N. A. MINER.

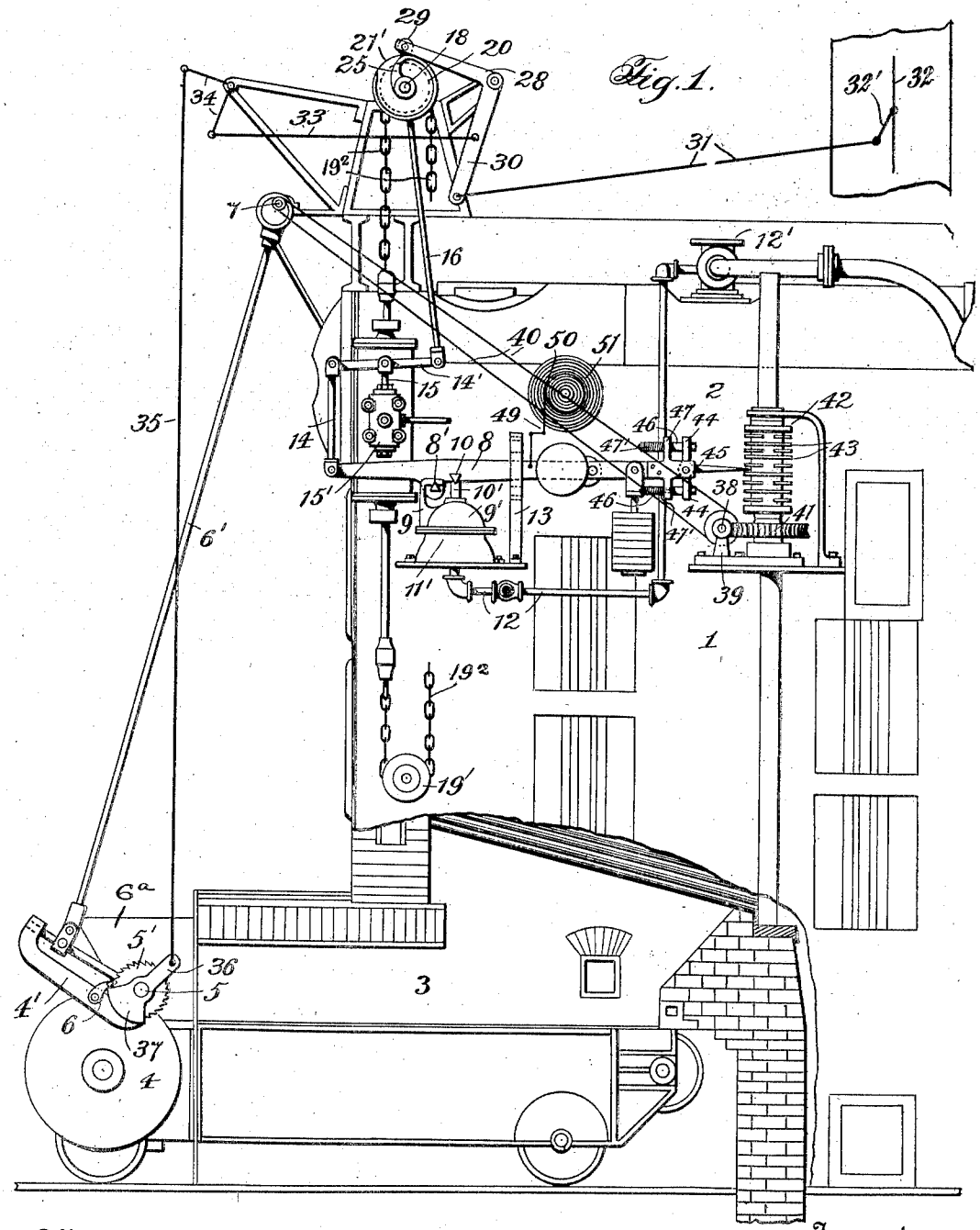
AUTOMATIC REGULATOR FOR STEAM BOILERS.

APPLICATION FILED SEPT. 3, 1915.

1,335,008.

Patented Mar. 30, 1920.

4 SHEETS—SHEET 1.



Witnesses:

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Inventor:

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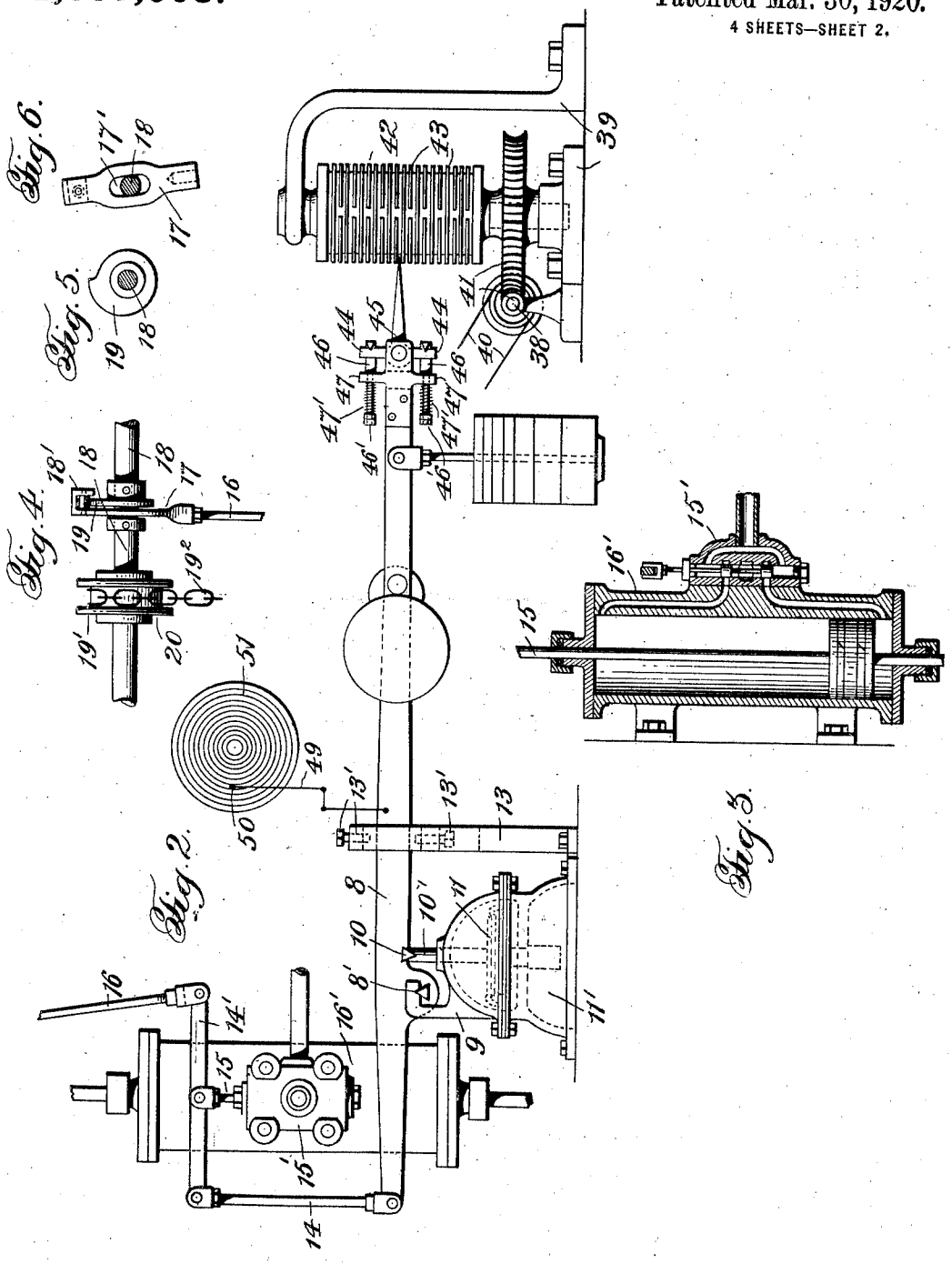
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4 SHEETS—SHEET 3.

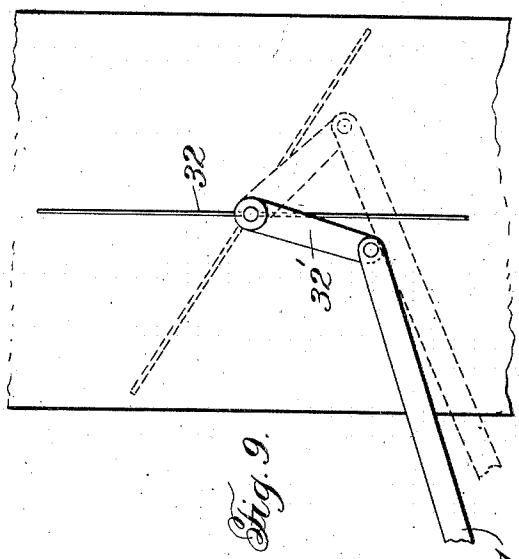


Fig. 9.

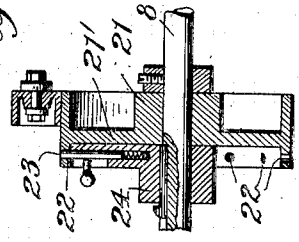


Fig. 11.

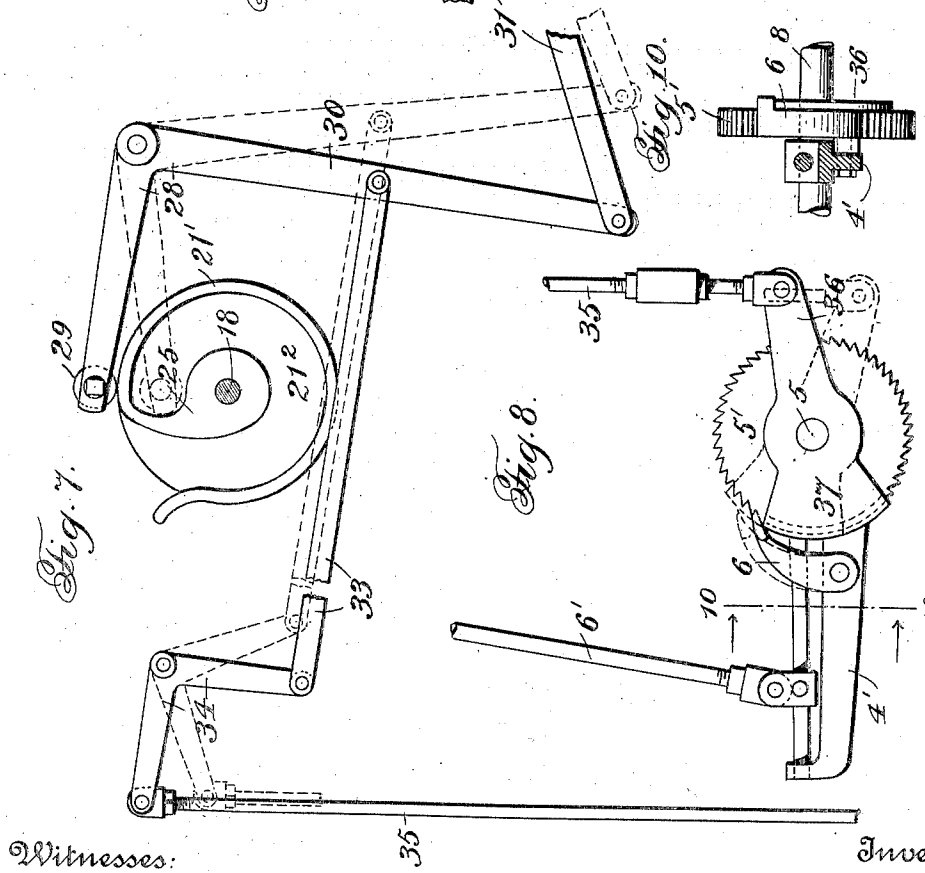


Fig. 7.

Fig. 10.

Fig. 8.

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4 SHEETS—SHEET 4.

Fig. 12.

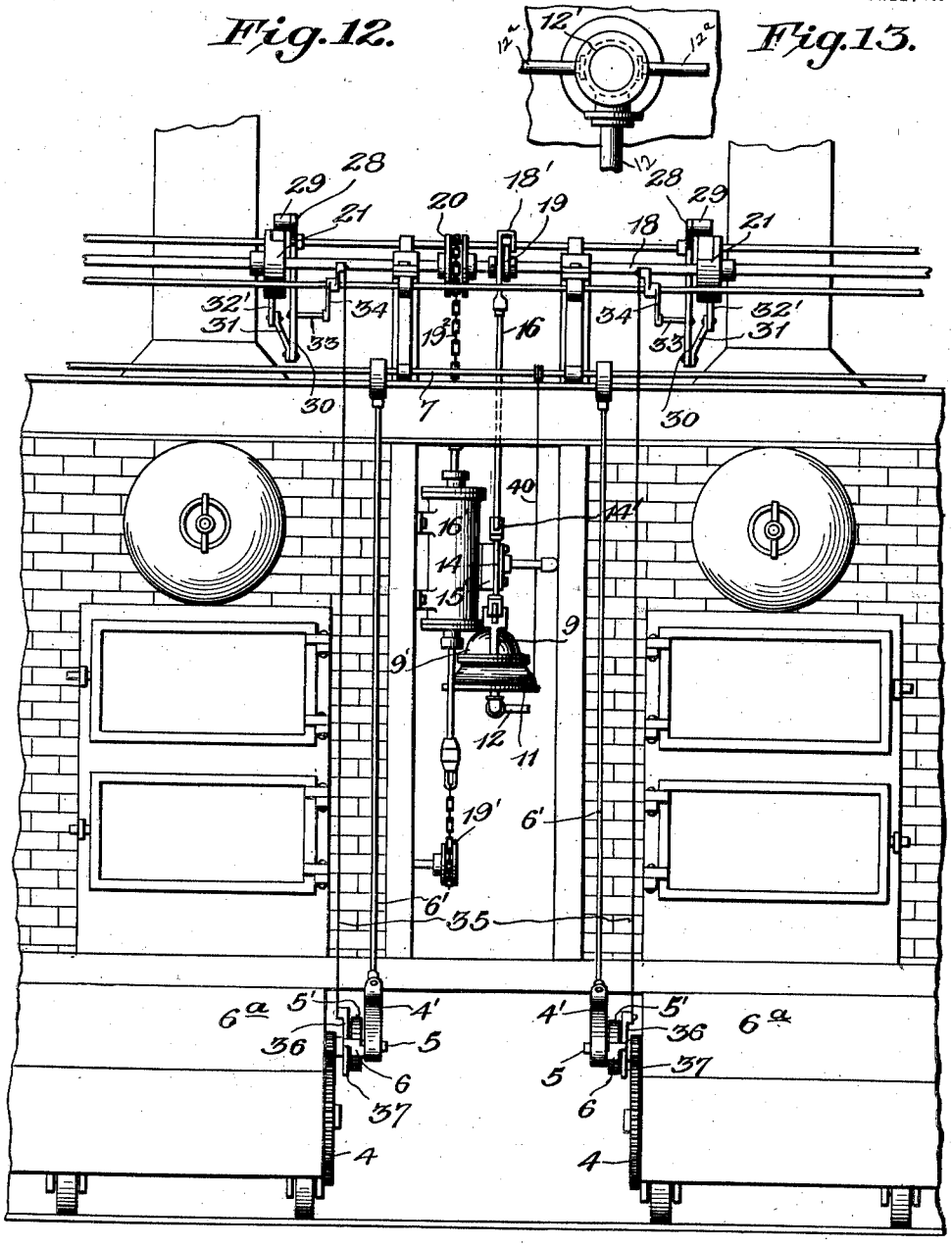


Fig. 13.

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UNITED STATES PATENT OFFICE.

NELSON A. MINER, OF RIVERTON, ILLINOIS.

AUTOMATIC REGULATOR FOR STEAM-BOILERS.

1,335,008. Specification of Letters Patent. Patented Mar. 30, 1920.

Application filed September 3, 1915. Serial No. 48,773.

To all whom it may concern:

Be it known that I, NELSON A. MINER, a citizen of the United States, residing at Riverton, in the county of Sangamon and State of Illinois, have invented certain new and useful Improvements in Automatic Regulators for Steam-Boilers, of which the following is a specification, reference being had therein to the accompanying drawing.

The invention relates to improvements in automatic regulators for steam boiler plants particularly to that type of regulator controlled by the steam pressure.

Heretofore in the art it has been customary to provide a controller for the fuel feeders and dampers of a boiler plant actuated by means of a driving member whereby all of the dampers and stokers of the different boilers arranged in the plant are placed in operation simultaneously when an extra demand for steam is made. These structures having proven to be very unsatisfactory in view of the fact that it often is only necessary to actuate the damper and stoker of a single boiler to produce the extra steam demanded due to the slight fluctuations in the load on the plant, whereas if the damper controlling mechanisms of all the different boilers are actuated simultaneously, the demand for steam is very often exceeded, causing the wasting of a considerable amount of fuel and not affording a proper regulating of the boilers.

It is the purpose of the present invention to provide a regulator of the general class described that is controlled by the steam pressure and adapted to operate the damper and fuel feeder of a single boiler at a time, allowing that boiler a slight time to respond to the extra demand for steam before the draft and fuel supply of the succeeding boiler is placed in operation, the controlling mechanism for the boilers regulating them in succession, it having been found that very often one boiler will be able to build up the desired steam supply due to slight fluctuations in the load on the plant. If the damper and stoker mechanisms for all of the boilers were placed in operation simultaneously, the steam supply would often go considerably beyond the demand and cause more steam to be generated than necessary. If the demand on the boiler for steam be great, due to rapid fluctuations of the load thereon it will be readily apparent that the required amount of steam will be furnished by operating the regulating mechanism so that all of the stokers and dampers of the different boilers are placed in an operating position in rapid succession.

Structurally speaking, the preferred embodiment of my invention capable of attaining the above results consists in the provision of a rotating shaft controlled by a hydraulic motor operated from any suitable source. The shaft has thereon, a series of adjustable cams set in any desired position and corresponding in number to the number of boilers in the plant, so that the regulating mechanism of any particular boiler can be advanced or retarded at the will of the operator, each of the operating devices being engaged by an independent link mechanism controlling the stoker and damper of a single boiler. The cams are so set that when the shaft rotates, the regulating mechanisms of the different boilers will be operated in succession the first regulating mechanism operated, being the last closed as the cam shaft turns back and forth in keeping with the variations of the steam pressure. If any of the boilers of the plant have a greater tendency to be more sensitive and respond to heat quicker than others, these boilers are the last ones to have their damper and fuel feeders placed in operation, being last opened and first closed, this being accomplished by the proper adjustment of the cams.

The present invention also embraces the use of a recording means in the nature of a chart having a series of indications thereon, corresponding in number to the number of boilers arranged in the plant, and a tracing member connected with the boiler regulating mechanism and coöperating with the chart in such a manner that a continuous record of the boilers that have been in use is kept.

Referring more particularly to the drawings:

Figure 1 is an end elevation of a steam boiler plant equipped with regulating means constructed in accordance with the present invention.

Fig. 2 is a detail side elevation, on an enlarged scale, of the regulator beam, and other parts of the regulating means directly associated therewith.

Fig. 3 is a detail sectional view of the hydraulic motor and its valve mechanism.

Figs. 4, 5 and 6 are detail views of parts of the mechanism for actuating the valve mechanism of the hydraulic motor.

Fig. 7 is a detail side elevation, on an enlarged scale, of one of the actuating cams, and the link and lever mechanism directly connected therewith.

Fig. 8 is a detail side elevation, on an enlarged scale, of part of the stoker actuating mechanism.

Fig. 9 is a detail side elevation of part of the lever operating mechanism for one of the dampers.

Fig. 10 is a detail front elevation of part of the mechanism illustrated in Fig. 8.

Fig. 11 is a transverse section of one of the actuating cams illustrating the adjustable connection of the cam with the actuating shaft.

Fig. 12 is a front elevation of part of the plant with the regulating means applied thereto, and

Fig. 13 is a detail view of the common header and its connection with the steam inlet and outlet pipes.

In the drawings wherein corresponding numerals indicate like parts, the numeral 1 designates the boiler plant having a series of boilers 2 arranged thereon and overlying the fire boxes 3 fed by the stokers 4 of the usual chain construction feeding from the usual fuel holding tanks or chutes 6^a, this type of feeder being preferably shown although it is apparent that any construction of fuel feeder capable of obtaining the desired results may be used. The stokers 4 are actuated by a rocking arm 4′ pivoted on a shaft 5 carrying the ratchet wheel 5′, this wheel being operated by the pawl 6 arranged on the rocking arm and through the medium of a series of gear wheels imparts motion to the stoking mechanism when the pawl is in engagement with the ratchet teeth. The rocking arm 4′ is preferably driven by an eccentrically mounted reciprocating member 6′ arranged on the driven shaft 7, that rotates continuously.

Arranged adjacent the furnace is the regulating beam 8 fulcrumed intermediate its end at the point 8′ on the arm 9 projecting from the supporting member 9′ and having a knife edge bearing 10 on the movable post 10′ supported by the diaphragm 11 arranged within the chamber 11′. The diaphragm is moved in either direction by steam pressure entering the housing through the pipe 12 leading from a header 12′ which is common to all of the boilers communicating in any convenient manner with the boilers of the plant, which may be by means of the steam conducting pipes 12^a leading from certain of the boilers to the header and discharging therein, as shown in Fig. 13. The beam 8 also passes through a guiding bracket 13 having adjustable screws 13′ carried thereby to limit the movement thereof in either direction and prevent the disengagement of the same from its supporting members. Near one end the beam carries a predetermined weight of any suitable construction adapted to act as a counterbalance for the steam generated by the boilers that enters the housing from the common header 12′ through the pipe 12 acting upon the moving diaphragm 11 carrying the post 10′ so that when the steam pressure is normal, the beam lies in the horizontal position indicated in Fig. 2. Pivotally attached to the opposite end of the beam and extending upwardly therefrom, is a lever 14 at its outer end pivoted to what is known as a floating lever 14′ having secured thereto, intermediate its ends, the valve rod 15 connected with the pilot valve 15′ controlling the inlet and exhaust passages leading to the hydraulic cylinder 16′ from any suitable source, the cylinder 16′ constituting the propelling means for operating the dampers and stokers through the medium of a cam shaft to be presently described. The forward end of the floating arm or lever 14′ is attached to the rod 16 fastened at its upper end to an engaging portion 17 having an elongated slot 17′ therein for the passage of the rotating cam shaft 18, and permitting the rod to have a slight vertical movement, the engaging part having an outstanding portion 18′ provided with a roller riding over a cam 19 on the shaft. It will be apparent that if the plant is called upon to furnish an additional amount of steam, the decreasing pressure within the housing will cause the diaphragm 11 to drop, actuating the regulator beam 8, which in turn operates the pilot valve leading to the cylinder, causing the piston within the cylinder to reciprocate. The piston at each end is connected with a chain 19^2 passing over an idler 19′ and a pulley 20, keyed to the shaft 18, rotating the shaft, which shaft when rotated a slight distance closes the pilot valve the valve being held in its closed position until there is a further actuation of the beam at which time the said valve is again operated.

Adjustably mounted on the shaft are a plurality of cam wheels 21 corresponding in number to the number of boilers, there being a single cam wheel provided for controlling the damper and fuel feeder of each boiler. The cam wheels are set so that anyone of the boilers desired, can be the first to have its damper and stoker placed in operation, allowing this boiler to get under way before a second cam operates the damper and stoker mechanism of a succeeding boiler, all of the boiler regulating devices operating in succession with a pre-

determined period of the time lapsing therebetween controlled by means of a timing mechanism to be later described.

As the cams are all of the same construction, it is thought that a description of one will suffice. 21 represents a cam wheel loosely mounted on the shaft 18 having a web portion 21′, and a peripheral flange extending upon both sides of the web. The flange on one side extends entirely around the wheel and is provided with a series of sockets 22 therein for the reception of a sliding pin 23 seated within a locking part 24 keyed to the shaft 18 and causing the cam wheel to be rotated therewith when engaged by the locking pin. Any one of the cam wheels may be set in an advanced or retarded position according to the working conditions of the boilers and retained in such position by the locking pin 23. The peripheral flange 24 on the opposite portion of the web 21′ has a part 25 projecting from the center of the web to the edge thereof and extending the greater portion around the said cam wheel, having its end flaring upwardly to prevent an engaging part from riding off the said flange. The operating mechanism for each boiler preferably consists of a link mechanism although I wish it to be clearly understood that any suitable means capable of attaining the desired results may be used. However, the preferred construction comprises a bell crank lever 28 pivoted intermediate its ends to a suitable support one arm of the said lever carrying a roller 29 riding on the flanged portion of one of the cams, the other arm 30 of the lever at its lower end being pivoted to an operating arm 31 which controls the damper 32 through the medium of the crank 32′. It will of course be understood that the damper of each boiler may be operated independently of the fuel feeder when desired. In order to control the stoker operating mechanism, when it is desired to operate the same with the damper, the arm 30 has pivotally attached thereto, intermediate its ends, a lever 33, this lever at its free end being connected with a pivoted bell crank lever 34, operating an adjustable connecting rod 35 attached to the ratchet wheel shield 36 at its lower end.

The shield 36 is provided with a relatively wide projecting part 37, covering a portion of the ratchet wheel 5′ and in a closed position causing the stoker to remain inactive, the operating pawl 6 merely sliding over the shield. when the damper of one boiler is open, the bell crank lever together with the connecting links 32, 32′ and 33 will be in the position indicated in full lines in Fig. 9, at this time the roller 29 carried by the bell crank lever will engage the peripheral flange of its cam wheel. The stoker is also being placed in operation in unison with its damper by means of the connecting links 33, 34 and 35 which lower the shield 36 so that the pawl 6 engages the ratchet teeth 5′, causing the rotation of this wheel through the medium of the reciprocating rod 6′ and allowing fuel to be furnished to the fire box by the stoker. It will of course be understood that when the damper is in a closed position, this operating mechanism will lie in the position indicated by the dotted lines in Figs. 7, 8 and 9, the roller 29 of the bell crank lever 28 at that time resting upon the portion 25 of its cam wheel.

Rotatably mounted on a shaft 38 suitably supported by a standard 39 arranged adjacent the regulating beam 8, and rotating continuously by means of the belt 40 leading from the driving shaft 7 and a worm gearing 41, is a timing mechanism 42 circular in construction and provided with a series of circumferentially arranged segments 40 and 43 placed in staggered relation on the drum, each of the segments being spaced a slight distance apart with relation to each other for a purpose presently presented.

Pivotally attached to the regulating beam 8 is a rocking lever having a vertically extending portion 44 and a horizontally extending portion 45 provided with a pointed end and lying in line with the beam 8. The vertically extending portion of the lever at each end is engaged by tension rods 46 secured to lugs 47 on each side of the beam 8 passing through apertures in the said lugs and having coil springs 47′ therein bearing against nuts 46′ allowing the lever to be shifted when the variation in steam pressure is abnormal.

Under normal conditions, the horizontal portion of the lever 45 will lie within the space between a pair of the circumferential ribs 43 on the timing device, not touching these ribs, the timing device rotating at all times. Now, if there is a variation in the steam pressure this will cause the beam 8 to be rocked, forcing the pointed lever 45 against one of the ribs, this lever following the rib during its rotation and when it reaches the opening passing therethrough, will shift into the space between the next pair of ribs, thus allowing each boiler to be placed in operation in advance of the succeeding one with a slight lapse of time to allow the said boiler to get under way before the damper and fuel supply of the suceeding boiler is operated. The time allowed to lapse between the operation of each boiler is governed by the speed of the timer it being apparent that if the timer is rotating rapidly the boilers act in rapid succession. In case of an abnormal variation, in the steam, due to a sudden load being put on or taken

off, the boiler, the lever 45 will be rocked in either direction according to the pressure of the steam against the tension of the springs 47', causing this lever to shift and be disengaged from between the flanges of the timing mechanism allowing all the stokers and dampers of the different boilers to be placed in action very rapidly.

In order that a complete record of the number of boilers in use can be kept, the beam 8 carries a tracing member 49 connected therewith and having a pointed end 50 contacting with a chart 51 arranged adjacent the beam having a series of circles thereon corresponding in number to the boilers in the plant, the beam when moved in either direction, due to variations in the steam pressure causes the tracing member to be drawn over the chart, leaving thereon a record of the boilers that have been used.

Having thus described the different parts, the operation is as follows:—

When all of the dampers and stokers of the plant are in a closed position, the steam pressure at this time being normal, the operating bell crank levers 28 will be resting upon the portions 25 of the cam wheels, this holding the levers in such a position that the dampers are all closed, the shields covering the ratchet teeth of the operating wheels for the stokers and preventing the same from being actuated. If the pressure falls, due to fluctuations in the load on the plant, the beam 8 will be operated, actuating in turn the pilot valve controlling the hydraulic cylinder having the reciprocating piston therein, causing the rotation of the cam shaft 18. Upon the rotation of this shaft, the bell crank levers 28 having portions 29 engaging the cams on the shaft 18 will ride on the peripheral flanges 24 of the cams causing the operation of the link mechanism controlling the stokers and dampers. The cams arranged on the shaft 18 are adjustably mounted so that the mechanism of certain of the stokers and damper controllers may be placed in operation in advance of others the regulating mechanism of the remaining boilers operating successively. When any of the dampers are opened the controlling means for the stoking mechanism are operated, causing the ratchet shield 36 to be lowered to permit the stokers to be placed in operation.

From the foregoing description it will be readily understood that I have devised a regulating construction that is efficient in every way, but it will of course, be understood that many modifications and changes in the present construction can be made without departing from the spirit of the invention.

What I claim is:

1. A regulator for a steam boiler plant having a plurality of boilers comprising a damper for each boiler, a plurality of actuating devices associated with said dampers, and operating means having adjustable elements thereon coacting with said actuating devices for opening or closing the dampers of the respective boilers successively.

2. A regulator for steam boiler plants having a plurality of boilers, comprising a damper for each boiler, actuating means associated with each damper, and an operating member provided with a plurality of cams engaging said actuating means for operating said dampers successively.

3. A regulator for steam boilers, comprising a damper for each boiler, actuating devices for said dampers, a rotating cam shaft having a series of adjustable cams thereon adapted to engage said actuating devices to operate the dampers successively.

4. A regulator for steam boilers, comprising a damper for each boiler, a plurality of independent links associated with said dampers, and a rotary shaft having cams thereon adapted to engage said links to operate the dampers successively.

5. A regulator for steam boilers, comprising a damper and fuel feeding controller for each boiler, link mechanism connecting said damper and fuel feeding controller of each boiler, an operating member having a plurality of cams thereon engaging said link members for actuating the dampers and fuel feeding controllers of the respective boilers successively and means for actuating the operating member.

6. A regulator for steam boiler plants having a plurality of boilers, comprising a damper and fuel feeding controller for each boiler, means for connecting the damper and fuel feeding controller for each boiler so that they act together, an operating shaft having a series of adjustable cams thereon for engaging the said connecting means to actuate the dampers and fuel feeding controllers of the respective boilers in succession.

7. A regulator for steam boilers, comprising a plurality of dampers, operating devices associated with said dampers for opening or closing them in succession, a pressure controlled regulating bar for controlling the actuation of said operating means, a resiliently mounted member carried by said bar, in combination with a timing mechanism adapted to be engaged by said resiliently mounted member to determine the lapse of time between the operation of each boiler.

8. A regulator for steam boilers, comprising a plurality of dampers, controlling devices connected with said dampers, and an operating member coacting with said controlling devices for actuating the dampers successively, in combination with a rotating timing mechanism having a series of engag-

ing portions thereon for determining the lapse of time between the operation of the dampers.

9. A regulator for steam boiler plants having a plurality of boilers, comprising a damper and fuel feeding controller for each boiler, means for operating the damper and fuel feeding controller of a single boiler together, and actuating the damper and fuel feeding controller of the respective boilers in succession, and a rotating timing mechanism for determining the lapse of time between the actuation of the damper and fuel feeding controller of each boiler.

10. An automatic regulator for steam boilers, comprising a plurality of dampers, controlling devices for said dampers, an operating shaft engaging said controlling devices, means for driving said actuating shaft to operate the dampers successively, and a pressure controlled regulator for said driving means.

11. An automatic regulator for steam boilers, comprising a plurality of dampers, controlling devices for said dampers, an operating shaft engaging said controlling devices, means for driving said actuating shaft to operate the dampers successively, a pressure controlled regulator for said driving means, a lever carried by said regulator, and a timing mechanism adapted to be engaged by said lever for determining the lapse of time between the operation of each damper.

12. An automatic regulator for steam boilers, comprising a plurality of dampers, controlling devices for said dampers, an operating shaft engaging said controlling devices, means for driving said actuating shaft to operate the dampers successively, a steam pressure controlled regulator for said driving means, a resiliently mounted lever arranged on said regulator and a timing device having a series of circumferential ribs provided with openings therethrough arranged adjacent said regulator and adapted to be engaged by the resilient lever for determining the lapse of time between the operation of each boiler.

13. A regulator for steam boiler plants having a plurality of boilers, comprising a damper for each boiler, actuating means associated with said dampers, an operating member engaging said actuating means and adapted to open or close the dampers successively, a pressure controlled regulator for controlling said operating means, in combination with a timing mechanism for coöperating with the regulator bar for determining the lapse of time between the actuation of each successive boiler.

14. A regulator for steam boiler plants having a plurality of boilers, comprising a damper for each boiler, and means for operating the dampers of the respective boilers in succession, in combination with a rotary timing mechanism for determining the lapse of time between the actuation of each damper.

15. A regulator for a steam boiler plant having a plurality of boilers comprising suitable dampers for each boiler, actuating means whereby each damper may be operated independently operatively connected to the dampers; and a rotatable operating shaft having a plurality of cams thereon engaging said actuating means for operating one damper in advance of another.

16. A regulator for a steam boiler plant having a plurality of boilers comprising a damper for each boiler, actuating devices for said dampers, a cam shaft having a plurality of adjustable cams thereon adapted to engage said actuating device to operate the dampers of the respective boilers successively and means for retaining said cams in their adjusted position.

17. A regulator for a steam boiler plant having a plurality of boilers comprising a damper for each boiler, actuating devices for said dampers, a cam shaft having a plurality of adjustable cams thereon adapted to engage said actuating device to operate the dampers of the respective boilers successively and means comprising a latch having an engagement with each cam for retaining the cams in their adjusted positions.

18. A regulator for a steam boiler plant having a plurality of boilers comprising a damper for each boiler, actuating devices for said dampers, a cam shaft having a plurality of adjustable cams thereon adapted to engage said actuating device to operate the dampers of the respective boilers successively, and means comprising a spring actuated latch mounted within a plate keyed to the shaft and adapted to engage each cam for retaining the cams in their adjusted positions.

19. A regulator for a steam boiler plant having a plurality of boilers comprising a damper for each boiler, actuating devices connected with said dampers, and an operating member having a plurality of adjustable cams thereon engaging the actuating devices of the dampers for opening or closing said dampers, and means for actuating the operating member.

20. A regulator for steam boilers comprising a fuel feeder for each boiler, a controller for each fuel feeder, an operating device for each controller, and an operating member having a plurality of adjustable actuating members thereon engaging said operating devices for the controllers for actuating said controllers successively.

21. A regulator for steam boilers, comprising a fuel feeder for each boiler, a controller for each fuel feeder, an operating device for each controller, and an operating

member having a plurality of adjustable cams thereon engaging said operating device for actuating the controllers successively.

22. A regulator for a steam boiler plant having a plurality of boilers comprising a damper for each boiler, means for operating said dampers, in combination with a rotary timing mechanism for permitting certain of said dampers to be operated in advance of others.

23. A regulator for steam boilers, comprising a plurality of dampers, actuating devices for said dampers, a pressure controlled regulating bar for said device, a resiliently mounted member carried by said bar, in combination with a timing mechanism adapted to be engaged by said resiliently mounted member to permit certain of said dampers to be actuated in advance of others.

24. A regulator for steam boilers, comprising a plurality of dampers, operating devices for opening and closing said dampers successively, a regulating bar for controlling said actuating devices, a resilient member carried by said bar, in combination with a timing mechanism adapted to be engaged by said resilient member to determine the lapse of time between the operation of each damper.

25. A regulator for a steam boiler plant having a plurality of boilers comprising a draft controlling device for each boiler, means for operating said controlling devices, in combination with a rotary timing mechanism having an operative connection with the controlling devices for allowing certain of said controlling devices to be actuated in advance of others, substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

NELSON A. MINER.

Witnesses:
E. C. MINER,
EMORY EDWARDS.