May 23, 1939. S. G. DOWN 2,159,785

FUEL CONTROL SYSTEM

Filed June 30, 1937

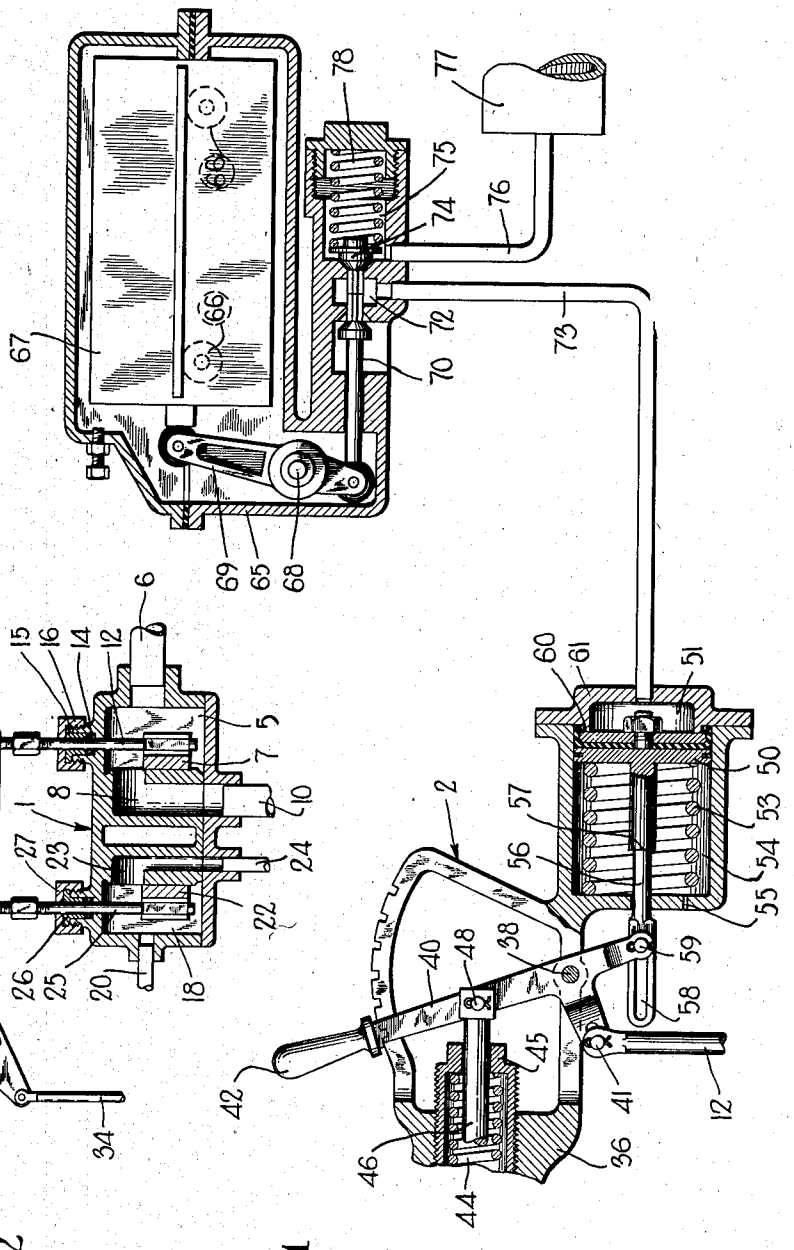


Fig 2

Fig 1

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Patented May 23, 1939 2,159,785

UNITED STATES PATENT OFFICE

2,159,785

FUEL CONTROL SYSTEM

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Application June 30, 1937, Serial No. 151,107

6 Claims. (Cl. 105—48)

This invention relates to a fuel control system, and particularly to means for regulating the rate of supply of fuel to the furnace of a locomotive boiler.

As usually constructed locomotive boilers are provided with fire boxes in which the combustion of the fuel takes place. The fire box is usually arranged at the rear of the boiler, and its upper wall is known as the crown sheet. The lower face of the crown sheet is exposed to the fire in the fire box, while the water in the boiler is normally maintained at such a level that the upper face of the crown sheet is covered to thereby prevent overheating of the crown sheet and resultant injury thereto.

Because of the high operating speeds now employed very effective braking is required, and results in high rates of deceleration of the train and of the locomotive. On a reduction in the speed of a locomotive, the force of inertia acting on the water in the locomotive boiler causes the water to move relative to the boiler from the rear of the boiler to the front.

It has been found that the high rates of deceleration employed at the present time may cause so great a movement of the water in the boiler from the rear to the front of the boiler as to leave the crown sheet bare. If this condition occurs, and if the furnace is being fired heavily at this time, the crown sheet may be overheated and seriously damaged.

It is an object of this invention to provide a fuel control system for the furnace of a locomotive fired with fluid fuel, such as fuel oil, and incorporating means automatically operated on a reduction in the speed of the locomotive at a predetermined rate, to restrict the rate of supply of fuel to the furnace to thereby prevent overheating of the crown sheet of the locomotive boiler and consequent injury thereto.

A further object of the invention is to provide a fuel control system of the type described, and incorporating a control member movable between spaced positions for varying the rate of supply of fuel to a furnace, together with means responsive to the rate of retardation of the locomotive for moving the control member to the position in which it restricts the rate of supply of fuel to the furnace.

Another object of the invention is to provide a fuel control system of the type described, and which is arranged so that the control member is normally movable throughout its range of movement without interference by the means responsive to retardation, but which is also arranged so that when the retardation responsive means is actuated, it will move the control member to limit the rate of supply of fuel to the furnace irrespective of the position which the control member occupies.

A further object of the invention is to provide an improved fuel control system for the furnace of a locomotive boiler.

Other objects of the invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawing, in which,

Fig. 1 is a fragmentary diagrammatic view, largely in section, of a fuel control system embodying my invention, and

Fig. 2 is a fragmentary sectional view of a portion of a fuel supply system with which the control system provided by my invention may be employed.

Referring to the drawing, the control system provided by this invention incorporates means responsive to the rate of retardation of the locomotive for controlling the rate of supply of fuel to the furnace of the locomotive boiler. This control system is shown in connection with one form of fuel supply system for the furnace of a locomotive boiler. Only a portion of the fuel supply system is shown in the drawing, and the complete system is shown and claimed in U. S. Patent No. 1,295,077, issued February 18, 1919, to Carlton D. Stewart and myself, and in our Reissue Patent No. 15,942, issued November 11, 1924.

The fuel supply system shown in the drawing comprises a valve device indicated generally by the reference numeral 1 for regulating the supply of liquid fuel, such as oil, to the furnace of a locomotive boiler, and for also regulating the supply of steam for atomizing the oil, while a regulating or control device 2 is provided for regulating the valve device 1 to vary the rate of supply of fuel to the furnace.

As shown in the drawing, the valve device 1 comprises a body having a valve chamber 5 formed therein to which is connected a pipe 6 through which fluid fuel, such as fuel oil, is supplied under pressure by suitable means, not shown. A slide valve 7 is mounted in the valve chamber 5 to control the supply of fuel from the valve chamber 5 through a passage 8 to which is connected a pipe 10 leading to a burner in the furnace for the locomotive boiler.

The slide valve 7 is actuated by means of a rod 12 which extends through an opening in the wall of the valve chamber 5, while this opening is

sealed by means of packing 14 which is held in place by a gland 15 and a pack nut 16.

The body of the valve device 1 has a chamber 18 formed therein to which is connected a pipe 20 leading from a source of steam. A slide valve 22 is mounted in the valve chamber 18 and controls the supply of steam from the valve chamber 18 to a passage 23 to which is connected a pipe 24 leading to the burner to which the pipe 10 is connected.

The slide valve 22 is operated by means of a rod 25 which extends through a wall of the valve chamber 18, while the opening through which the rod 25 extends is sealed by suitable packing held in place by a gland 26 and a pack nut 27.

The rods 12 and 25 for operating the slide valves 7 and 22, respectively, are pivotally connected to a lever 30 which is movable about an axis determined by a pin 31. The pin 31 is movable by a rod 32, as explained in the above identified patents, while the lever 30 has one end of a link 34 connected thereto for operating a damper, not shown, for the furnace.

The control device 2 comprises a body 36 having pivotally supported thereon by means of a pin 38 a control member in the form of a lever 40. An extension of the rod 12 of the valve device 1 is secured to an arm of the lever 40 by means of a pin 41, while the lever 40 has a handle portion, indicated at 42, adapted to be grasped by the hand of an operator for moving the lever 40 throughout its range of movement.

The control device 2 has associated therewith means responsive to the pressure of the steam in the boiler of the furnace for moving the control member 40. This means comprises a piston, not shown, which is subject on one face to the steam in the boiler of the locomotive, and is subject on the other face to the force exerted by a coil spring 44 which extends between the piston and an adjustable spring seat 45 carried by the body 36. The piston above referred to has a stem 46 which is pivotally connected to the lever 40 by means of a pin 48. On an increase in the pressure of the steam in the boiler, the piston and piston rod 46 are moved against the spring 44, and move the lever 40 in a clockwise direction, as viewed in Fig. 1 of the drawing, and on this movement of the lever 40, the valve device 1 is conditioned to reduce the rate of supply of fuel to the furnace of the boiler.

The fuel control system provided by this invention has means operated on a predetermined increase in the rate of retardation of the locomotive to move the control member 40 to a position to condition the valve device 1 to supply fuel to the furnace of the locomotive boiler only at a predetermined restricted rate.

As shown in the drawing, the body 36 of the control device 2 has a portion having a bore therein in which is mounted a piston 50 which is subject to the opposing pressures of the fluid in a chamber 51, and of a coil spring 53 mounted in a chamber 54 which is constantly open to the atmosphere by way of a passage 55.

The piston 50 has a stem 56 formed integral therewith and extending through a bore in the wall of chamber 54, while the end of the stem 56 has a slot 58 formed therein through which extends a pin 59 carried by the lower end of the lever 40.

The piston 50 is normally held by the spring 53 in engagement with a projection 60 formed on the casing cover section 61. The slot 58 in the rod 56 and the other parts of the apparatus are arranged and proportioned so that when the piston 50 is in engagement with the projection 60, the lever 40 may be moved throughout its entire range of movement without moving the pin 59 beyond the limits of the slot 58 in the rod 56. The lever 40, therefore, may be moved freely without interference by the means responsive to retardation of the locomotive.

The system provided by this invention incorporates means responsive to the rate of retardation of the locomotive for controlling the supply of fluid under pressure to and the release of fluid under pressure from the chamber 51 at the face of the piston 50.

As shown there is a casing 65 which is secured on any suitable part of the locomotive, and has pivotally supported thereon rollers 66 which support a weighted body 67. The casing 65 is mounted on the locomotive in such a manner that the weighted body 67 is movable in a plane extending in the direction in which the locomotive moves, while it is also arranged on the locomotive so that on a reduction in the speed of the locomotive, the force of inertia operating upon the weighted body 67 moves it to the left, as viewed in Fig. 1 of the drawing.

The casing 65 has pivotally supported thereon by means of a pin 68 a lever 69, one end of which carries a roller which is engaged by the weighted body 67, while the other end thereof carries a roller which is engaged by an end of the stem of a valve 70.

The valve 70 has a seating face adapted to engage a seat surrounding a passage connecting the atmosphere and a chamber 72, which is constantly connected by way of a pipe 73 with the chamber 51 at the face of the piston 50.

The other end of the stem of the valve 70 engages the end of the stem of a valve 74 which has a seating face adapted to engage a seat surrounding a passage between the chamber 72 and a chamber 75, which is constantly connected by way of a pipe 76 with a reservoir 77 which is charged with fluid under pressure. The valve 74 is yieldingly urged to the seated position by means of a coil spring 78 which is mounted in the chamber 75, and when the valve 74 is held in the seated position, it holds the valve 70 in the open position to permit communication between the chamber 72 and the atmosphere.

The valve device 1 and the control device 2 are shown in the drawing in the position to permit the supply of fuel to the furnace of the locomotive boiler substantially at the maximum rate, while the means responsive to the retardation of the locomotive is shown in the position which it assumes when the speed of the locomotive is not being reduced at a high rate.

As a result of the supply of fuel to the furnace of the locomotive boiler, the pressure of the steam in the boiler may increase. If there is such an increase in the pressure of the steam in the boiler, the piston secured on the piston stem 46 will move against the spring 44, and its movement will be transmitted through the stem 46 to move the lever 40 in a clockwise direction about the pin 38, while the pin 59 will be moved in the slot 58 in the piston rod 56.

On movement of the lever 40 in this direction, the rod 12 is moved upwardly and moves the slide valve 7 of the valve device 1 in the direction to restrict the rate of supply of fuel from the chamber 5 to the passage 8, and thus to the burner of the furnace of the locomotive boiler. On this movement of the rod 12, the lever 30

is moved and its movement is transmitted through the rod 25 to the slide valve 22 to move it in a direction to restrict the rate of supply of steam from the chamber 18 to the pipe 24 leading to the furnace burner.

As a result of the reduction in the rate of supply of fuel to the burner of the locomotive furnace there will be a reduction in the rate at which steam is generated, and the pressure of the steam in the boiler will be maintained substantially at the desired pressure.

If at this time the locomotive is moving along the track and there is a moderate application of the brakes, the speed of the locomotive will be reduced, but the force of inertia operating upon the water in the boiler of the locomotive will not be great enough to cause the water to move relative to the locomotive boiler to uncover the crown sheet of the furnace fire box. Accordingly there is no danger of injury to the crown sheet, even if the boiler continues to be supplied with fuel at a relatively rapid rate.

On this moderate application of the brakes on the locomotive, the force of inertia operating on the weighted body 67 is insufficient to cause this body to move the lever 69 and thereby move the valves 70 and 74 against the spring 78. Accordingly, the chamber 51 will remain connected to the atmosphere, while the piston 50 will be maintained by the spring 53 in engagement with the projection 60.

It will be seen, therefore, that upon a moderate application of the brakes, and a corresponding reduction in the speed of the locomotive at a moderate rate, that the rate of supply of fuel to the furnace for the locomotive boiler is not altered by operation of the means responsive to the retardation of the locomotive. However, at this time the rate of retardation of the locomotive is insufficient to cause movement of the water in the boiler to uncover the crown sheet, and, accordingly, there is no need for reducing the rate of supply of fuel to the furnace.

If, however, at a time when the locomotive is moving along a track there is a relatively heavy application of the brakes on the locomotive, the speed of the locomotive will be reduced at a rapid rate, and the water in the boiler of the locomotive may be caused to move forward in the boiler so as to uncover the crown sheet.

On a reduction in the speed of the locomotive at a rapid rate, the force of inertia operating upon the weighted body 67 causes this body to move upon the rollers 66, and to press upon the end of the lever 69 to move it about the pin 68 so that the other end of the lever 69 presses upon the end of the stem of the valve 70 and moves the valve 70 to the seated position, while the valve 74 is moved to the open position against the spring 78.

On movement of the valve 74 to the open position fluid under pressure flows from the reservoir 77 to the chamber 72, and thence by way of the pipe 73 to the chamber 51 to increase the pressure of the fluid in this chamber.

On an increase in the pressure of the fluid in the chamber 51, the piston 50 is moved against the spring 53, while the piston stem 56 is moved until an end of the slot 58 engages the pin 59, and upon further movement of the piston 50 and the stem 56 force is exerted through the pin 59 to move the lever 40 about the pin 38 in the direction to condition the valve device 1 to reduce the rate of supply of fuel to the furnace for the boiler of the locomotive. On this movement of the lever 40, the piston rod 46 and the piston secured thereon are moved against the spring 44.

The stem 56 on the piston 50 has a shoulder indicated at 57 formed thereon and adapted to engage the end wall of the chamber 54 when the piston 50 has been moved against the spring 53 a distance far enough to move the lever 40 in a clockwise direction about the pin 38 substantially to the end of its range of movement. When the lever 40 has been moved to this position, it conditions the valve device 1 to supply fuel to the burner of the locomotive furnace only at a predetermined relatively slow rate, and this rate is such that the fire in the furnace fire box will not be large enough to cause injury to the crown sheet if at this time the crown sheet is not covered with water.

The various parts of the means responsive to retardation are arranged and proportioned so that this means is operable to reduce the rate of supply of fuel to the furnace on a reduction in the speed of the locomotive at a rate somewhat less rapid than will cause the water in the locomotive boiler to move forward in the boiler and uncover the crown sheet. This will insure that the supply of fuel to the furnace for the boiler is restricted when the rate of retardation of the locomotive is such that there is danger that the crown sheet may be uncovered.

On a reduction in the rate of retardation of the locomotive following retardation of the locomotive at a rapid rate, there is a decrease in the force of inertia operating upon the water in the boiler of the locomotive, and this water will equalize throughout the boiler and the crown sheet will again be covered with water.

In addition, there will be a similar reduction in the force of inertia operating upon the weighted body 67, and this body will not be able to maintain the valve 74 in the open position against the spring 78. The spring 78, therefore, will expand and will move the valve 74 to the seated position to cut off the supply of fluid under pressure from the reservoir 77 to the pipe 73 leading to the chamber 51, while the valve 70 will be moved to the open position to release fluid under pressure from the chamber 72. On this release of fluid under pressure from the chamber 72 there is a reduction in the force exerted upon the piston 50, and the spring 53 thereupon expands and moves the piston 50 into engagement with the projection 60, thereby relieving the force exerted by the piston 50 through the stem 56 and the pin 59 upon the lever 40, and permitting the lever 40 to be returned by the spring 44 to the position determined by the means responsive to the pressure of the steam in the boiler. On this movement of the lever 40, the valve means 1 is conditioned to supply fuel to the furnace for the boiler of the locomotive at a more rapid rate. As the water in the boiler again covers the crown sheet of the boiler there is no danger of injury to the crown sheet as a result of the rapid supply of fuel to the furnace for the boiler.

From the foregoing it will be seen that the fuel control system provided by my invention provides means operative upon a predetermined increase in the rate of retardation of the locomotive to reduce the rate of supply of fuel to the furnace for the locomotive boiler to thereby prevent injury to the crown sheet of the locomotive fire box, which might result if fuel is supplied to the furnace of the locomotive at a rapid

rate at a time when the crown sheet is not covered with water.

It will be seen also that the control system provided by this invention is arranged so that during normal operation of the locomotive, the system does not interfere with or affect in any manner the operation of the means for supplying fuel to the furnace of the locomotive boiler.

While one embodiment of the improved control system provided by my invention has been illustrated and described in detail, and has been shown in connection with one form of means for supplying fuel to the furnace of a locomotive boiler, it should be understood that the invention is not limited to these details of construction, nor is it limited to use in connection with the fuel supply means shown, but that numerous changes and modifications may be made without departing from the scope of the following claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a fuel supply system for the furnace of a locomotive boiler, means for varying the rate of supply of fuel to said furnace, means responsive to the pressure of the fluid in a chamber for conditioning said means to supply fuel only at a restricted rate, and means responsive to the rate of retardation of the vehicle for controlling the pressure of fluid in said chamber.

2. In a fuel supply system for the furnace of a locomotive boiler, a control member movable between spaced positions for varying the rate of supply of fuel to the furnace, an element having a normal position and being operable on movement therefrom to move the control member to the position to restrict the supply of fuel to the furnace, said control member being movable relative to said element when the element is in the normal position, means responsive to the rate of retardation of the locomotive for effecting movement of said element away from its normal position to thereby effect movement of the control member to restrict the supply of fuel to the furnace, and means operable when said element is in its normal position for moving the control member relative to the element to thereby vary the rate of supply of fuel to the furnace.

3. In a fuel supply system for the furnace of a locomotive boiler, a control member movable between spaced positions for varying the rate of supply of fuel to the furnace, means subject to the opposing pressures of the fluid in a chamber and of a spring, said means having a normal position and being movable therefrom in response to variations in the pressure of the fluid in said chamber, said means being operable on movement from said normal position to move the control member to the position to restrict the supply of fuel to the furnace, and means responsive to the rate of retardation of the locomotive for controlling the pressure of fluid in said chamber.

4. In a fuel supply system for the furnace of a locomotive boiler of the type having a wall normally covered with water on one side and exposed on the other side to the fire in said furnace, the water in the boiler being moved by the force of inertia away from said wall on a reduction in the speed of the locomotive at a predetermined rate, the fuel supply system comprising supply means for supplying fuel to said furnace, and means operable on a reduction in the speed of the locomotive at a rate less rapid than said predetermined rate for restricting the rate of supply of fuel to the furnace by said supply means.

5. In a fuel supply system for the furnace of a locomotive boiler, a member movable between spaced positions for varying the rate of supply of fuel to the furnace, yielding resistance means urging said member to the position to permit the supply of fuel to the furnace at a rapid rate, means subject to and operated on an increase in the pressure of the steam in the boiler for moving said member against said yielding resistance means to thereby reduce the rate of supply of fuel to the furnace, and means operated on a predetermined increase in the rate of retardation of the locomotive for also moving said member against said yielding resistance means and thereby reducing the rate of supply of fuel to the furnace.

6. In a fuel supply system for the furnace of a locomotive boiler, a member movable between spaced positions for varying the rate of supply of fuel to the furnace, yielding resistance means urging said member to the position to permit the supply of fuel to the furnace at a rapid rate, means subject to and operated on an increase in the pressure of the steam in the boiler for moving said member against said yielding resistance means to thereby reduce the rate of supply of fuel to the furnace, and means operated on a predetermined increase in the rate of retardation of the locomotive for also moving said member against said yielding resistance means and thereby reducing the rate of supply of fuel to the furnace, said member being moved relative to the other of said means on movement of said member by one of said means.

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