Sept. 1, 1925. 1,551,651

C. O. EVERHART

APPARATUS FOR REGULATING FLUID FUEL

Filed March 19, 1919 2 Sheets-Sheet 1

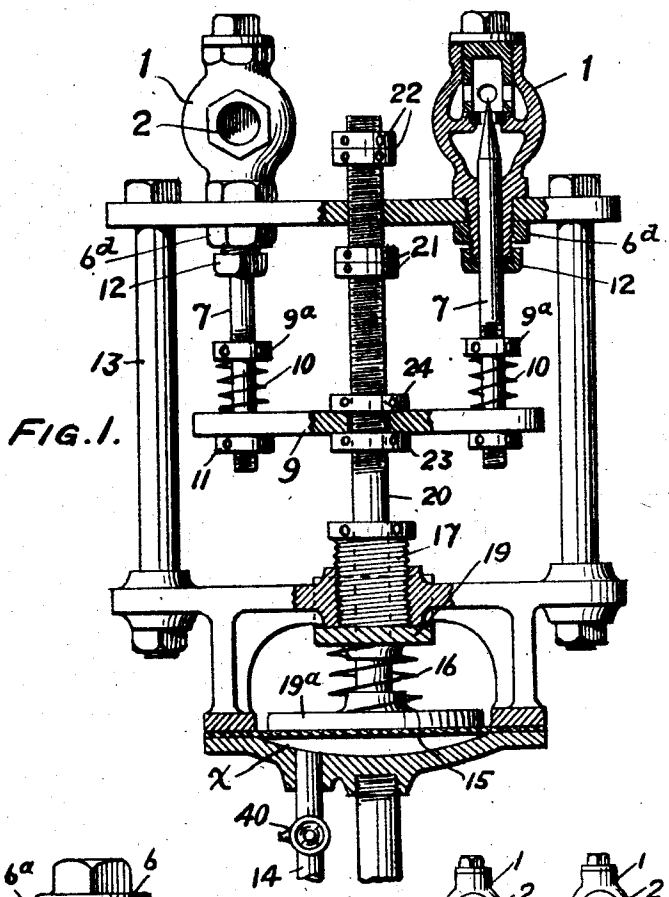


FIG. 1.

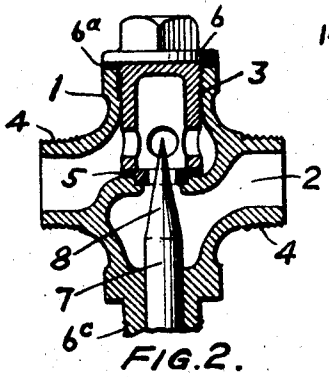


FIG. 2.

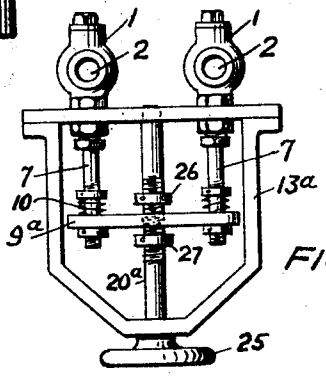


FIG. 3.

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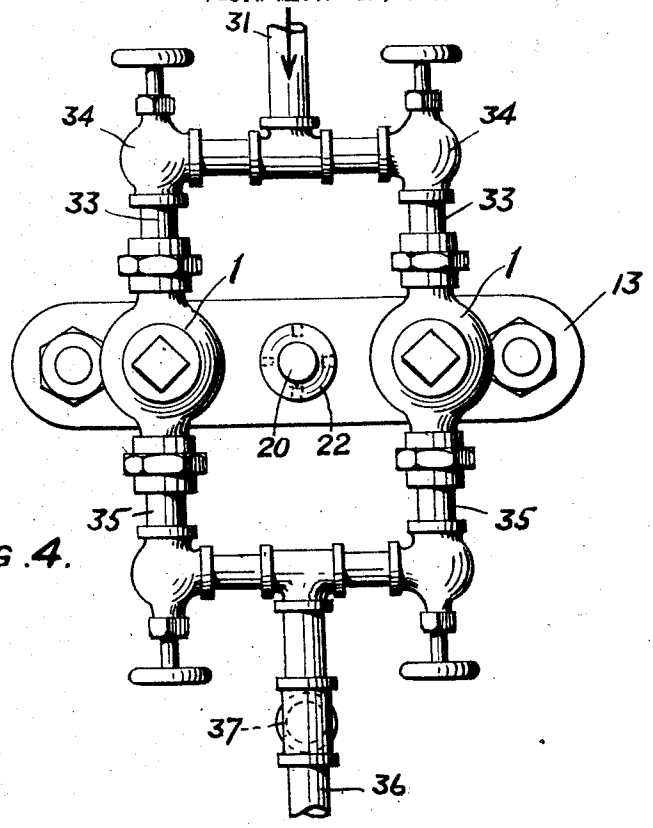


FIG. 4.

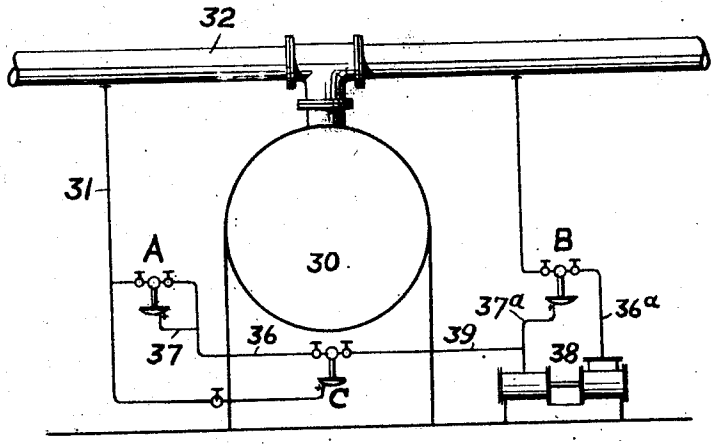


FIG. 5.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR REGULATING FLUID FUEL.

Application filed March 19, 1919. Serial No. 283,583.

To all whom it may concern:

Be it known that I, CHARLES O. EVERHART, a citizen of the United States, residing at Warren, in the county of Warren and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Regulating Fluid Fuel, of which the following is a specification.

In the combustion of fluid fuel for heating boilers it is desirable, first, to feed the proper quantity of fluid fuel mixture for maintaining normal working boiler pressure and at the same time to have the ingredients present in the mixture in proper ratio for economical and efficient combustion, second, to reduce and increase the quantity of mixture supplied at boiler pressures above and below normal working pressures respectively, but without materially departing from the proper ratio of ingredients in the mixture and without extinguishing combustion, and third, to regulate the pressure of the constituents of the mixture so that they can be fed at substantially constant pressure for combustion.

Apparatus embodying features of my invention is capable of use in performing all those objects and that is one of its advantages, but, in whole or in part, it is capable of other uses in cases where heating by the combustion of fluid fuel is involved.

The principal objects of the present invention are, first, to provide for accuracy of adjustment and convenience in repairs, second, to adjustably limit the increase and reduction of the fuel supply in respect to the quantity of fuel fed at constant pressure for any pre-determined boiler pressure, without disturbing the previously fixed adjustment for ratio of ingredients at normal boiler pressure, and third, to economize in the use of fluid fuel and attain improved heating results.

The invention will be claimed at the end hereof, but will be first described in connection with the embodiments of it chosen from other embodiments for illustration in the accompanying drawings forming part hereof and in which—

Figure 1 is a side elevation, partly in section, of apparatus embodying features of the invention.

Fig. 2 is an enlarged sectional view of one of the casings shown in Fig. 1.

Fig. 3 is a side view drawn to a reduced scale and illustrating a modification.

Fig. 4 is a top or plan view showing a modification, and

Fig. 5 is a diagrammatic view.

In the drawings, 1 is a casing having a fluid way 2, and a transverse opening 3, extending through it. The casing is shown as provided with externally threaded portions 4, which is a matter of convenience in pipe fitting. 5, is a calibrated orifice plate interposed in the fluid way 2, and insertable and removable through the opening 3. 6, is a removable spider-cap for closing one of the ends 5. It is called a spider-cap because of the openings in it which permit of fluid flow. 6^a, is a washer as of metal and fabric, inserted between a flange of the cap and the top of the casing for making an air tight joint. The casing is provided with a threaded extension 6^c, adapted to receive a nut 6^d, by means of which it is secured in place on the frame 13. 7, is a stem arranged through the other end of the opening 3, and removable through that opening when the plate 5, and cap 6, have been removed. The stem 7, is provided with a pointed end 8, co-operating with the orifice but not intended in normal operation to close it. 9, is a carrier movable towards and away from the casings 1, for there may be more duplicate casings than one and their accessories, although only one has been described. The stem 7, passes through a hole in the carrier and is movable in respect thereto, but such movement is controlled by an adjusting nut 9^a, and by a spring 10, bearing upon the carrier and by a second nut 11, on the stem. 12, are glands carried by the extensions 6^c. In the following description and claims reference will be made to oil and steam as ingredients of the mixture, but this language is used for the sake of description of the apparatus and is intended to include any other ingredients of a combustible fluid fuel mixture of which air instead of steam is an example. It is evident that a comparatively rough adjustment of proportions of oil, passing for example, through the fluid way of the lefthand casing in Fig. 1, and steam, passing through the other casing, in the mixture can be made by mounting appropriately calibrated orifice plates 5, in the respective casings. A finer or more accurate adjustment can be made by the nuts 9^a, act-

ing against the springs 10. If the carrier 9, be moved towards the casings 1, from the position which it occupies normally, or which it occupies at normal boiler pressure, the pointed ends 8, of the stems 7, reduce the effective size of the orifice and so cut down the quantity of oil and steam, immaterially unbalancing the proportions in the mixture, but that is not important so long as combustion is maintained, and combustion is always maintained because the stems are not permitted to completely close the orifices for example by limiting the travel of the carrier 9, as will be hereinafter described. If the carrier 9, be moved from the position above indicated as normal position and away from the casings 1, the retrograde movement of the pointed ends 8, of the stems increases the effective size of the orifices and so increases the quantity of oil and steam, immaterially unbalancing the proportions in the mixture. Whenever the carrier is returned to its normal position the proportions in the mixture are restored to the adjusted ratio which may be that best suited for complete or efficient combustion. Again the ratio for normal combustion can be readily re-adjusted by replacing the orifice plates with others having orifices of different size, and re-adjusting the stems as desired. The orifice plates and the stems are parts that may require removal and they can be readily removed by removing the caps 6.

The carrier 9, may be adjusted and moved in respect to the casings 1, in response to pressure changes as of the boiler, or otherwise. Referring to Fig. 1, use is made of means responsive to pressure changes. Pressure admitted to diaphragm chamber X, at inlet 14, on one face of the diaphragm 15, is opposed by a spring 16, of which the tension is adjustable by the screw 17, acting on a block 19, upon which the spring bears. The rod 20, is operated by the diaphragm and for this purpose it is shown as provided with a head 19^a, upon which the spring 16, bears, and the range of movement of the rod is limited by the nuts 21 and 22. 23, and 24, are adjusting nuts for adjusting and connecting the carrier 9, on the rod 20. In Fig. 3, the rod 20^a, is turnable and endwise immovable in the frame 13^a, and is provided with a hand wheel 25. The rod 20^a, is threaded and works through a threaded opening in the carrier 9^a, and the nuts 26 and 27, limit the range of travel of the carrier.

The springs 10, serve to relieve the carrier from tilting stress, because they can yield if the movement of a stem, 7, should be unduly retarded.

A description will now be given of the mode of operation of one complete embodiment of the invention adapted to accomplish all the objects set forth at the beginning of this specification and from it those skilled in the art will understand how to use the invention for the accomplishment of less than all of those objects.

Three sets of casings and their auxiliary pressure operated stems are employed. In Fig. 5, the three sets are indicated A, B, C. The set A, serves to regulate the pressure of steam and to supply it at constant pressure to the set C, and the set B, serves to regulate the pressure of oil and to supply it at constant pressure to the set C. The set C, supplies a regulated mixture in regulated quantity to the combustion chamber of the boiler 30. In this way the mixture is appropriately supplied for combustion and danger of blowing out the flame is avoided. Referring to Figs. 4 and 5, the inlets of the fluid ways of the casings 1, of the set A, are connected to the boiler pressure as by a pipe 31, leading to a steam line 32, through branches 33, having valves 34, used for stopping and starting. The outlets of these fluid ways are connected through valved branches 35, to a pipe 36, leading to the fluid way of the steam casing of the set C. The diaphragm chamber X, of the set A, is connected to the outlet side of the set, as by a pipe 37, branching from the pipe 36, in order to keep the outlet pressure substantially constant by varying the effective size of the orifices through the instrumentality of the stems as has been described. The piping at the set B, is the same as at set A, except that the steam line 36^a, leads to the oil pump 38, and the diaphragm chamber is connected by a pipe 37^a, to the oil line 39, that leads from the outlet of the pump to the oil casing 1, of the set C. Thus variations in the oil pressure regulate the steam supply of the pump in such a way that it keeps the oil pressure substantially constant. 40, are pet-cocks for venting the diaphragm chambers when the apparatus is shut down. The apparatus at each set A and B, is adjusted in the manner described to supply both the oil and the steam or air to the set C, at any required constant pressure and the apparatus at set C, is adjusted to supply the desired ratio of oil and steam and to regulate the quantity of mixture to keep the boiler pressure constant as determined by the setting of the spring 16, within permissible limits of variation determined by the setting of the adjustable stop nuts 21 and 22, the setting of which in no way interferes with any other adjustments and fixes the length of the stroke of the stems in any degree required.

I claim:

1. In apparatus of the class described the combination of a plurality of independent casings each having a fluid way adapted for the removable reception of an orifice plate, an opening provided in the wall of each casing and opposed to the valve stem and

adapted for the passage of orifice plates and provided with a closure, calibrated orifice plates interposed in the fluid ways to permit of approximately fixing any desired flow relation and adapted for removal without disturbing the stems, spiders for holding the plates against the thrust of the stems, a carrier simultaneously movable toward and away from the casings, stems each carried in the same direction by the carrier and co-operating with the orifices to change their effective areas, and means for adjusting each stem in respect to the carrier to accurately fix the flow relation, substantially as described.

2. In apparatus of the class described the combination of a frame, a carrier arranged in and clear of the frame, means for moving the carrier in respect to the frame, casings carried by the frame and having fluid ways, stems co-operating with the fluid ways and carried by and movable in respect to the carrier, adjusting nuts for limiting the movement of each of the stems in respect to the carrier and towards the fluid ways, and springs biasing the stems against the restraint of the nuts and operative to restore the stems to adjusted position in respect to the carrier.

3. In apparatus of the class described the combination of casings having fluid ways, a carrier movable towards and away from the casings, stems co-operating with the fluid ways and carried by and movable in respect to the carrier, adjusting nuts for limiting the movement of each of the stems in respect to the carrier and towards the fluid ways, and springs biasing the stems against the restraint of the nuts and operative to restore the stems to adjusted position in respect to the carrier.

4. In apparatus of the class described the combination of a plurality of casings each having a fluid way and a transverse opening, calibrated orifice plates interposed in the fluid ways and removable through said openings, detachable spider-caps for closing one of the ends of said openings and for retaining the plates, stems arranged through the ends of said openings and removable through said openings when the caps are detached and provided with pointed ends co-operating with the orifices, a carrier having detachable and adjustable and spring connection with each stem, a frame for the casings, and a rod for positioning the carrier in respect to the frame, substantially as described.

CHARLES O. EVERHART.