnaces, particularly for stoker fed apparatus. The main object of the invention is to control the intake of air to the furnace or boiler and the outlet of the gaseous products of combustion from the combustion chamber to avoid waste of heat energy.

Our invention contemplates the use of a multiple damper control by means of which the outlet control damper is positively opened in advance of the opening of the air intake damper, and the latter is positively closed in advance of the closing of the outlet control damper. The damper actuating means are mechanically interconnected, and are efficient and dependable in operation. The opening of the outlet control damper before opening the air intake damper, and the closing of the air intake damper before closing the outlet control damper is essential to economical and efficient combustion of fuel, prevents smoke and gas from passing back through the boiler, and prevents formation of objectionable back pressure in the furnace or boiler.

In the drawings:

Fig. 1 is a longitudinal vertical sectional view of a stoker fed boiler, partly in elevation, embodying our invention.

Fig. 2 is a vertical sectional view, partly in elevation, on an enlarged scale, of part of the control system shown in Fig. 1.

Referring to that embodiment of the invention which we have chosen to illustrate in the drawings, 10 indicates a boiler or furnace, 11 an underfeed stoker, and 12 a hopper for receiving fuel. An air duct 13 supplies air from the motor operated fan 14 to the combustion chamber of the boiler 10. A stack 15 provides an outlet for the gaseous products of combustion.

We provide a damper 16 in the air duct 13 and a damper 17 in the stack 15 as part of our control system. The damper 16 is connected through pivotally mounted links 18 and 19 to a piston rod 20 which is mounted in and projects from a cylinder 21, the inner end of the piston rod 20 being rigidly connected to a piston 22. The cylinder 21 has a closed end 23 through which the piston rod 20 extends and a coiled spring 24 surrounds that part of the piston rod 20 between the piston 22 and cylinder end 23. A small drain outlet 25 is provided for a purpose to be explained. Between the piston 22 and the opposite end 26 of the cylinder there is formed a compression chamber 27 for the reception of pressure fluid, preferably oil.

The stack damper 17 is similarly connected through pivotally mounted links 28 and 29 to a piston rod 30 mounted in and extending from a cylinder 31, the inner end of the piston rod 30 being connected to a piston 32. Between the closed end 33 of the cylinder through which the rod 30 extends and the piston 32, a coiled spring 34 is wrapped around the piston rod 30. A drain 35 leads from the cylinder as shown. Between the opposite end 36 of the cylinder and said piston 32, there is formed a compression chamber 37 for the reception of pressure fluid, as will be more fully explained. The two dampers, 16 and 17, are essential to efficient and economical operation of a stoker fired furnace. If there were no damper 16 in the air intake leading to the furnace or boiler, gases could flow back through the furnace when the flue damper 17 is closed. If a damper were provided only in the air intake and not in the stack, great waste of fuel would result, for there would be excessive draft even if the damper 16 in the air intake were closed, resulting in loss of the products of combustion. Even when the damper 16 in the air duct is closed, there is sufficient air leakage in all conventional furnaces and boilers to permit some intake of air, sufficient to maintain the desired rate of combustion while the furnace is not being actively fired.

A fluid container 38 is preferably located adjacent a pressure pump 39 actuated by a motor 40. A conduit 41 has its open end in the fluid in the container 38 for delivering it to the pump 39, from whence it is forced into the conduit 42, provided with a relief valve 43, to the chamber 37 of the cylinder 31 for the purpose of forcing the piston 32 toward the cylinder end 33, thereby compressing the spring 34 and actuating the damper 17 to open it.

Between the pump 39 and cylinder 31, the pressure fluid conduit 42 is connected with the chamber 27 of the cylinder 21 for actuating the air duct damper 16, by a pressure fluid conduit 44. A relief valve 45 is located in the line 44, preferably adjacent to the connection 46 between the conduits 44 and 42. A parallel conduit 47 provided with a check valve 48 also connects the conduits 42 and 44 between the joints 49, 50.

The control system is designed to be actuated by the pump 39 driven by the motor 40. This motor may be thermostatically controlled so as to operate simultaneously with the motor which operates the stoker and air duct fan, also thermostatically controlled as is well understood in the art; or the oil pump 39 may be operated

through mechanical connectionts between the pump and the stoker actuating means. Assuming the dampers 16 and 17 to be closed, as shown in the drawings, when the stoker actuating means and fan 14 are put into operation either automatically or manually, the pump 39 will start to work, forcing fluid, preferably oil, from the container 38, through the conduit 41, under pressure into the conduit 42, to the chamber 37 of the cylinder 31. The presence of the check valve 48 and relief valve 45 prevent fluid passing into the conduit 44 until a predetermined pressure has been built up in the line 42 and chamber 37 sufficient to actuate the piston 32 and rod 30 to open the stack damper 17, the pressure being maintained in the chamber 37 to hold the damper 17 in open position. Thereupon, as the pressure builds up in the line 42, the relief valve 45 opens the line 44 to permit the flow of pressure fluid from the conduit 42 through conduit 44 to the chamber 27 of the cylinder 21, whereby the piston 22 and rod 20 are actuated to open the air duct damper 16. The pressure is maintained in the line 44 to hold the damper 16 open as long as the pump 39 is working. Should the pressure in the lines 42 and 44 exceed a predetermined pressure, the relief valve 43 will open to the extent required to relieve the pressure in said conduits. As soon as the operation of the oil pump ceases, either through thermostatic control of the motor 40 or by reason of mechanical connections between the pump and stoker operating motor, when the stoker stops operating, the pressure exerted by the pressure fluid in the conduits 42 and 44, respectively, against the pistons 32 and 22 will be relieved and the coiled springs 34 and 24 will force the pistons and piston rods back to the positions shown in the drawings. The spring 24 which is part of the means for actuating the air duct damper 16 is heavier than the spring 34 which is part of the means for actuating the stack damper 17 and consequently the spring 24 has greater expansible power than the spring 34. The result is that when pressure in the lines 42 and 44 is relieved, the spring 24 causes the return movement of the piston 22 and rod 20 to close the air duct damper 16 before the stack damper 17 is closed. The pressure fluid returns from the cylinder 31 through conduits 42, 41 to the container 38, and the pressure fluid returns from the cylinder 21 through conduits 44, 47, joining the conduit 42 for the return to the container 38. The control system is inoperative and the dampers remain closed while the stoker feed is inactive and the fan 14 inoperative but, as explained, as soon as the said parts are again put into operation, the pressure fluid will first open the damper 17 and then open the damper 16.

The drains 25 and 35 are provided to carry off any fluid which may pass around the pistons 32 and 22. Preferably the drains are connected with the container 38.

Changes may be made in details of construction without departing from the scope of my invention. Whenever the word "boilers" is used in the claims, it is intended to include boilers, furnaces and fuel burning apparatus. The "pressure fluid" referred to may be oil, water or air pressure.

We claim:

1. A multiple damper control for boilers comprising an air duct through which air passes into the boiler, a damper in the air duct, a damper controlling the outlet of gaseous products of combustion from the boiler, pressure-operated means connected with each of said dampers for actuating the same, a pressure pump, a pressure fluid conduit between the pump and said means for actuating the outlet control damper, a pressure fluid conduit connected to the means for actuating the air duct damper and to said first mentioned conduit between the pump and said means for actuating the outlet control damper, and means in one of said fluid conduits for permitting said pressure fluid to operate the actuating means to open the outlet control damper before the air duct damper is opened.

2. A multiple damper control for boilers comprising an air duct through which air passes into the boiler, a damper in the air duct, a damper controlling the outlet of gaseous products of combustion from the boiler, pressure-operated means connected with each of said dampers for actuating the same, a pressure pump, a pressure fluid conduit between the pump and said means for actuating the outlet control damper, a pressure fluid conduit connected to the means for actuating the air duct damper and to said first mentioned conduit between the pump and said means for actuating the outlet control damper, and means in the pressure-operated damper actuating means for causing the air duct damper to close before the outlet control damper is closed.

3. A multiple damper control for boilers comprising an air duct through which air passes into the boiler, a damper in the air duct, a damper controlling the outlet of gaseous products of combustion from the boiler, pressure-operated means connected with each of said dampers for actuating the same, a pressure pump, a pressure fluid conduit between the pump and said means for actuating the outlet control damper, a pressure fluid conduit connected to the means for actuating the air duct damper and to said first mentioned conduit between the pump and said means for actuating the outlet control damper, means in one of said fluid conduits for permitting said pressure fluid to operate the actuating means to open the outlet control damper before the air duct damper is opened, and means in the pressure-operated damper actuating means for causing the air duct damper to close before the outlet control damper is closed.

4. A multiple damper control for boilers comprising an air duct through which air passes into the boiler, a damper in the air duct, a damper controlling the outlet of gaseous products of combustion from the boiler, pressure-operated means connected with each of said dampers for actuating the same, a pressure pump, a pressure fluid conduit between the pump and said means for actuating the outlet control damper, a pressure fluid conduit connected to the means for actuating the air duct damper and to said first mentioned conduit between the pump and said means for actuating the outlet control damper, and means in one of said fluid conduits for permitting said pressure fluid to operate the actuating means to open the outlet control damper before the air duct damper is opened, each of said pressure-operated means comprising a cylinder, a piston and piston rod movable longitudinally of the cylinder, the rod being operatively connected to a damper, and a coiled spring between the piston and one end of the cylinder.

5. A multiple damper control for boilers comprising an air duct through which air passes into the boiler, a damper in the air duct, a damper controlling the outlet of gaseous products of com-

bustion from the boiler, pressure-operated means connected with each of said dampers for actuating the same, a pressure pump, a pressure fluid conduit between the pump and said means for actuating the outlet control damper, a pressure fluid conduit connected to the means for actuating the air duct damper and to said first mentioned conduit between the pump and said means for actuating the outlet control damper, and means in the pressure-operated damper actuating means for causing the air duct damper to close before the outlet control damper is closed, each of said pressure-operated means comprising a cylinder, a piston and a piston rod movable longitudinally of the cylinder, the rod being operatively connected to a damper, and a coiled spring between the piston and one end of the cylinder, the springs in the cylinders being of different tensile strength.

6. A multiple damper control for boilers comprising an air duct through which air passes into the boiler, a damper in the air duct, a damper controlling the outlet of gaseous products of combustion from the boiler, pressure-operated means connected with each of said dampers for actuating the same, a pressure pump, a pressure fluid conduit between the pump and said means for actuating the outlet control damper, a pressure fluid conduit connected to the means for actuating the air duct damper and to said first mentioned conduit between the pump and said means for actuating the outlet control damper, and means in one of said fluid conduits for permitting said pressure fluid to operate the actuating means to open the outlet control damper before the air duct damper is opened, said means comprising a relief valve in the conduit leading to the air duct damper actuating means allowing pressure fluid to enter said conduit after a predetermined pressure has been built up in the means for actuating the outlet damper, and a by-pass, including a check valve, connecting said pressure fluid conduits at opposite sides of the relief valve.

7. A multiple damper control for boilers comprising an air duct through which air passes into the boiler, a damper in the air duct, a damper controlling the outlet of gaseous products of combustion from the boiler, pressure-operated means connected with each of said dampers for actuating the same, a pressure pump, a pressure fluid conduit between the pump and said means for actuating the outlet control damper, a pressure fluid conduit connected to the means for actuating the air duct damper and to said first mentioned conduit between the pump and said means for actuating the outlet control damper, a relief valve in the conduit leading to the air duct damper actuating means, and a by-pass, including a check valve, connecting said pressure fluid conduits at opposite sides of the relief valve.

EDWARD C. NIVEN.
JOHN A. NIVEN.