June 27, 1939. C. W. BROS 2,163,825

STOKER

Filed July 29, 1935 6 Sheets-Sheet 1

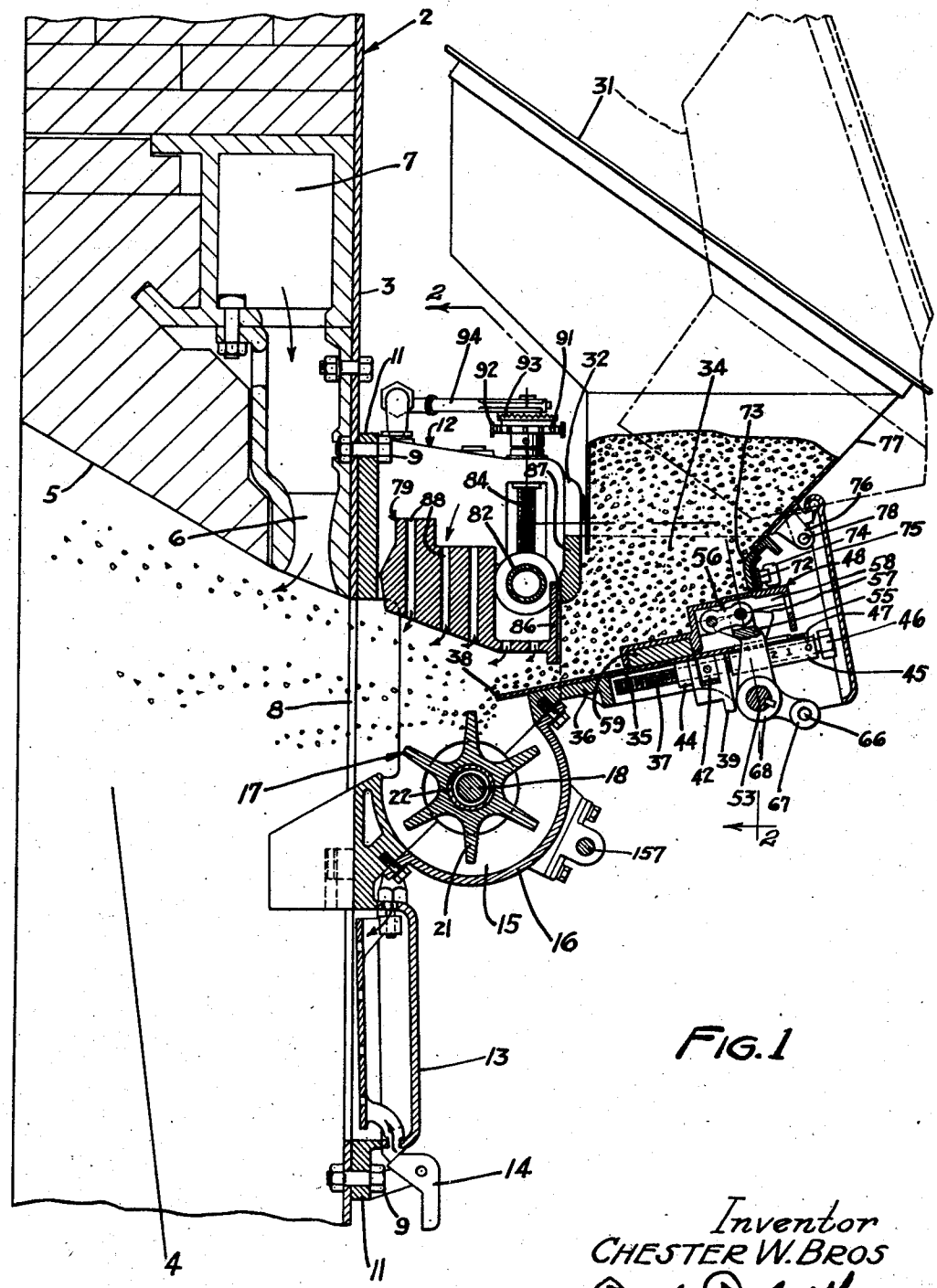


FIG. 1

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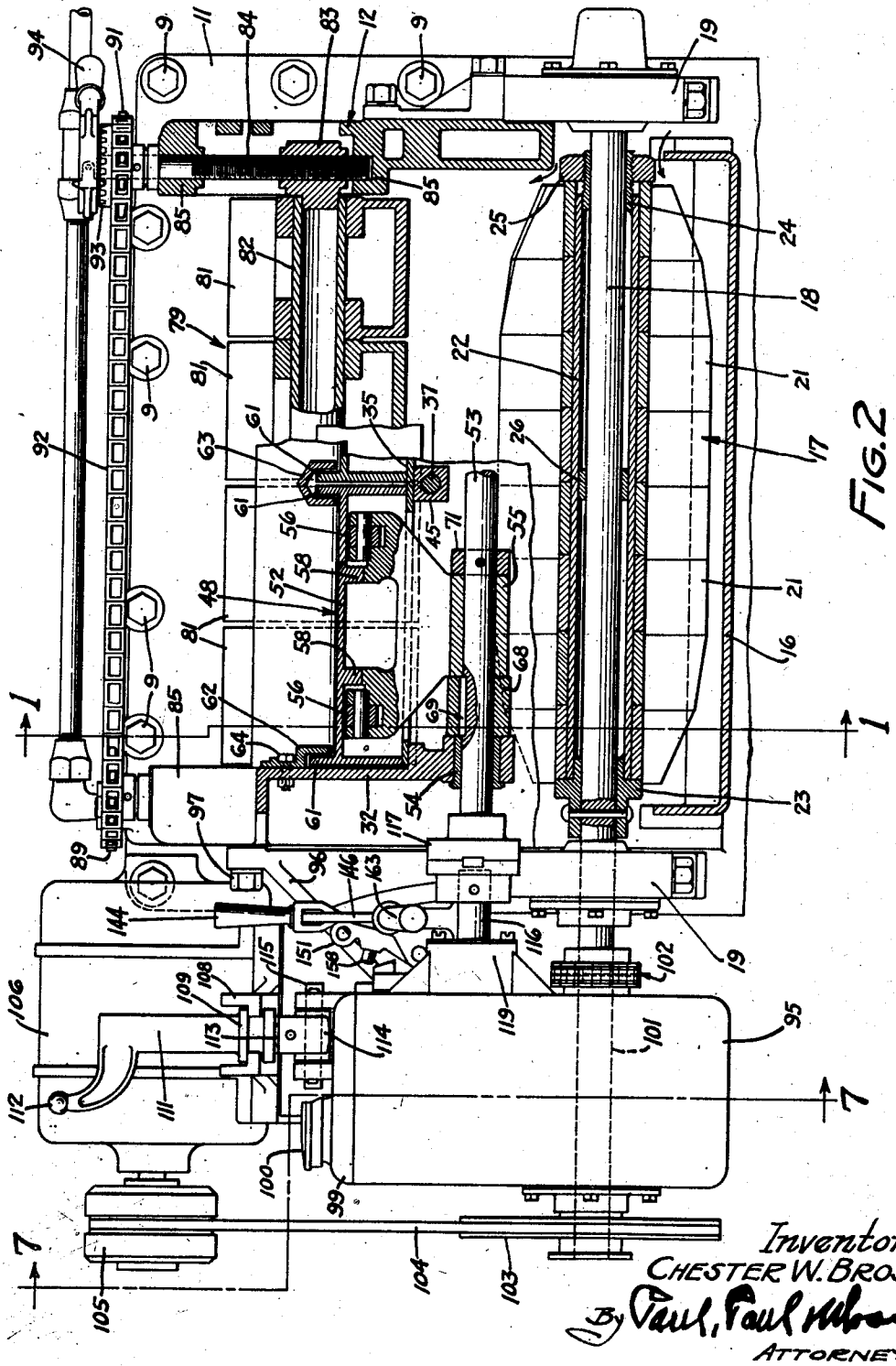


FIG. 2

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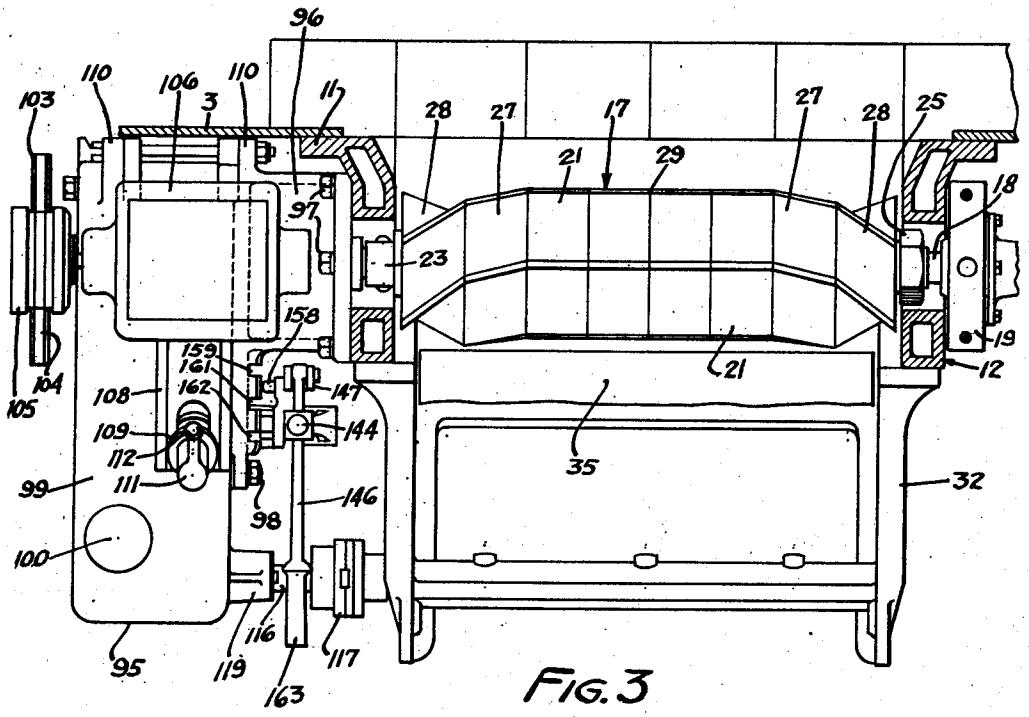


FIG. 3

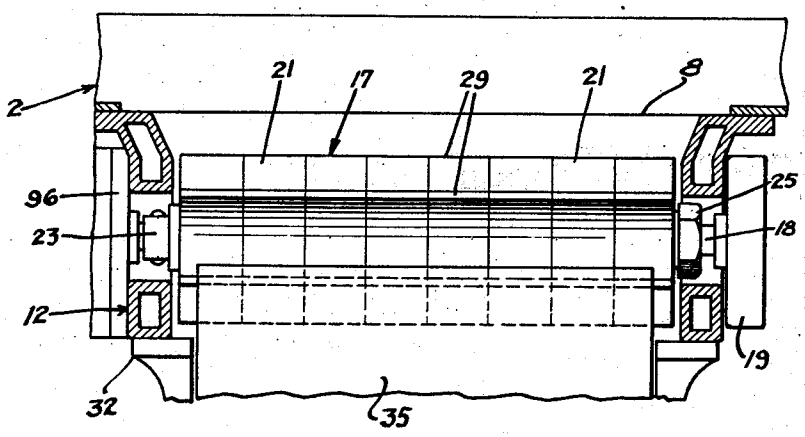


FIG. 4

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STOKER

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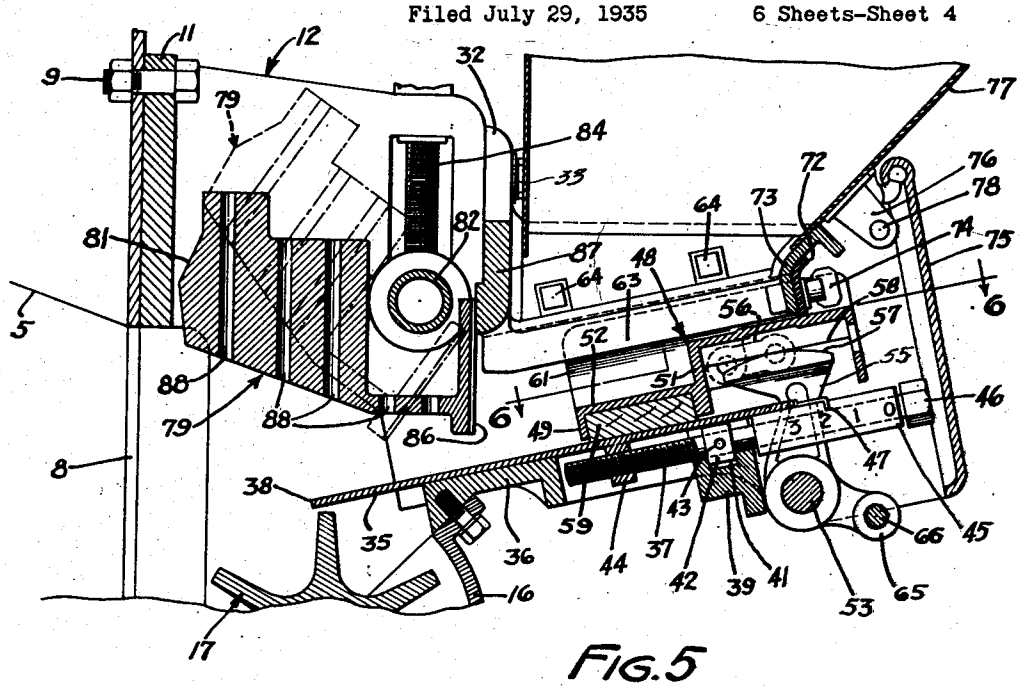


FIG. 5

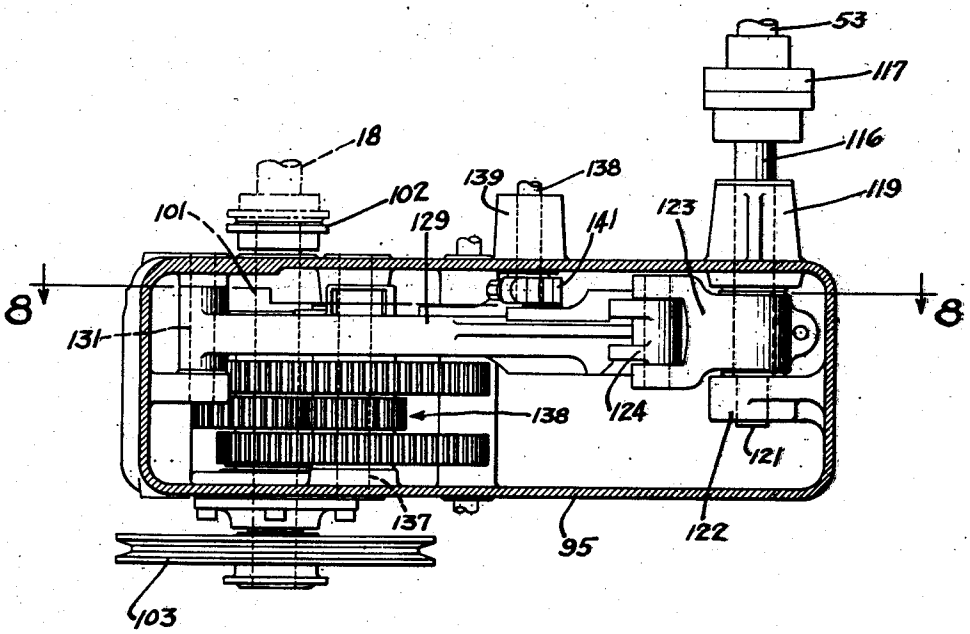


FIG. 9

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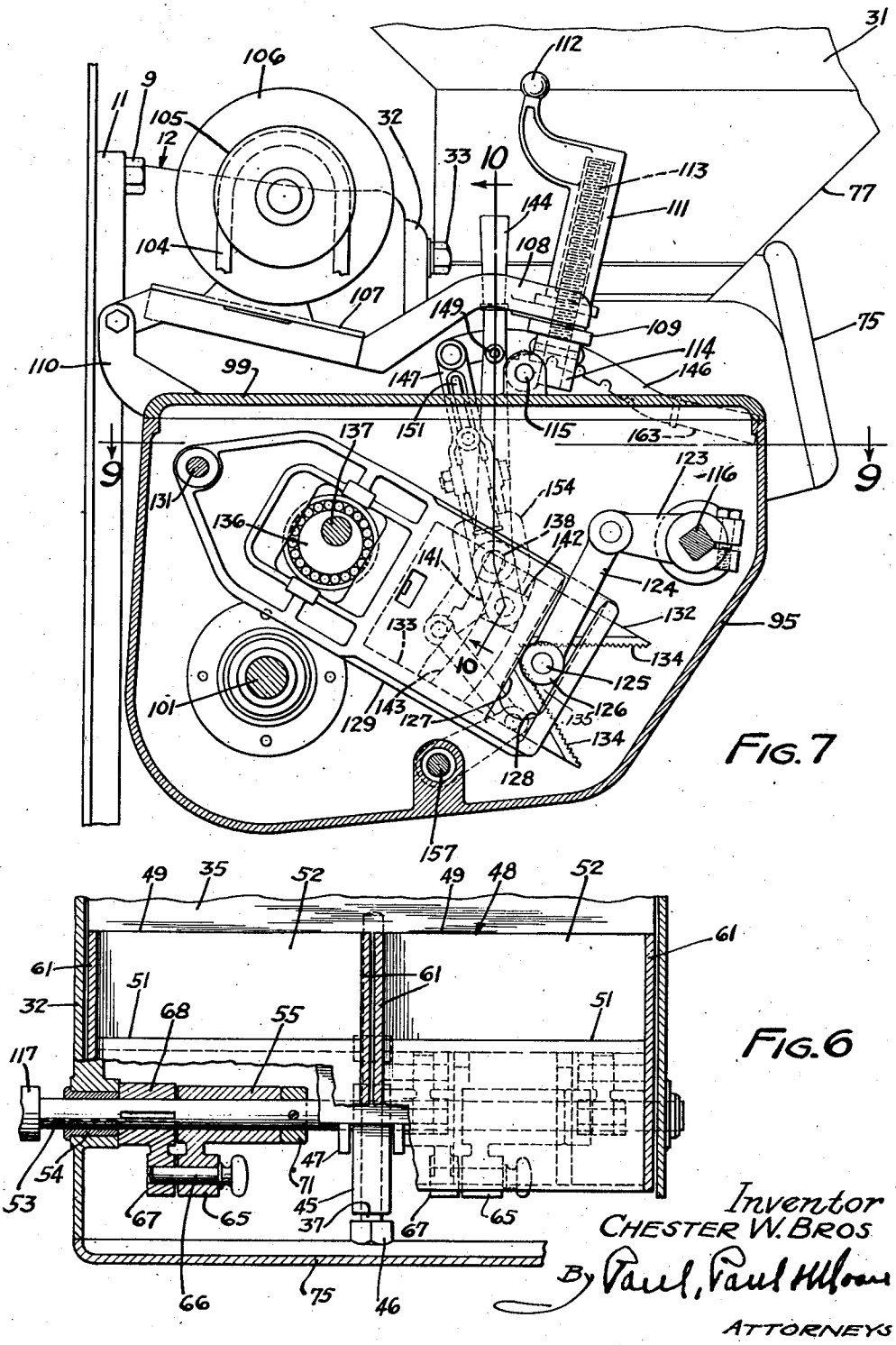


FIG. 7

FIG. 6

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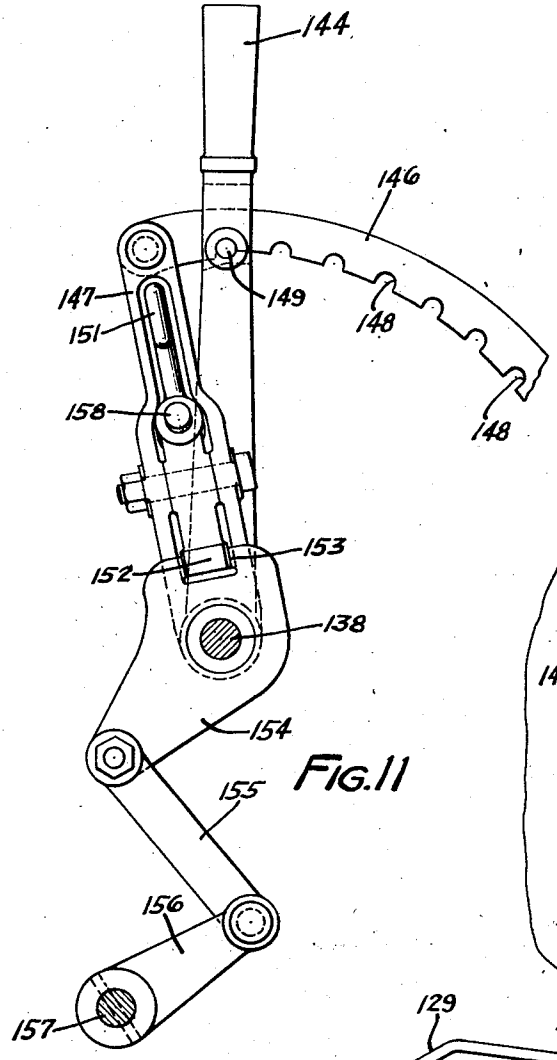


FIG. 11

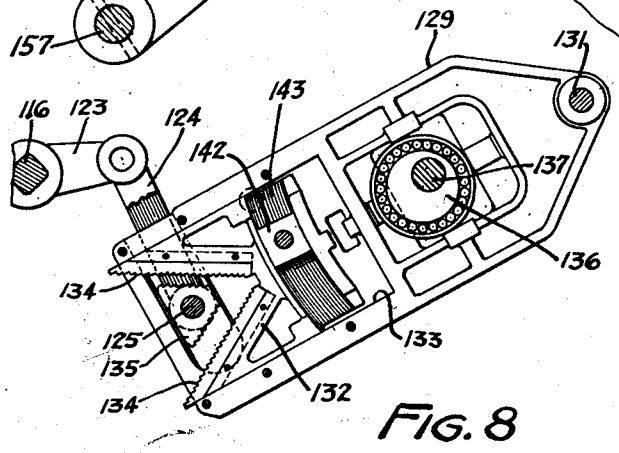


FIG. 8

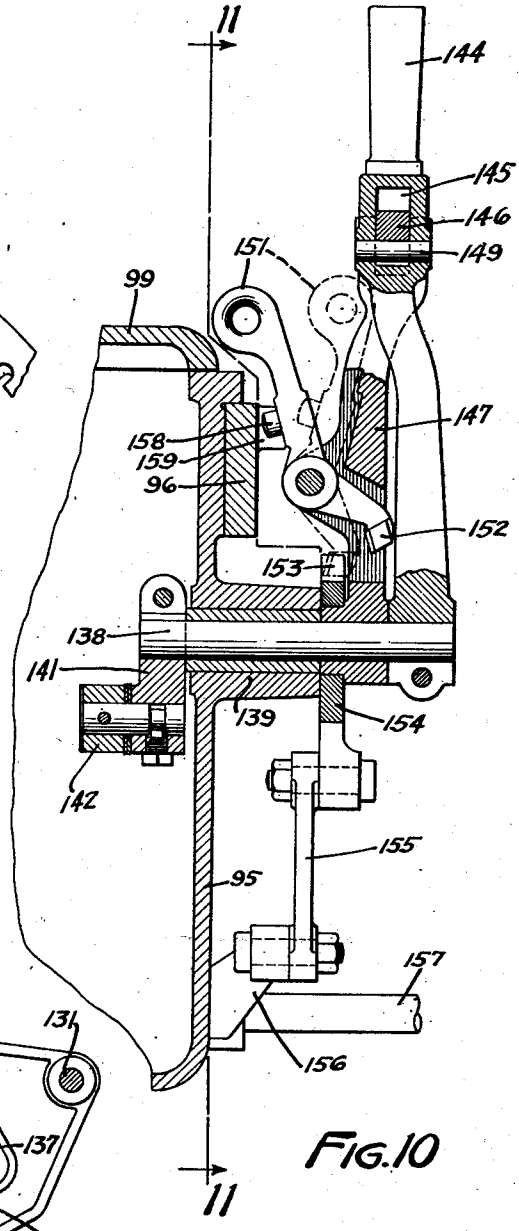


FIG. 10

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Patented June 27, 1939 2,163,825

UNITED STATES PATENT OFFICE

2,163,825

STOKER

Chester W. Bros, Minneapolis, Minn., assignor to Wm. Bros Boiler & Manufacturing Company, Minneapolis, Minn., a corporation of Minnesota

Application July 29, 1935, Serial No. 33,753

7 Claims. (Cl. 110—115)

This invention relates to new and useful improvements in sprinkler or overfeed stokers and more particularly to sprinkler type stokers of the commercial type.

Recent years have seen a rapid growth in the development and manufacture of stokers of both commercial and domestic types and, as a result, a great many stokers are now in everyday use throughout the country. A large number of these stokers have not proven very satisfactory in actual operation, primarily because of not being designed to withstand the hard usage to which such apparatus is subjected, particularly commercial stokers. Commercial stokers are required to operate for long intervals without interruption, and may frequently be subjected to heavy loads in order to supply the demand for steam during peak periods. Unless a stoker is properly designed, it may not be capable of meeting the demand placed upon it. This may result in loss of economy, or may result in breakage, necessitating that the plant be temporarily shut down. It is also desirable in a stoker, that the operating parts thereof be so arranged and constructed that the stoker will be substantially noiseless in operation, as stokers are frequently operated in places where noise is extremely objectionable.

The novel sprinkler type stoker herein disclosed, has been designed to remove the objectionable features present in ordinary stokers. To facilitate installation, the stoker, including the motor for driving the same, is assembled as a unit, whereby the entire stoker may readily be secured to the steel plate front of a boiler at comparatively small cost, and without danger of the operating parts thereof becoming disalined, as when the various parts thereof are assembled independently of one another. Sturdiness of construction is reflected throughout the entire design of the stoker. It is provided with various control means which present the utmost in flexibility, whereby any condition met in the combustion field may readily be satisfied. The stoker is designed to provide at all times, the proper mixture of air and fuel for high efficiencies; suitable air ports being provided whereby air is drawn into the furnace adjacent the fuel delivery thereto, whereby an intimate mixture of air and fuel is provided which is of a highly combustible nature, resulting in high efficiencies and economy of operation.

The particular object of the invention, therefore, is to provide a sprinkler type stoker of simple and rugged constructon, which is extremely quiet in operation, and is so constructed as to present the utmost in efficiency and continuity of operation, and is extremely economical in operation.

A further object is to provide a sprinkler type stoker, all of the parts of which are assembled as a unit, including the motor and the driving mechanism for the stoker, whereby the stoker may be conveniently secured to the steel plate front of the boiler, as a single unit, and whereby the operating mechanism thereof is not likely to become disalined, when installing the stoker, or when the stoker is subsequently operated.

A further object is to provide a sprinkler type stoker comprising a rotor constructed of a plurality of sections interchangeably secured together to form a single unit, whereby sections having blades inclined to the axis thereof, may be substituted for other dissimilar sections, whereby the angle of inclination of the rotor blades may be varied to thereby cause the fuel being delivered into the furnace by the rotor to be spread over the fire bed in a direction laterally with respect to the rotor, and whereby the fuel may be evenly spread over the entire fire bed, even though the fire box is actually wider than the length of the rotor.

A further object is to provide a sprinkler type stoker comprising a feed plate disposed at an incline and adjustable with respect to the rotor, whereby the length of the fuel throw into the furnace may be varied to accommodate the particular type of furnace and coal with which the stoker is used.

A further object is to provide a sprinkler type stoker having a pivoted gate cooperating with the feed plate and feed shoe to control the feeding of the fuel into the furnace, said shoe being constructed of a plurality of sections each mounted for pivotal movement, whereby tramp iron and other foreign objects delivered into the stoker may pass therethrough without damaging the stoker, or causing it to cease operations.

Other objects reside in the unique construction of the rotor and the manner of mounting it upon its supporting shaft, whereby a dead air space is provided to prevent direct conduction of heat from the rotor to the shaft; in the specific construction of the gate which comprises a plurality of air ducts, whereby air may circulate therethrough and into the furnace, directly over the rotor, where it is intermixed with the fuel stream to thereby provide a highly combustible fuel mixture, and whereby combustion is greatly facilitated; in the novel arrangement and con-

struction of the feed shoe, which comprises a plurality of sections which may be operated simultaneously as a unit, or, if desired, independently of one another; and, in the simple and inexpensive construction of the control means, whereby the stoker is adapted for either manual or automatic operation, as may be desired.

Other objects of the invention will appear from the following description and accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a vertical sectional view on the line 1—1 of Figure 2, showing the construction of the fuel feeding means;

Figure 2 is a vertical sectional view, substantially on the line 2—2 of Figure 1, with some of the parts shown in elevation;

Figure 3 is a plan view of the structure shown in Figure 1, partially broken away, and showing the rotor adapted for spreading the fuel laterally beyond the length of the rotor;

Figure 4 is a detail sectional view showing a rotor composed of sections which are all alike, whereby the fuel delivered into the furnace will not be spread laterally beyond the length of the rotor;

Figure 5 is an enlarged detail sectional view showing the fuel feeding mechanism, including the feed plate and feed shoe, and also the feed gate mounted for pivotal movement whereby it may be tilted to permit tramp iron and other foreign objects to pass through the stoker;

Figure 6 is a detail sectional view substantially on the line 6—6 of Figure 5, showing the sectional construction of the feed shoe, and some of the parts being broken away to more clearly illustrate the means for controlling the operation of the sections thereof;

Figure 7 is a vertical sectional view on the line 7—7 of Figure 2, showing the driving means for the feed shoe positioned for maximum stroke;

Figure 8 is a detail sectional view on the line 8—8 of Figure 9, looking in the direction of the arrow and showing the parts adjusted to reduce the stroke of the feed shoe;

Figure 9 is a sectional plan view on the line 9—9 of Figure 7;

Figure 10 is an enlarged detail sectional view on the line 10—10 of Figure 7, showing the feed control mechanism; and

Figure 11 is a detail sectional view on the line 11—11 of Figure 10.

Stoker frame

In the selected embodiment of the invention here shown, there is illustrated in Figure 1, for purposes of disclosure, a portion of a conventional furnace, generally indicated by the numeral 2, and comprising a front wall 3 and a combustion chamber 4. The upper portion of the combustion chamber is shown defined by an inclined wall 5 having an air duct 6 therein communicating with an air trunk 7, whereby air is delivered into the fuel adjacent the fuel opening 8 provided in the front wall 3.

The novel stoker herein disclosed, is constructed as a unitary structure, and is shown adapted to be secured to the front wall 3 of the furnace by suitable bolts 9 received in suitable apertures provided in the flange 11 of the main frame of the stoker, generally indicated by the numeral 12.

The supporting flange 11 of the main frame of the stoker extends below the fuel opening 8, as best shown in Figure 1, and is provided with a hinged door 13, through which access may be had to the interior of the furnace. The door 13 is normally held closed by a suitable latch 14. A cylindrical chamber 15 is provided in the main frame of the stoker adjacent to the fuel opening 8, and has a removable casing 16, whereby access may be had to the interior thereof.

Rotor

An important feature of the novel stoker herein disclosed resides in the construction of the means for distributing the fuel over the fire bed. As best shown in Figure 1, such means consists of a rotor, generally indicated by the numeral 17, suitably secured to a shaft 18 mounted in suitable bearings, generally indicated by the numeral 19 in Figure 2. The rotor 17 may be composed of a plurality of straight sections 21 and angle sections 27 and 28; which are suitably secured together to provide a rigid structure, as illustrated in Figure 3. The sections 21, are mounted directly upon a tubular member 22, one end of which is fixedly secured to a flanged collar 23 which, in turn, is secured to the shaft 18, as best shown in Figure 2.

The opposite end of the tubular member 22 has a sleeve 24 fixedly secured thereto which is bored to receive the shaft 18. A suitable nut 25 is received in threaded engagement with the sleeve 24 and provides means for clamping the rotor sections 21 in position upon the tubular member 22, as will readily be understood by reference to Figure 2. A suitable spacing collar or sleeve 26 is provided intermediately of the ends of the tubular member 22 to retain the latter in axial alinement with the shaft 18. By thus supporting the rotor sections upon the shaft 18, a dead air space is provided between the shaft 18 and the tubular member 22 to thereby protect the shaft from the heat of the furnace.

In Figures 2 and 3, the rotor is shown provided at its ends with sections 27 and 28 which have their blades disposed at different inclines with respect to the axes of said sections, so that when said sections are secured in position upon the tubular member 22, the blades 29 formed by the rotor sections 21, 27, and 28, will be shaped as best shown in Figure 3. By thus shaping the ends of the rotor blades, the fuel engaged thereby will be thrown outwardly to the sides of the fire box, whereby the fuel may be spread over the entire fire bed. In Figure 4, the entire length of the rotor is shown composed of sections 21, whereby the blades 29 thereof will be parallel to the axis of the rotor their entire length. When thus arranged, the fuel delivered into the furnace by the rotor will cover an area, the width of which will be substantially equal to the length of the rotor. By assembling the rotor of sections with blades of different angles of inclination to the axis of the rotor, any desired spread of coal may be obtained.

Hopper and feed plate

A suitable fuel hopper 31 is supported in a bracket 32 secured to the front side of the main frame 12 of the stoker by suitable bolts 33. The hopper 31 has the usual throat 34, the bottom of

which is defined by an inclined feed plate 35 slidably supported in the lower portion 36 of the bracket 32, and mounted for relative adjustment thereon by a suitable adjusting screw 37, whereby the discharge end 38 of the feed plate may be varied with respect to the rotor 17, to thereby control the distance the fuel is delivered into the furnace. The adjusting screw 37 is rotatably mounted in a guide 39, preferably integrally formed with the lower portion 36 of the bracket 32. The guide 39 is shown provided with a cavity 41 adapted to receive a collar 42 suitably secured to the screw 37 by such means as a pin 43, whereby the screw cannot move axially with respect to the guide 39, but is free to rotate with respect thereto. The lower end of the screw 37 is received in a threaded engagement with a lug 44 suitably secured to the feed plate 35, whereby, when the screw is rotated, the feed plate will be relatively moved with respect thereto.

The opposite end of the adjusing screw 37 is shown having a suitable sleeve 45 loosely mounted thereon, which is supported between the guide 39 and a head 46 on the screw 37. The sleeve 45 is preferably square in cross-section, as shown in Figures 2 and 6, and is provided with suitable marks adapted to cooperate with an indicating member or pointer 47, secured to the outer end of the feed plate 35, to indicate the position of the inner edge 38 of the feed plate with respect to the rotor. From the foregoing, it will be noted that the feed plate may readily be adjusted from the front of the stoker by the simple manipulation of the head 46 of the screw 37, to thereby control the distance the fuel is delivered into the furnace.

Feed shoe

The means for feeding the fuel from the hopper into the furnace is shown comprising a feed shoe, generally indicated by the numeral 48. This feed shoe has a plurality of substantially vertical walls 49 and 51, arranged at different elevations and adapted to impinge against the fuel and shove it forwardly over the surface of the feed plate 35, as will readily be understood by reference to Figures 1 and 5. The feed shoe preferably comprises a plurality of similarly shaped sections 52, operatively connected to a rocker shaft 53 mounted in suitable bearings 54 in the bracket 32, as best shown in Figure 2.

The sections 52 of the feed shoe are shown operatively connected to the shaft 53 by forked arms 55, loosely mounted upon the shaft, and having their upper ends pivotally connected to a pair of links 56, the opposite ends of which are pivotally connected to the sections 52, as best shown in Figures 1 and 5. Thus, when the arms 55 are oscillated, reciprocal movement will be imparted to the sections 52 of the feed shoe, to thereby feed the fuel onto the rotor, as illustrated in Figure 1. The upper ends of the arms 55 are provided with curved bearing surfaces 57 adapted to be engaged by the lower edges of the flanges 58 provided upon the feed shoe sections 52, whereby a portion of the weight of said sections and the load carried thereby will be supported directly upon the arms 55, independently of the links 56.

The rearward ends of the feed shoe sections 52 are shown provided with suitable wearing plates 59, adapted to slide upon the upper surface of the feed plate 35, as clearly illustrated in Figure 5. The feed shoe sections are provided at their ends with upstanding flanges 61 which are guidingly supported in suitable guides 62 and 63 secured to the bracket 32, as best shown in Figure 2. The side guides 62 may be suitably secured to the walls of the bracket 32 by suitable bolts 64, and the center guide 63 may be integrally formed with the bracket 32, as shown.

The feed shoe sections 52 are operatively connected to the rock shaft 53, whereby they are adapted for either independent or simultaneous operation. To thus connect the sections 52 to the rock shaft 53, the hub of each arm 55 is shown provided with a suitable lug 65 having a pin 66 slidably mounted therein, one end of which is adapted to be received in an aperture provided in a lug 67 secured to a hub 68 which is suitably keyed or otherwise secured to the shaft, as shown, for example, at 69 in Figures 2 and 6. Suitable collars 71 are secured to the shaft 53 to prevent endwise movement of the arms 55.

Thus, it will be seen that the pins 66 operatively connect the arms 55 to the shaft 53 and, as hereinbefore stated, provide means whereby the shoe sections 52 may be operated independently of one another or simultaneously. By thus constructing the shoe 48 of a plurality of sections, and providing means whereby said sections may be operated independently of one another, or simultaneously, a greater range of control is provided, in that if it is desired to feed the fuel to one side of the furnace for the purpose of cleaning the other side, one of the shoe sections 52 may be disconnected from the shaft 53 by removal of the pin 66, whereby the fuel is delivered to only one-half the rotor for each stroke of the feed shoe. To seal the joint between the bottom of the hopper and the upper surfaces of the shoe sections 52, a suitable sealing member 72 is shown secured to the wall portion 73 of the bottom of the hopper, by suitable thumb screws 74, as best shown in Figure 5. The wall portion 73, in the present instance, is shown integrally formed with the bracket 32.

A suitable door 75 is pivotally supported upon a pivot casting 76, shown secured to the inclined wall 77 of the hopper, and normally conceals and protects the operating mechanism, above described. The pivot casting 76 is supported on a pivot 78 secured to the bracket 32. Thus, the hopper is pivotally supported at the front of the stoker, so that it may be tilted forwardly, as indicated by the dotted lines in Figure 1, whereby access may be had to the mechanism back of the hopper, which will subsequently be described.

Feed gate

Another important feature of the invention resides in the construction of the means for varying the depth of the fuel fed over the feed plate 35 to the rotor by the feed shoe 48. Such means is best shown in Figures 1, 2, and 5, and comprises a gate, generally indicated by the numeral 79. This gate comprises a plurality of sections 81 pivotally supported upon a tubular shaft 82 having its terminals supported on suitable blocks 83, adjustably supported upon threaded adjusting rods 84, rotatably supported in suitable bearings 85 provided in the side members of the main frame 12. The sections 81 of the gate 79 are shaped as best shown in Figures 1 and 5, and each has a vertical wall 86 slidingly engaged with an abutment 87 of the bracket 32. By referring to Figure 5, it will be noted that the axis of the hollow shaft 82 is disposed above the lower edge of the abutment wall 87, whereby said wall provides an abutment for the sections 81 to thereby normally retain them in their operative positions, as shown in full lines in Figure 5. Each gate section 81 is shown provided with a plu-

rality of air ducts 88, through which air is drawn into the furnace from the exterior thereof, as clearly illustrated by the arrows in Figure 1.

The gate sections 81 are mounted for pivotal movement, whereby tramp iron and other foreign objects which may be entrained with the fuel, may pass through the stoker without damaging the same, it being understood that when such foreign objects engage the upright wall portion 86 of any one or more of the gate sections 81, said section or sections will swing outwardly, as indicated by the dotted lines in Figure 5, and thereby permit such objects to pass through the stoker without damaging the same.

The means provided for vertically adjusting the gate 79 is best shown in Figures 1 and 2, and comprises suitable sprocket wheels 89 and 91 secured to the upper ends of the adjusting rods 84 and operatively connected together by a suitable chain 92. The sprocket wheel 91 is shown provided with a ratchet wheel 93 adapted to be engaged by means, not shown, provided upon an operating handle 94, whereby the sprocket wheel 91 may be rotated in either direction, to thereby rotate the screws 84, with the result that the gate is vertically adjusted.

Driving mechanism

The driving means for the rotor 17 and feed shoe 48 is best shown in Figures 2, 3, and 7 to 11, inclusive, and comprises a suitable gear casing 95, shown mounted directly upon the main bracket 12 of the stoker by a suitable bracket 96. The bracket 96 is shown secured to the main bracket 12 by suitable bolts 97, and to the gear casing 95 by bolts 98, one of which is shown in Figure 3. The gear casing 95 is shown provided with a suitable cover 99 suitably secured thereto and whereby convenient access may be had to the interior thereof. A suitable filler cap 100 is provided on the cover 99 for the introduction of a suitable lubricant into the casing 95.

A suitable coupling, generally indicated by the numeral 102, connects the rotor shaft 18 directly to one end of a suitable drive shaft 101, mounted in the gear housing 95. The drive shaft 101 has a sheave or pulley 103 secured to the opposite end thereof, exteriorly of the casing 95, and a belt 104 operatively connects the sheave to a variable speed pulley 105 secured to the shaft of a suitable motor 106. The variable speed pulley 105 is of well-known construction, and it is therefore thought unnecessary to herein describe the same in detail.

The motor 106 is shown mounted upon a suitable base 107 supported upon an arm 108, which has one end pivotally connected to a pair of lugs 110, shown provided upon the cover 99 of the casing 95. The opposite end of the arm 108 is forked to receive a flanged head 109 provided upon a member 111 having an operating handle 112, whereby it may be conveniently rotated. The member 111 is received in threaded engagement with a threaded stem 113, the lower end of which is secured to a block 114 pivotally mounted upon the cover 99 of the casing 95, as indicated at 115. By rotating the member 112 in one direction, the arm 108 will be elevated, whereby the motor is likewise elevated to tighten the belt 104.

The shaft 53 of the feed shoe 48 is coupled to a rocker shaft 116 by a suitable coupling 117. The rocker shaft 116 is rotatably mounted in a suitable bearing 119 and has a reduced terminal 121 supported in a bearing 122 within the gear casing 95. The rocker shaft 116 is squared between the bearings 119 and 122, as best shown in Figure 7 to receive a forked arm 123 which is suitably secured thereto, as shown in Figure 7. A forked link 124 has one end pivotally connected to the arm 123 and a suitable pin 125 is mounted in the opposite end of the link 124, and is shown provided at its ends with suitable collars 126 adapted to slide between guides 127 and 128 provided in an oscillatable member 129, supported within the casing 95. The member has its upper end mounted upon a pivot pin 131 secured in the casing 95, as best shown in Figure 9.

A slide 132 is mounted for reciprocal movement in guides 133 provided in the member 129, as best shown in Figure 8. The slide 132 is provided with oppositely disposed inclined stepped edges 134 adapted to be engaged by a V-shaped block 135, mounted upon the pivot pin 125 supported in the forked link 124. The member 129 is oscillated by an eccentric 136 secured to a shaft 137 which is driven from the drive shaft 101 by a suitable train of gears, generally indicated by the numeral 138, whereby the eccentric shaft 137 will rotate at a relatively lower rate of speed than the drive shaft 101.

As a result of the geared connection between the drive shaft 101 and the shaft 137, the latter will rotate continually when the stoker is operating and will thereby continually oscillate the member 129, whereby an oscillating movement is imparted to the forked arm 123, because of its connection with the link 124 of the member 129. To vary the amount of fuel fed into the furnace for each stroke of the feed shoe, the degree of oscillation of the forked arm 123 is varied. In other words, when the maximum amount of fuel is fed into the furnace per stroke of the feed shoe, the forked arm 123 is oscillated its maximum stroke, and when less fuel is required, the stroke of the forked arm 123 is shortened which, of course, directly effects the reciprocal movement of the feed shoe because of its operative connection therewith through the coupling 117.

To thus vary the degree of oscillation of the forked arm 123 and therefore the stroke of the feed shoe 48, the slide 132 in the member is mounted for longitudinal adjustment, whereby the inclined edges 134 thereof may be moved with respect to the V-shaped block 135. In Figure 7, the slide is shown adjusted to impart maximum movement to the forked arm 123, wherein it will be noted that the oppositely disposed inclined edges of the V-shaped block 135 is engaged with both of the inclined edges 134 of the slide 132, whereby no lost motion is permitted between the block 135 and the inclined edges 134 of the slide. When the slide is thus positioned, the arm 123 will be operated at its maximum stroke. When it is desired to feed less fuel into the furnace, the slide 132 is relatively moved in the member 129 in a direction towards the pivot pin 131, as best shown in Figure 8, whereby a lost motion is provided between the inclined edges 134 of the slide and the V-shaped block 135, thereby reducing the stroke of the arm 123 and therefore, the stroke of the feed shoe 48.

Control means

The means provided for relatively adjusting the slide 132 in the member is best illustrated in Figures 3, 7, 10, and 11, and comprises a rocker

shaft 138 mounted in a suitable bearing 139 in a wall of the casing 95, as best shown in Figure 10. This rock shaft has at one end, a crank arm 141 to which is secured a block 142 slidably supported in an arcuate guide groove 143 provided in the slide 132, as best shown in Figure 8. The curvature of the guide groove 143 is in the form of an arc struck approximately from the axis of the pivot pin 131 so that the member 129 may oscillate without imparting any relative movement to the slide 132 thereof.

To the opposite end of the rock shaft 138, there is secured a lever 144 having a suitable opening 145 adjacent its upper end adapted to receive a quadrant bar 146, one end of which is pivotally connected to an arm 147, the lower end of which is loosely mounted upon the rock shaft 138. The bar 146 has a plurality of spaced notches 148 adapted to engage a suitable pin 149 traversing the lower portion of the opening 145 of the lever 144. A latch member 151 is pivotally mounted in the arm 147 and has its lower end 152 adapted to be received in a notch 153 provided in the upper edge of a plate 154, mounted for relative rotary movement upon the hub of the arm 147. The plate 154 has a link 155 connecting it to an arm 156 secured to a shaft 157 mounted in suitable bearings which may be provided within or on the gear casing 95. One end of this shaft may be connected to a suitable automatic control, not shown in the drawings.

The upper end of the latch member 151 is shown provided with a suitable projection 158 adapted to be selectively received in a plurality of notches 159, 161, and 162, provided in a portion of the bracket 96 which provides the connection between the main frame of the stoker and the gear casing 95, as shown in Figure 3. When the latch member 151 is engaged with one of the notches 159, 161, or 162, as best shown in Figure 10, the control mechanism is adapted for manual operation. When the latch 151 is positioned for manual operation, the slide 132 is relatively adjusted in the member 129 by oscillating the lever 144, which is normally retained in adjusted position by the notched bar 146 engaging the pin 149 thereof.

When the adjusting lever 144 is positioned as shown in Figures 7 and 11, the slide 132 is positioned to impart maximum movement to the arm 123 of the rock shaft 116. To relatively adjust the slide 132 in the member 129, the adjusting lever 144 is moved in a direction towards the right, when viewed as shown in Figures 7 and 11, which may readily be accomplished when the notched bar 146 is moved upwardly to free the pin 141 therefrom. The notched bar 146 is shown provided with a suitable hand grip 163, whereby it may be conveniently manipulated, as will readily be understood by reference to Figure 7.

When the latch member 151 is in the notch 159, the parts are positioned for maximum movement of the rock shaft 53 and may be adjusted from maximum within predetermined limits by manipulation of the adjusting arm 144, with respect to the notched bar 146. When the latch member is shifted from the notch 159 to notch 161, the lever 144 and arm 147 are swung forwardly to intermediate position, whereby relative adjustment of the lever 144 with respect to the arm 147, and within the limits of the notches in the bar 146, may vary the rocking movement of the shaft 153, because of the slide 132 then being positioned to cause a lost motion to obtain between the V-shaped block 135 and the inclined edges 134 of the slide 132. In like manner, when the latch member 151 is moved into locking engagement with the notch 162, minimum rocking movement may be imparted to the shaft 53, whereby the feeding of the fuel into the furnace may be reduced to minimum. Thus, it will be seen that the above described mechanism provides means whereby the feeding of the fuel into the furnace may be controlled at will. The mechanism also is so arranged that it may be used for either manual or automatic operation, which is desirable in the operation of stokers, in that it is often desirable to control their operation automatically, while at other times, it may be deemed more desirable to manually control their operation.

Operation

In the operation of the novel stoker herein disclosed, the fuel is delivered into the hopper 31 in the usual manner.

The amount of fuel delivered into the furnace may readily be controlled by manipulation of the control lever 144 and arm 147, as hereinbefore described, which controls the operation of the feed shoe. The spreading of the fuel over the fire bed is controlled by adjustment of the feed plate 38 and the speed of the rotor. All of these adjustments may be conveniently made while the stoker is in operation as they are readily accessible, as clearly illustrated in Figures 2 and 3. Because of the motor being supported directly upon the main frame of the stoker, it becomes, in effect, an integral part thereof, and provides a unitary structure which may readily be secured to the wall of a furnace without danger of any of the working parts of the stoker becoming disalined, thereby assuring that the stoker will always operate with minimum friction and substantially without vibration. Also, because of the operating mechanism of the stoker, including the gear train 38 and the member 129, and its associated parts, operating in a bath of oil within the gear case 95, these parts are substantially noiseless in operation, which is a very desirable feature in the operation of a stoker.

I claim as my invention:

1. In a stoker, a rotor, a fuel hopper, an inclined feed plate forming the bottom of the hopper having its discharge end positioned over the rotor, means mounted for reciprocating movement over the feed plate for feeding fuel from the hopper to the rotor, a gate mounted for vertical adjustment with respect to the bottom wall, and whereby the amount of fuel delivered to the rotor per stroke of the feeding means may be varied, means whereby the gate may be swung in the direction of fuel travel, when engaged by a foreign object entrained with the fuel to thereby prevent damage to the stoker, and said gate being provided with openings permitting the circulation of air therethrough.

2. In a stoker, a rotor, a fuel hopper, a plate forming the bottom of the hopper and having its discharge end positioned over the rotor, a reciprocating feed shoe mounted over said plate to feed fuel from the hopper to the rotor, an air-cooled gate vertically adjustable to limit the amount of fuel delivered to the rotor per stroke of the feed shoe, and means pivotally supporting the gate whereby the latter may yield, when engaged by tramp iron and other foreign objects entrained with the fuel, to thereby permit such foreign objects to pass through the stoker without damaging the same.

3. In a stoker, a rotor, a fuel hopper having a

bottom wall whose discharge end is positioned over the rotor and is adjustable with respect thereto, a reciprocating feed shoe mounted over said bottom wall to feed fuel from the hopper to the rotor, a vertically adjustable gate for controlling the amount of fuel delivered to the rotor per stroke of the feed shoe, and means pivotally supporting the gate whereby the latter may swing in the direction of fuel travel, when engaged by tramp iron and other foreign objects, thereby to permit such foreign objects to pass through the stoker without damaging the same, said gate having a plurality of air ducts therein for the admission of air into the fuel adjacent the rotor to facilitate combustion.

4. In a stoker, a rotor, a fuel hopper having a bottom wall whose discharge edge is positioned over the rotor, means for feeding fuel from the hopper to the rotor, a horizontally pivoted gate having its lower edge spaced from said bottom wall to provide an elongated feed opening, means for vertically adjusting said gate to vary the size of the feed opening and thereby control the amount of fuel fed from the hopper to the rotor by the fuel feeding means, and said gate comprising a plurality of sections independently movable to permit tramp iron and other foreign objects to pass through the feed opening without damaging the stoker.

5. In a stoker, a rotor, a fuel hopper, an inclined feed plate forming the bottom of the hopper and having its discharge edge positioned over the rotor, means mounted for reciprocating movement over the feed plate for feeding fuel from the hopper to the rotor, a gate mounted for vertical adjustment with respect to the bottom wall and comprising a plurality of pivoted sections adapted to swing about a common horizontal axis, said gate limiting the amount of fuel delivered to the rotor per stroke of the feeding means, and said gate sections being adapted to yield independently of one another, thereby to permit foreign objects to pass through the stoker without damaging the same.

6. In an overfeed stoker, a rotor, a fuel hopper, an inclined feed plate forming the bottom of the hopper and having its discharge edge positioned over the rotor, means mounted for reciprocating movements over the feed plate for feeding fuel from the hopper to the rotor, a gate mounted for vertical adjustment with respect to said bottom wall and whereby the amount of fuel delivered to the rotor per stroke of the feeding means may be varied, means pivotally supporting the gate whereby it may yield when engaged by a foreign object entrained with the fuel, thereby to prevent damage to the stoker, and means for driving said feeding means, comprising a suitable mechanism operable within an oil tight housing.

7. In an overfeed stoker, a fuel hopper, a rotor, a shaft for the rotor, means for feeding fuel from the hopper to the rotor, the intermediate portion of said rotor being composed of a plurality of sections each having a plurality of blades disposed in substantially parallel relation to the axis of the rotor, and the blades of said sections being alined lengthwise of the rotor and cooperating to provide elongated unbroken blade portions extending a substantial length of the rotor, and other rotor sections having blades disposed at an angle to their axes and constituting the end portions of the rotor, said end sections having their blades abuttingly engaged with the blades of said intermediate section, whereby the end portions of the effective blades of the rotor are rearwardly inclined to the direction of rotation, thereby to spread the fuel outwardly to the sides of the fuel bed.

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