

May 9, 1939.

L. S. REAGAN

2,157,245

MOTOR MODULATOR

Filed March 30, 1938

4 Sheets-Sheet 1

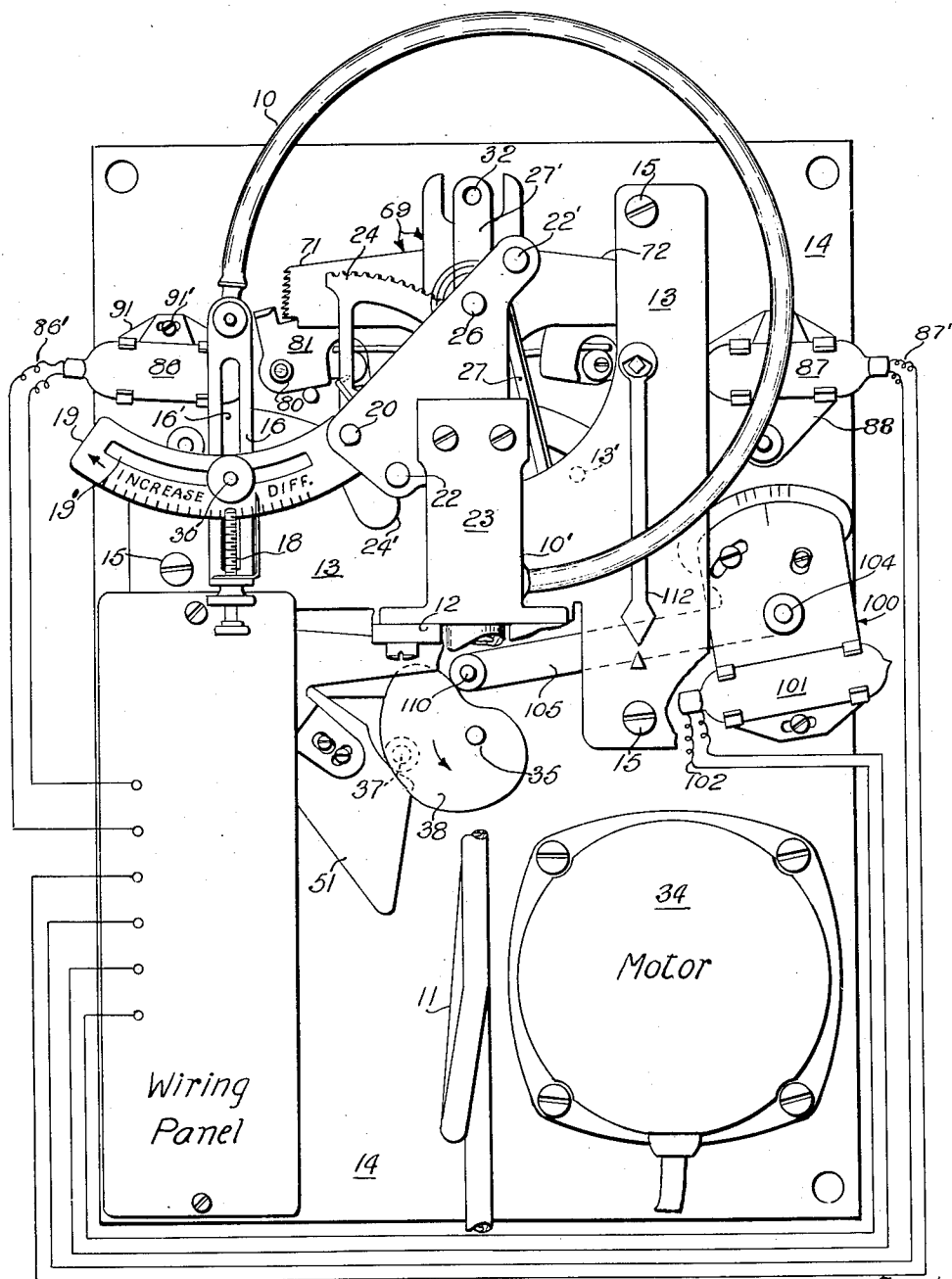


Fig. 1.

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4 Sheets-Sheet 2

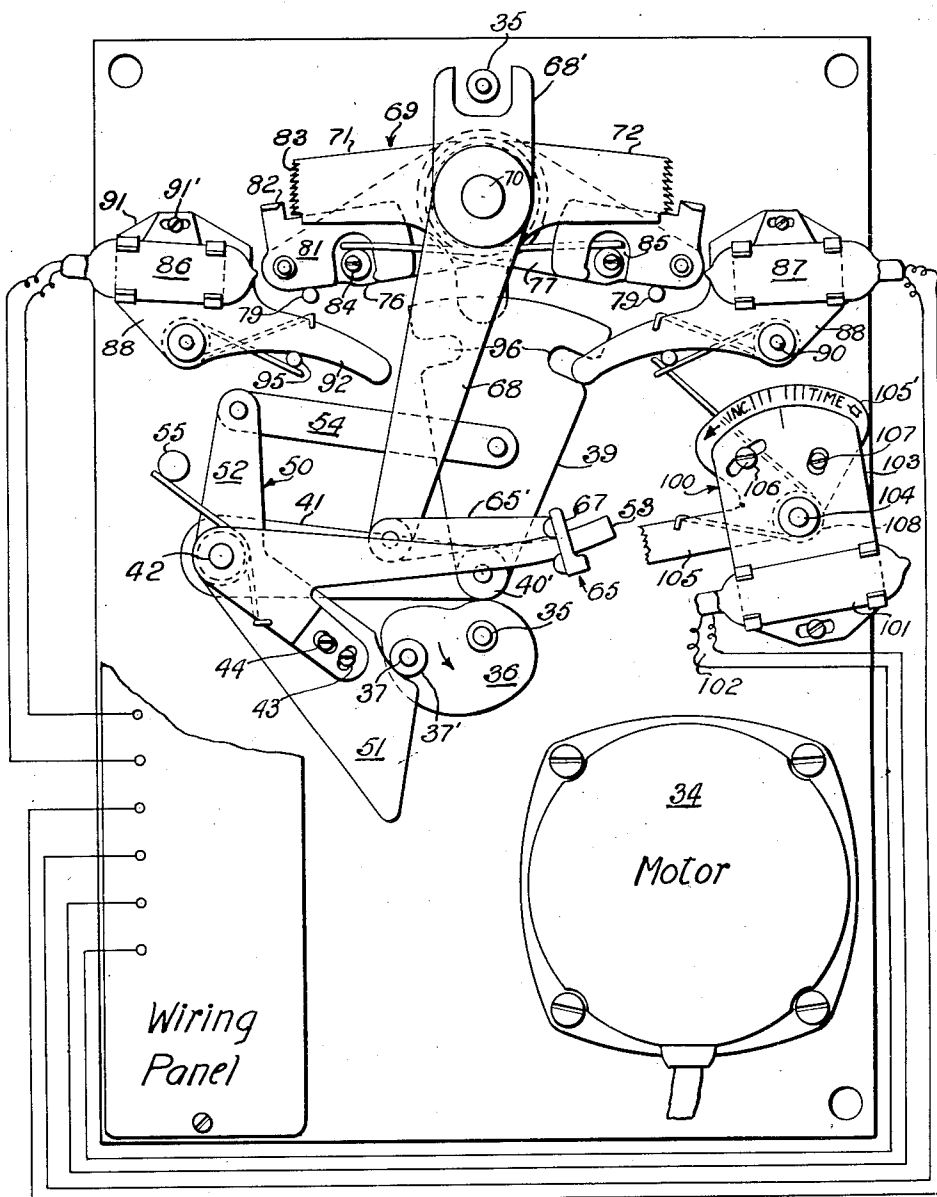


Fig. 2.

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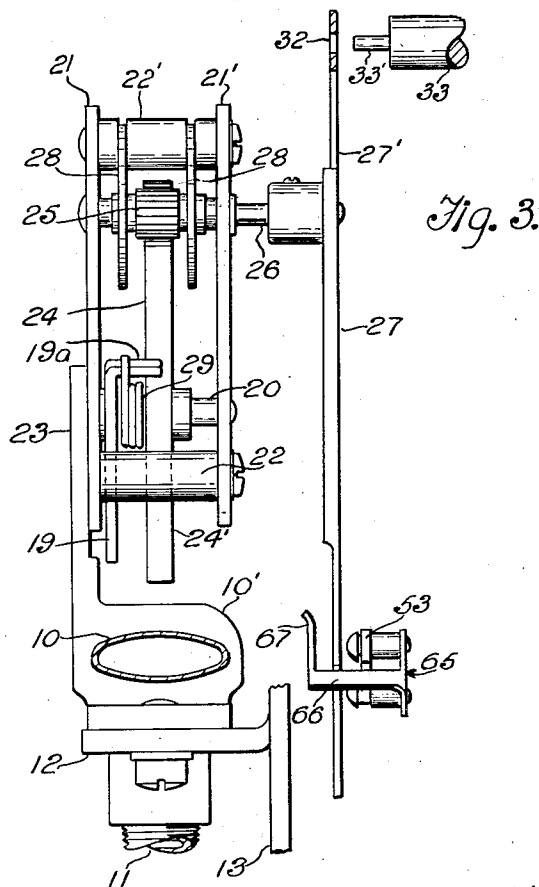


Fig. 3.

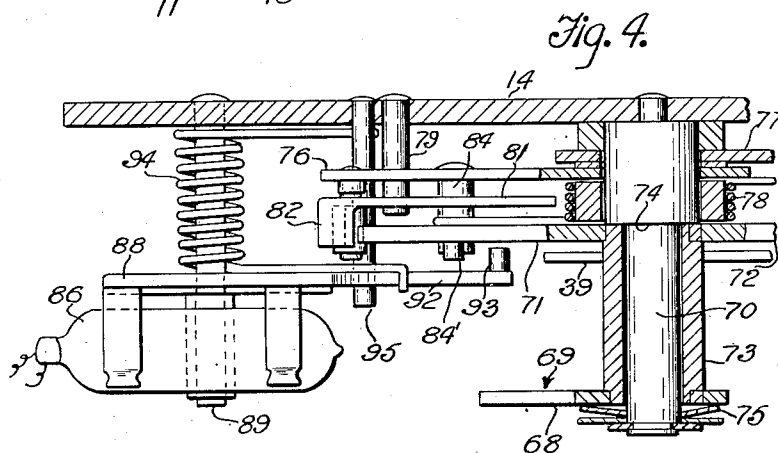


Fig. 4.

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4 Sheets-Sheet 4

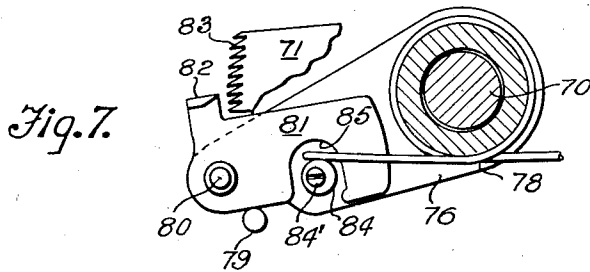
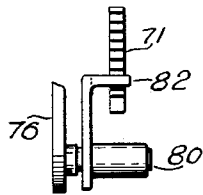
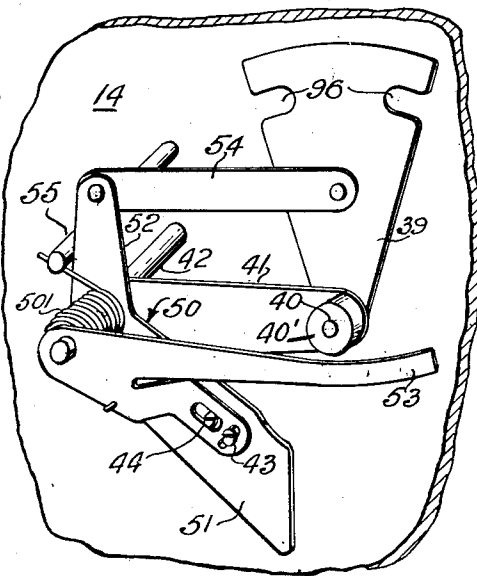
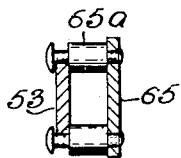
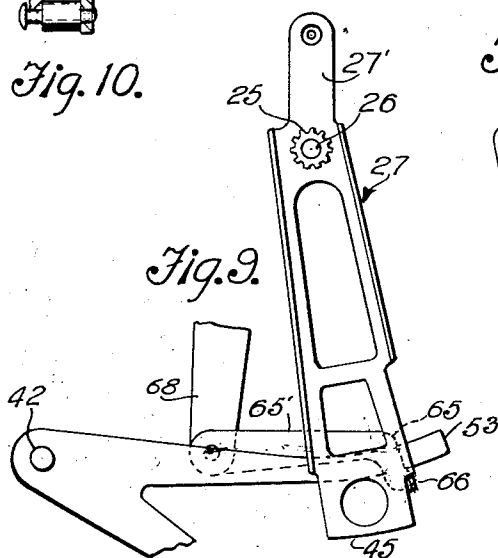


Fig. 12.

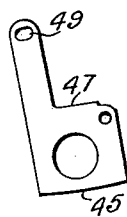


Fig. 11.

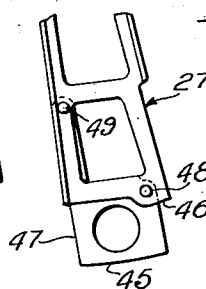
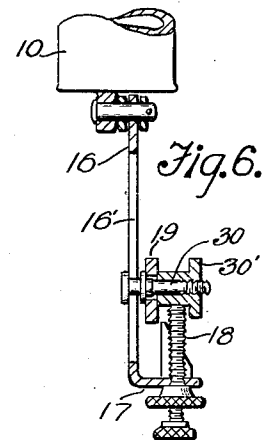


Fig. 6.

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UNITED STATES PATENT OFFICE

2,157,245

MOTOR MODULATOR

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Application March 30, 1938, Serial No. 198,981

10 Claims. (Cl. 200—56)

This invention relates to apparatus controlled by steam pressure for automatically controlling the fuel supply to a steam boiler in response to changes in the steam pressure.

5 The apparatus embodies a deflectable pendulum controlled by a Bourdon tube and a pair of circuit makers and breakers which control the operation of a reversible electric motor which in turn controls the setting of the fuel supply means for the boiler.

10 The object of the invention is to provide improvements in means under the control of the pendulum for actuating the circuit makers and breakers as circumstances require to maintain the steam pressure at a predetermined value.

15 Referring to the accompanying drawings wherein the preferred form of the invention is shown,—

Fig. 1 is a front elevation of the improved instrument removed from its case, some parts being broken away to expose other parts and some parts being omitted to simplify the view;

Fig. 2 is a front elevation of the mechanism behind the Bourdon tube assembly, the outer cam which is shown in Fig. 1 being omitted and the arm which is actuated by that cam being broken off to more clearly expose other parts;

Fig. 3 is an enlarged side elevation of parts shown in Fig. 1;

Fig. 4 is an enlarged fragmentary plan and sectional view of parts shown in Fig. 2;

Fig. 5 is a fragmentary perspective view of parts shown in Fig. 2;

Fig. 6 is an enlarged fragmentary sectional view of parts shown in Fig. 1;

Fig. 7 is an enlarged fragmentary front elevation and sectional view of parts shown in Fig. 2;

Fig. 8 is a fragmentary end elevation of parts shown in Fig. 7;

Fig. 9 is a fragmentary front elevation of parts partly shown in Fig. 3;

Fig. 10 is a fragmentary vertical sectional view of parts shown in Fig. 9;

Fig. 11 is a fragmentary front elevation of parts shown in Fig. 9, and

Fig. 12 is a front elevation of a detail shown in Fig. 11.

10 indicates a Bourdon tube which is responsive to boiler steam pressure through a connecting pipe 11. The lower end of the tube 10 terminates in a fitting 10' which is supported on a horizontally extending shelf 12 carried by an upright frame plate 13 which is held in spaced relation with respect to a back frame plate 14 by three

horizontally extending spacer posts 15. A link 16 is hung on the free end of the Bourdon tube. This link has a longitudinal slot 16' and a laterally extending shelf 17 at its lower end for supporting an adjustable screw 18. (See Fig. 6.)

19 indicates a slotted arcuate arm which is turnably supported on a fulcrum pin 20 supported by and between two spaced upright plates 21 and 21' which are held in fixed spaced relation by two spacer posts of which the lower one is indicated at 22 and the upper one at 22', the front plate 21 being fixedly secured to a bracket 23 which extends upwardly from the fitting 10' to which the lower end of the Bourdon tube is secured. Also mounted on the fulcrum pin 20 is a gear sector 24 which meshes with a pinion 25 which is fixedly secured on a spindle 26 which is turnably supported by and between the plates 21 and 21'. Also fixedly secured on the spindle 26 is a depending lightweight element 27 which corresponds to the hand of a gauge and which, for convenience of description, will sometimes be referred to as a pendulum. Two spiral hair springs 28 connected to the spindle 26 and the upper spacer post 22' serve to take up any lost motion between the pinion 25 and the gear sector 24. The gear sector 24 and the arcuate arm 19 are operatively connected by a relatively light helical twist spring 29 in such a way that the said arm tends to move in a counterclockwise direction whereas the gear sector tends to move in a clockwise direction. Integral with and extending downward from the hub of the gear sector 24 is a finger 24' adapted to abut against the lower spacer post 22, whereby to limit movement of the gear sector in a counterclockwise direction and thus prevent it from becoming disengaged from the pinion 25.

Extending through the arm slot 19' of arm 19 is a pin 30 having a double flanged head (see Fig. 6) which is slidable in the link slot 16', the pin being adjustably clamped to the arm 19 by a thumb nut 30'. The adjustable screw 18 at the lower end of the link determines the point of operative connection between the link 16 and the arm 19. It will be readily appreciated that by changing the position of the pin 30 with reference to the fulcrum pin 20, the degree to which the pendulum 27 will be moved by any change in steam pressure may be varied within relatively wide limits. The pendulum 27 is so hung that its center of gravity is always at the right, as viewed in Fig. 1 (see also Fig. 9) of its free or unrestrained position of rest with the result that gravity always tends to move it in a clockwise direction.

This is the same as saying that the pendulum always tends to rotate the gear sector 24 in a counterclockwise direction. The limit of movement of the pendulum in counterclockwise direction is limited by a stop pin 13' carried by the plate 13. Free downward movement of the arm 19 with reference to the gear sector 24 is limited by a lateral finger 19A which forms part of the arm and which underlies the gear sector some distance upwardly from the fulcrum pin 20 as clearly shown in Fig. 3. Fig. 1 shows the position of the link and arm when steam pressure is not applied to the Bourdon tube. Note that in this position the arm 19 has moved downwardly a lesser distance than the screw 18 carried by the link 16.

The pendulum is provided with an upwardly extending radial finger 27' provided with a sighting hole 32. Behind the finger is a horizontally extending sighting post 33 carried by the back frame plate 14, the adjacent end 33' of the post being materially reduced and terminating relatively close to the said radial finger 27' as clearly shown in Fig. 3. When the hole and the post are coaxial the pendulum is in "neutral" position. This visibility of the neutral position of the pendulum is made use of in adjusting the instrument for operation. For example, suppose that the desired steam pressure to be maintained in a boiler is 100 pounds. In adjusting the instrument to maintain this steam pressure, the adjustments will be such as to insure that the pendulum is in the said neutral position when the steam pressure is at 100 pounds. Any change in steam pressure from that value will cause the pendulum to move in one direction or the other as will now be readily understood.

In order to maintain the boiler steam pressure constant, more fuel will have to be supplied to the boiler when the steam pressure decreases and less fuel will have to be supplied when the steam pressure increases. This control of the fuel supply is obtained by mechanism whose operation is controlled by the position of the pendulum as will presently appear. The controlling mechanism includes a constant speed electric motor 34 carried by the back frame plate 14. This motor drives a train of gears (not shown but located behind the plate 14), the last gear of the train being affixed to a horizontally extending drive shaft 35 which extends through the back frame plate 14.

Fixedly secured on the shaft 35 are two cams 36 and 38 between which is a crank pin 37 shown as provided with an antifriction roller 37'. The primary purpose of the inner cam 36 is to raise and lower a sector plate 39, the lower end of the plate having a lateral pin 40 on which is mounted an antifriction roller 40' which rides on the cam 36. A link 41 (through one end of which the plate pin 40 extends and through the other end of which a horizontally extending post 42 extends) serves to hold the lower end of the plate 39 in operative position on the cam 36. The post 42 extends from and is supported by the back frame plate 14.

Turnably mounted on the post 42 is a three-armed bell crank lever 50 (see Fig. 5) whose arms are indicated at 51, 52 and 53 respectively. A link 54 connects the arm 52 with the plate 39 at a point intermediate the top and bottom ends of the latter. A helical twist spring 501 tends to turn the bell crank lever in a counterclockwise direction, the turning movement in that direction being limited by a stop 55 which ex-

tends from the back frame plate 14. The downwardly extending arm 51 is in the path of travel of the crank pin 37 and it will, therefore, be understood that the crank pin imparts a clockwise turning movement to the sector plate 39 through the instrumentality of the bell crank lever and the connecting link 54. That portion of the arm 51 which is contacted by the crank pin is of such configuration that as the crank pin moves away from said arm, the bell crank lever will move in counterclockwise direction (under the influence of the spring 501) at the same rate that it moves in a clockwise direction, thereby insuring uniform to and fro movement of the sector plate 39.

The third arm 53 of the bell crank lever 50 is adjustably secured to the arm 51 by means including a clamping screw 43 and an eccentric adjusting screw 44, it being noted that the arm 53 is not in the same vertical plane as the arm 51 but at one side thereof and that its outer end has an upward curvature. Inasmuch as the arm 53 is, in effect, part of the bell crank lever, it will be readily appreciated that the angular position of the sector plate 39 may be controlled by controlling the position of the bell crank lever.

Referring to Figs. 11 and 12, the pendulum 27 is provided with cutouts to reduce its weight and with side flanges to increase its rigidity. Its bottom end 45 is in the arc of a circle whose center is the spindle 26 and at its righthand edge it is provided with a shoulder 46. That portion of the pendulum below the shoulder 46 is an L-shape member 47 which is rotatably secured to the main body of the pendulum by a lower pivot pin 48 and an upper pin and slot connection 49. The slot is only slightly longer than the diameter of the pin 49 with the result that the rotative movement of said member 47 is barely perceptible. Gravity tends to turn said member in a counterclockwise direction. In Fig. 3 the pendulum is shown as a one piece member.

Slidably supported on the bell crank arm 53 is a head 65 at one end of a link 65' whose other end is connected to a swingable arm 68. As shown in Fig. 10, the head comprises upper and lower laterally-extending pins 65A between which the arm 53 is slidably confined by notches at the ends of the pins. The head 65 also comprises a laterally extending finger 66 which extends below the arm 53 (see Fig. 9) and across the vertical plane in which the pendulum 27 is swingable (see Fig. 3). If the position of the finger 66 with respect to the pendulum 27 is such that the finger underlies either the shoulder 46 or the bottom edge 45 of the pendulum, then it will be self-evident that the angular position of the bell crank 50 will be determined accordingly. The finger 66 terminates in an upstanding and rearwardly inclined guide 67 to insure proper positioning of the finger with respect to the pendulum 27. At this point in the description it will be helpful to say that when the finger 66 is held against upward movement by the pendulum shoulder 46, the sector plate 39 will be idly raised and lowered by the constantly rotating cam 36. To put the matter in another way, when the finger 66 is prevented from upward movement by the shoulder 46 the pendulum will be in neutral position, this being another way of saying that the boiler steam pressure has reached, and is being maintained at, the predetermined pressure. It will also be remembered that the bell crank lever 50 is being

periodically rocked by the crank pin 37 and it should be noted that the clockwise movement of the bell crank lever will always be sufficient to lower the finger 66 below the level of the lower edge 45 of the pendulum.

During the time that the finger 66 is below and out of contact with the bottom edge 45 of the pendulum, the latter is free to be moved, either toward the right or toward the left, by the Bourdon tube, assuming of course that there has been a change in steam pressure since the finger was in engagement with the shoulder 46. If the pendulum has moved toward the right, it will now be understood that the finger 66 will come in contact with the lower edge 45 of the pendulum and thereby prevent the arm 53 from moving upwardly. On the other hand, if the pendulum has moved toward the left, the finger 66 will move idly upwardly past the shoulder 46 until the bell crank is arrested by the stop 55 behind the upright arm 52. In case the adjacent edge of the finger 66 should almost, but not quite, clear the adjacent corner of the lower edge 45 of the pendulum as the finger moves upwardly, then the hinged member 47 of the pendulum will be pushed over toward the left by the finger which will then come to rest under the shoulder 46. This relatively slight displacement of the member 47 therefore serves the useful purpose of preventing the apparatus from hunting when the pendulum is within a small fraction of a degree of being at neutral position.

Referring to Fig. 2, it will be noted that the shape of the cam 36 and the location of the crank pin 37 are such that the cam does not cause any displacement of the sector plate 39 while the bell crank lever 50 is being actuated. In other words, the angular position of said plate with respect to the vertical is adjusted while the plate is at its lowered position with respect to the cam.

The arm 68 to which the link 65' is one leg of a T-shape lever or member 69 turnably mounted on a pin 70 which is secured to and which projects horizontally from the back frame plate 14. The horizontal arms of the member 69 are indicated as 71 and 72, respectively, both of these arms being of equal length and in the same vertical plane whereas the arm 68 is at one side of the said plane, there being a connecting sleeve 73 between the arm 68 and the other two arms. Referring to Fig. 4, it will be seen that the pin 70 extends through the sleeve 73 and that the pin is formed with a shoulder 74. The sleeve is pressed against the shoulder by a spring washer 75 for the purpose of frictionally holding the T-shape lever in adjusted position. The upper end of the arm 68 is extended in the form of a fork 68' between which extends the previously mentioned sighting post 35 (see Fig. 2). The free angular movement of the member 69 is, therefore, limited by the fork.

Turnably mounted on the fulcrum pin 70 are two identical arms 76 and 77 which extend in opposite directions. A helical twist spring 78 (see Fig. 7) concentric with the pin 70 tends to turn both of said arms in a downward direction, the degree of downward movement being limited by individual stop pins 79 which are secured to and project horizontally from the frame plate 14. At the outer end of each arm is a horizontally extending pin 80. Pivotaly mounted on each of these pins 80 is an L-shape

lever 81. The short leg of the lever extends upwardly for a short distance and then laterally as indicated at 82. The long leg of the lever extends horizontally in a direction toward the pivot pin 70 of the T-shape lever 69 and the weight of the long arm is such as to tend to move it in a downward direction. The degree of downward movement, however, is limited by the stop pin 79. When the long arm of the lever 81 and the arm to which it is pivoted are both in engagement with the stop pin 79, the laterally extending finger 82 of the lever 81 is out of engagement with the adjacent end of the horizontal arm of the T-shape lever 69. The outer end of each of the T-lever arms 71 and 72 is serrated as indicated at 83 and the horizontally extending finger 82 of the L-shape lever 81 has a wedge-shape edge for entering between the teeth formed by the serrations 83. It will, therefore, be seen that the lever 81 is, in effect, a pawl and that the serrations 83 constitute a rack. The pawl 81 is brought into engagement with the adjacent rack 83 by upward movement of the arm to which the pawl is pivoted and this upward movement is accomplished by means including a laterally extending pin 84 which is carried by the arm to which the pawl is pivoted, the pawl being provided with a cutout 85 of sufficient width and height to prevent any binding action between the pin and the pawl. When the arm (76 or 77) is moved upwardly by upward force against the pin 84, there is relative turning movement between the arm and its pawl 81 and this movement continues until the pawl interengages with the rack 83. Continued upward movement of the pawl and arm will thereupon cause the T-shape lever to turn on its supporting pin 70 as will now be understood. It will also be understood that only one pawl at a time will be operated to adjust the position of the T-shape lever. It will be noted that the ends of the helical twist spring 78 rest on the respective pins 84 whereby to turn the arms 76 and 77 in a downward direction as previously mentioned. The pins 84 are of a length to extend across the plane of the sector plate 39 and the outer end of each pin is eccentric with respect to the main body of the pin as indicated at 84'. Consequently by turning the pin as with a screwdriver, the axis of the eccentric portion may be raised or lowered with respect to the said plate 39. One of the reasons for causing the sector plate 39 to move up and down is to provide for the automatic raising by the plate of one or the other of the arms 76 and 77 to adjust the position of the T-shape lever 69 and thus to adjust,—with respect to the horizontally extending arm 53 of the bell crank lever 50 when the prevailing boiler steam pressure so requires,—the position of the head 65 of the link 65' which is connected to the depending arm 68 of the T-shape lever 69. In this connection it should be noted that the horizontal distance between the eccentric portions 84' of the pins 84 is greater than the length of the chord of the arc at the top end of said plate 39 and consequently unless the angular position of the plate with respect to the vertical is such as to cause it to underlie one or the other of said pins, the plate in moving upwardly will pass between said pins with the result that the position of the T-shape lever 69 remains undisturbed. As has already been explained the said angular position of the plate 39 is determined by whether or not the pendulum 27 is in a position to be

engaged or not be engaged with the said finger 66. However, it may be helpful at this point to elaborate more fully.

If the finger 66 is held from upward movement by the shoulder 46 of the pendulum 27, then the position of the plate 39 will be such that when it is elevated by the cam 36 it will move upwardly between the pins 84 without touching the same. On the other hand, if the position of the finger 66 with respect to pendulum 27 is such that the finger may assume a position above the level of the shoulder 46 of the pendulum (it being remembered that in such case the arm 52 of the bell crank lever will abut the stop 55) then it will be readily appreciated that the sector plate 39 will be tilted toward the left, as viewed in Figs. 2 and 5, by the link 54. Consequently, when the cam 36 elevates said plate, the latter will abut the left hand pin 84 with consequent adjustment of the T-shape lever in a clockwise direction. As a result of this adjustment, the finger 66 will be adjusted toward the left, as viewed in Fig. 2. If, now, after the crank pin 37 has turned the bell crank lever to the limit of its movement in a clockwise direction, the lower end of the pendulum 27 is still too far toward the left to permit the finger 66 to engage either the lower edge 45 or the shoulder 46 of the pendulum, the sector plate 39 on its next upward movement will again contact with the lefthand pin 84 and thus once again adjust the T-shape lever in a clockwise direction with the result that the finger 66 will again be moved a slight distance toward the left on the arm 53. This sequence of movement is continued until the finger 66 is brought to an upward stop, either by the shoulder 46 or the lower edge 45 of the pendulum. If the finger 66 is brought to an upward stop by contact with the lower edge 45, then it will be evident from what has already been said that the position of the sector plate 39 will be such as to engage the righthand pin 84 instead of the lefthand pin in its upward movement. Consequently, the finger 66 will be adjusted toward the right instead of toward the left on the arm 53. This gradual adjustment of the finger 66 will continue until the position of the finger 66 is such that it will be arrested on its upward movement by the shoulder 46 of the pendulum 27 at which time the latter will be in neutral position which is the same thing as saying that the steam pressure is at its predetermined value.

The primary function of the sector plate 39 is to control the amount of fuel supplied to the furnace of the boiler whose steam pressure is to be controlled and this control is effected by causing said plate to actuate one or the other of two mercury switches 86 and 87 which control the power supply to a reversible electric motor (not shown) which in turn controls the adjustment of a fuel supply means (not shown) such as a gas valve.

Both of said switches 86 and 87 are mounted on individual rockers 88 at either side of the sector plate 39 on rocker pins 89 and 90 which are supported by and extend laterally from the back frame plate 14. The circuit wire which lead from the mercury tubes are indicated at 86' and 87', respectively, the same leading to a wiring panel as shown in Fig. 1. The normal position of both switches is open position from which it will be understood that the motor whose circuit is controlled by said switches is normally deenergized. It may also be stated at this point that the maximum period during which the switches remain

closed is a matter of seconds, say ten seconds. However, as will presently appear, there may be associated with the instrument a timing switch 100 for reducing the effective closing time of the switches 86 and 87.

The switch rocker 88 comprises an upright tube-supporting arm 91,—with respect to which the angular position of the mercury tube may be adjusted by releasing a set screw 91',—and a horizontally extending arm 92 whose terminal is provided with a lateral pin 93. A helical twist spring 94 supported on the fulcrum pin 89 tends to turn the arm 92 in a downward direction against a stop pin 95 which extends from the frame plate 14. When the arm 92 abuts said pin the switch carried by the rocker is open. The sector plate 39 is provided with two arcuate notches 96, one at either side, and when the plate is in lowered position, the lateral pins 93 of the rocker arms 92 will be in arcuate alinement with said notches and the plate may, therefore, be rocked to the full limit of its movement in either direction without interference by said pins. If, after the crank pin 37 has caused the plate to be rocked, the previously mentioned finger 66 engages with the shoulder 46 of the pendulum, then the plate 39 will be in position to pass upwardly between the said arm pins 93 with the result that neither of the switches 86 and 87 will be rocked to closed position. If by the next time the crank pin rocks the plate the pendulum has moved toward the right, then the finger 66 will be arrested in its upward movement by the bottom edge 45 of the pendulum and the plate will therefore be held far enough over toward the right to be in operative engagement with the lateral pin of the righthand rocker 88 with the result that as the plate moves upwardly it will close the righthand switch 87. If, on the other hand, the pendulum instead of having moved toward the right had moved toward the left, then it would not have arrested upward movement of the said finger and the plate would have come into operative engagement with the lateral pin of the lefthand rocker with resultant closing of the lefthand switch 86 when the plate was raised.

From the foregoing description it will be understood that there will be no automatic adjustment of the fuel supply to the boiler furnace so long as the steam pressure remains constant at its predetermined value or in other words so long as the pendulum remains in neutral position, it being remembered that in that position the finger 66 will be arrested in its upward movement by the shoulder 46 of the pendulum. As already stated the effective closing time of the two switches 86 and 87 may be controlled by a timing switch 100.

The timing switch 100 comprises a mercury tube 101 at one end of which are the circuit wires 102 whose terminals are to be closed by the pellet of mercury in the tube, the wires leading to the wiring panel as shown in Fig. 1. The tube is supported at the lower end of a plate 103 through the middle of which extends a fulcrum pin 104 which extends from the back frame plate 14. Turnably mounted on the fulcrum pin is a rocker arm 105 having an upward extension 105' whose upper end is arcuate and graduated. The plate 103 is adjustably clamped to said extension by upper and lower screw and slot connections 106 and there is provided an eccentric screw 107 for effecting the angular adjustment between the plate and said extension. A helical twist spring

108 mounted on the pin 104 tends to turn the rocker arm in a counterclockwise direction. The rocker arm is periodically rocked by a cam 38 (see Fig. 1). A lateral pin 110 at the end of the rocker arm establishes operative connection between the rocker and its cam, it being understood that the pin is held against the cam by the spring 108.

The switch wires 102 will be so connected to the motor circuit established by the switches 86 and 87 that the circuit thus established may be opened by the switch 100 after a predetermined time interval depending on the angular adjustment of the plate 103 with respect to the arm 105'. It will therefore be understood that if the normally closed period of the respective switches 86 and 87 is, say, ten seconds, the switch 100 may be adjusted to shorten the effective closed period to some predetermined value less than ten seconds.

Referring to Fig. 1, the front frame plate 13, carries a plumb arm 112 to assist the installer of the instrument in properly installing the same.

Although many parts of the invention have been described in considerable detail it will be understood that such description is primarily for the purpose of making clear the construction and mode of operation of the instrument as a whole and that no limitations are intended except as expressed in the appended claims.

What I claim is:

1. In apparatus of the class described, the combination of two switch-operating members, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by the apparatus, a sector plate having an axis of rotation remote from its arc, means for oscillating said plate on said axis and for reciprocating the same, said plate being arranged to actuate one or the other or neither of said members depending on its position in the plane of its swing prior to its being reciprocated, and means under the control of the pendulum for adjusting the position of said plate in said plane.

2. In apparatus of the class described, the combination of two switch-operating members, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by said apparatus, a rockable and bodily displaceable sector plate adapted to actuate one or the other or neither of said members depending on its position in the plane of its swing prior to its being bodily displaced, and means under the control of the pendulum for adjusting the position of said plate in said plane, said means comprising a vertically-reciprocable laterally adjustable finger whose upward movement is subject to arrest by the pendulum.

3. In apparatus of the class described, the combination of two switch-operating members, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by said apparatus, a rockable and bodily displaceable sector plate adapted to actuate one or the other or neither of said members depending on its position in the plane of its swing prior to its being bodily displaced, and means under the control of the pendulum for adjusting the position of said plate in said plane, said pendulum having a shoulder at one radial side and said means comprising a vertically-movable laterally-adjustable finger whose upward movement is subject to arrest by said shoulder, and said plate when said finger is arrested by said shoulder being held in a position permitting it to be bodily

displaced without actuating either of said members.

4. In apparatus of the class described, the combination of two switch-operating members, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by said apparatus, a rockable and bodily displaceable sector plate adapted to actuate one or the other or neither of said members depending on its position in the plane of its swing prior to its being bodily displaced, and means under the control of the pendulum for adjusting the position of said plate in said plane, said pendulum having secured thereto a depending hinged extension and having at one of its radial sides a shoulder, and said means comprising a vertically-reciprocable laterally adjustable finger whose upward movement is subject to arrest, either by said shoulder or by the bottom edge of said extension.

5. In apparatus of the class described, the combination of two switch-operating members, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by said apparatus, a rockable and bodily displaceable sector plate adapted to actuate one or the other or neither of said members depending on its position in the plane of its swing prior to its being bodily displaced, and means under the control of the pendulum for adjusting the position of said plate in said plane, said sector plate having side notches one at each radial side for establishing operative connection between the plate and said switch-operating members.

6. In apparatus of the class described, the combination of two switch-operating members, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by said apparatus, a rockable and bodily displaceable sector plate adapted to actuate one or the other or neither of said members depending on its position in the plane of its swing prior to its being bodily displaced, and means under the control of the pendulum for adjusting the position of said plate in said plane, means including a bell crank lever for rocking said plate, a finger extending across the plane of swing of said pendulum and carried by one of the arms of said lever, and means actuable by said plate for adjusting the position of said finger with respect to the fulcrum point of said lever, said pendulum being adapted to arrest the upward movement of said finger at one or the other of two different levels.

7. In apparatus of the class described, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by the apparatus, a sector plate and means including a bell crank lever for rocking the plate, constantly rotating means for raising and lowering said plate and for rocking said lever, a laterally extending arm carried by said lever, a finger extending across the plane of swing of said pendulum and carried by said arm, means adapted to be actuated by said plate for adjusting the position of said finger lengthwise of said arm, and circuit-controlling means adapted to be operated by said plate if the latter actuates the finger adjusting means, said pendulum being adapted to arrest the upward movement of said finger.

8. In the combination specified in claim 7, means operated by said constantly rotating means for controlling the effective circuit-control period of the circuit-controlling means.

9. In apparatus of the class described, a pendulum whose position with respect to a neutral position is subject to change by a condition to be controlled by the apparatus, a vertically reciprocable finger extending across the plane of swing of the pendulum and adapted to be arrested in its upward movement by the pendulum at either of two levels, a laterally extending arm on which the finger is laterally adjustable, means including a T-shape lever for adjusting the position of the finger on said arm, and means for adjusting the

position of said lever comprising a vertically reciprocable sector plate whose angular position may be adjusted with respect to the fulcrum of said lever, said angular position determining whether or not the lever will be adjusted.

10. In the combination specified in claim 9, circuit-controlling means adapted to be actuated by said plate if the angular position of the latter is such as to cause said lever to be adjusted.

LEON S. REAGAN.

DISCLAIMER

2,157,245.—*Leon S. Reagan*, Tulsa, Okla. MOTOR MODULATOR. Patent dated May 9, 1939. Disclaimer filed June 7, 1940, by the assignee, *The Brown Instrument Company*.

Hereby enters this disclaimer to claims 1, 2, 3, 5, 6, 7, 8, 9, and 10 in said specification.

[*Official Gazette July 9, 1940.*]