No. 840,723.

PATENTED JAN. 8, 1907.

W. H. STROUSE.

MECHANICAL STOKER.

APPLICATION FILED FEB. 19, 1906.

3 SHEETS—SHEET 1.

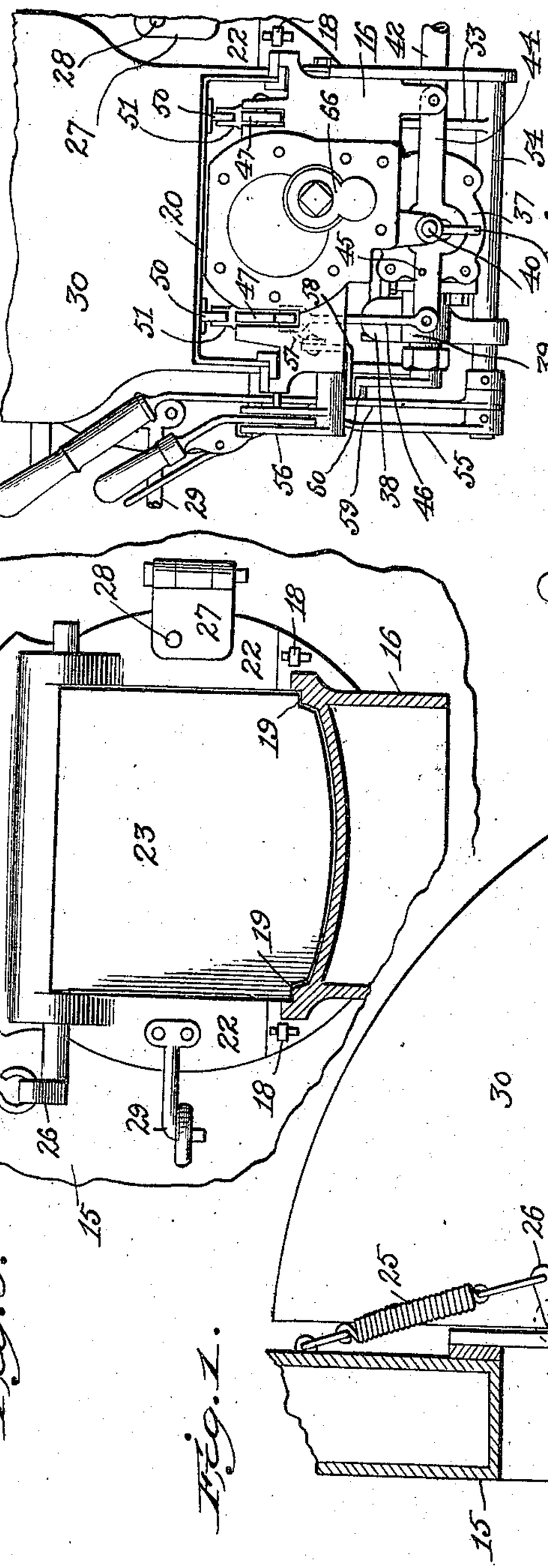


Fig. 2.

Fig. 3.

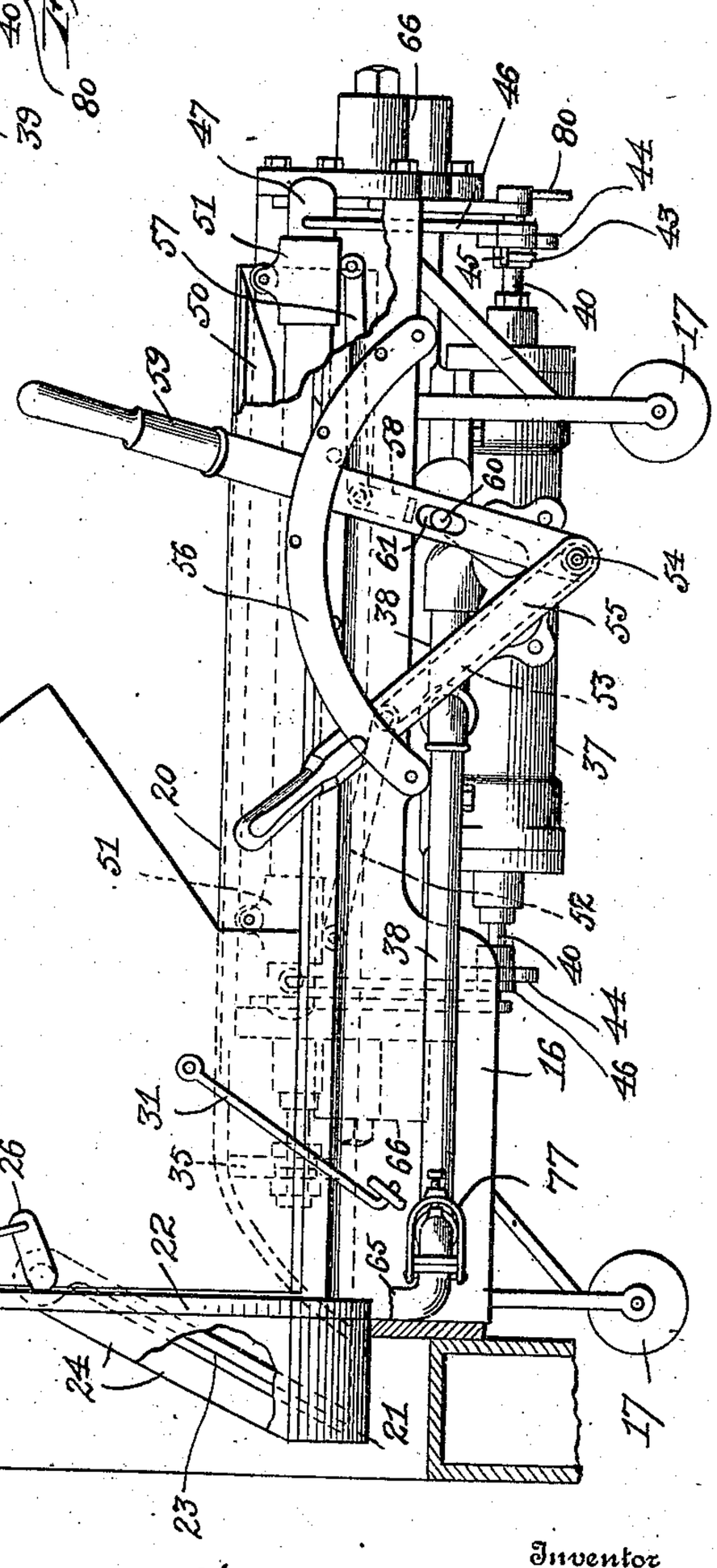


Fig. 1.

Witnesses
Edwin L. Jewell
Thomas Durant

Inventor
William H. Strouse,
By Church & Church
his Attorneys

No. 840,723. PATENTED JAN. 8, 1907.

W. H. STROUSE.

MECHANICAL STOKER.

APPLICATION FILED FEB. 19, 1906.

3 SHEETS—SHEET 2.

Fig. 4.

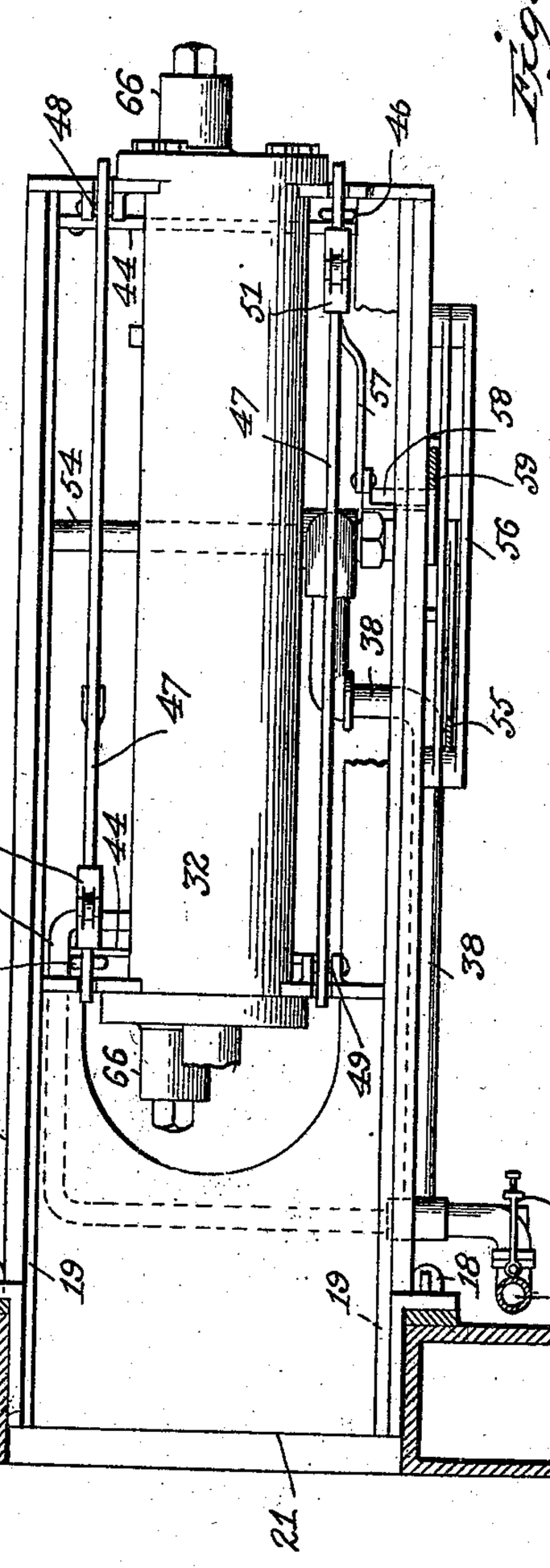


Fig. 7.

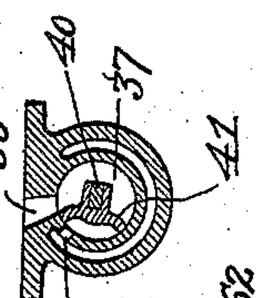


Fig. 6.

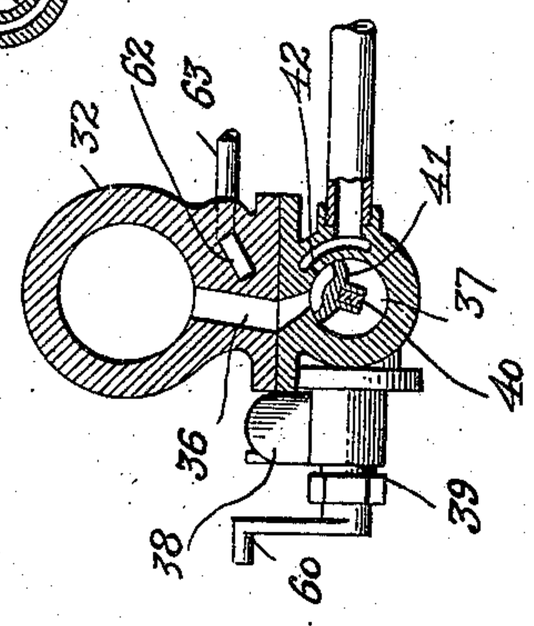
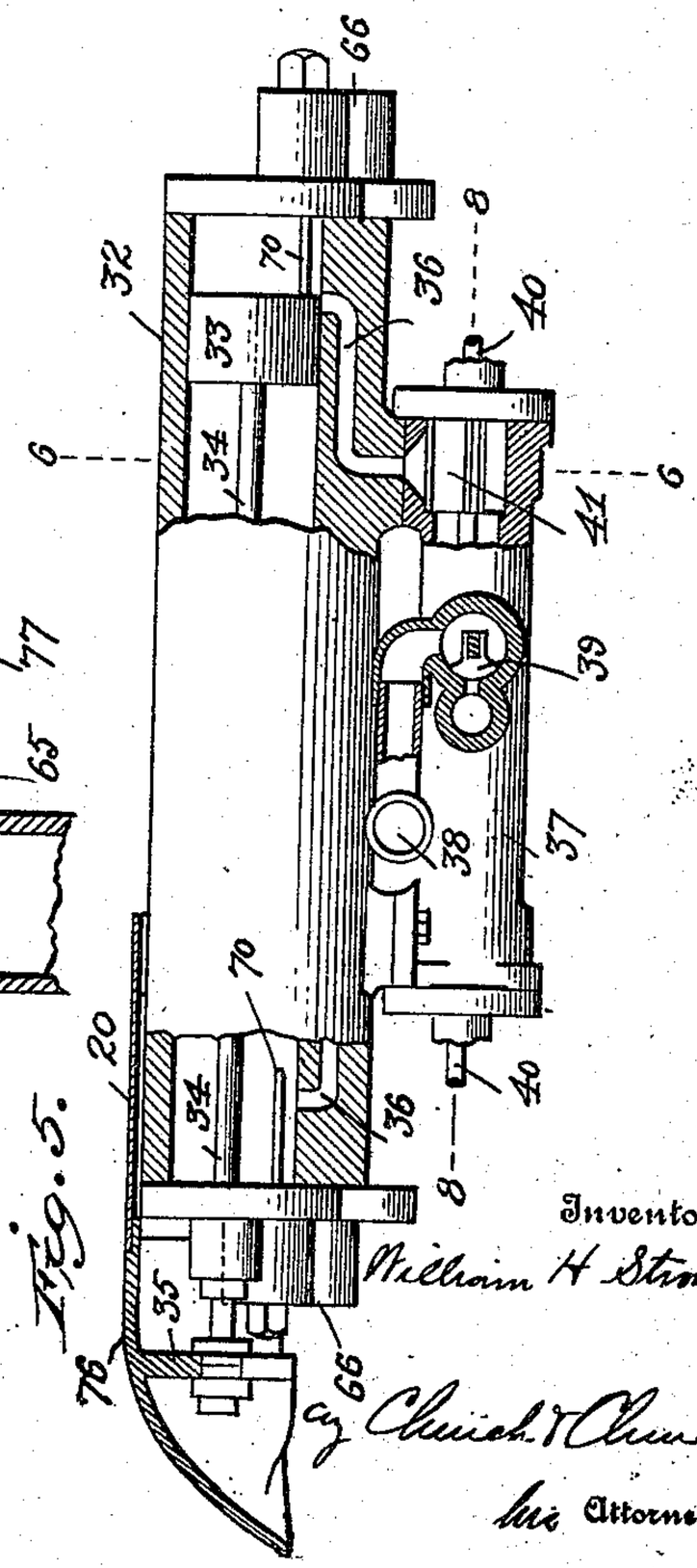


Fig. 5.



Witnesses

Edwin L. Yewell

Thomas Durant

Inventor

William H. Strouse

by Church & Church

his Attorneys

No. 840,723.

PATENTED JAN. 8, 1907.

W. H. STROUSE.

MECHANICAL STOKER.

APPLICATION FILED FEB. 19, 1906.

3 SHEETS—SHEET 3.

Fig. 9.

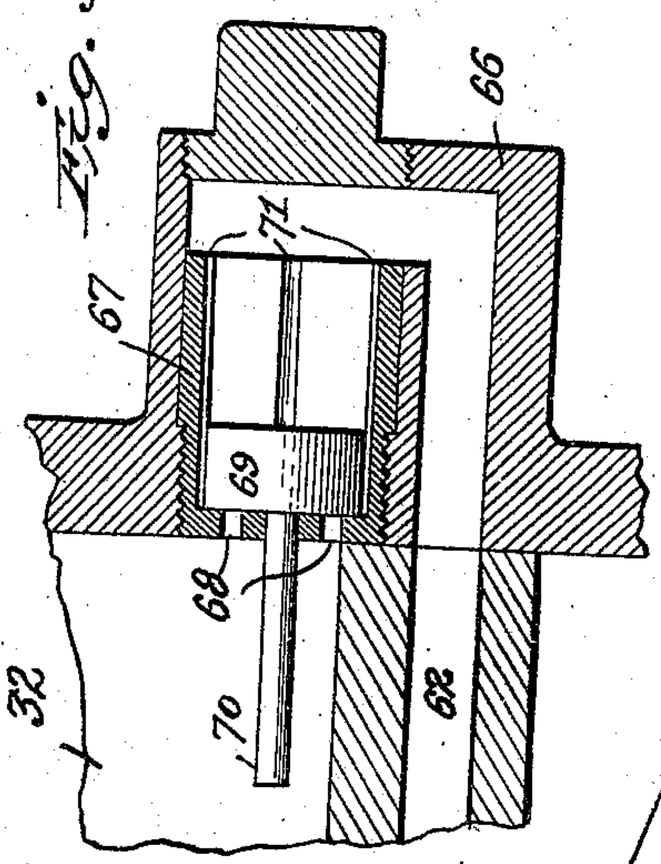
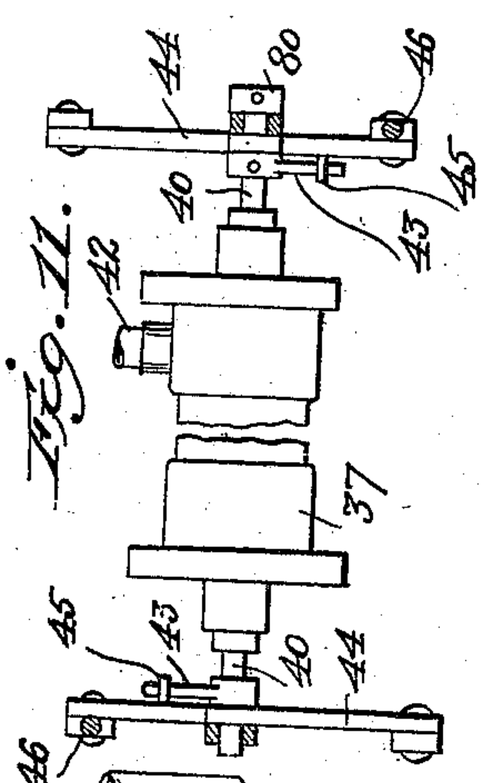


Fig. 11.



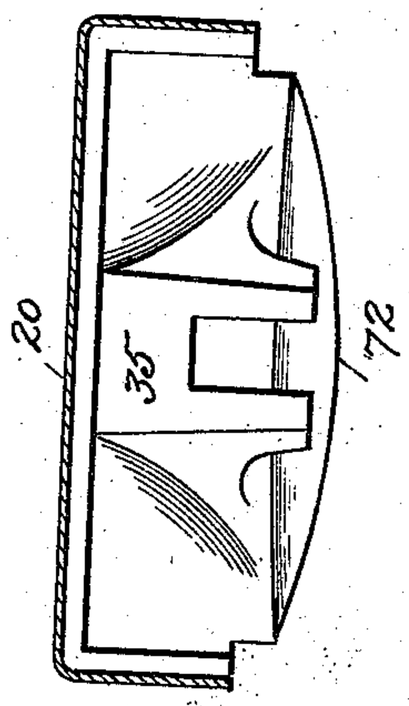


Fig. 13.

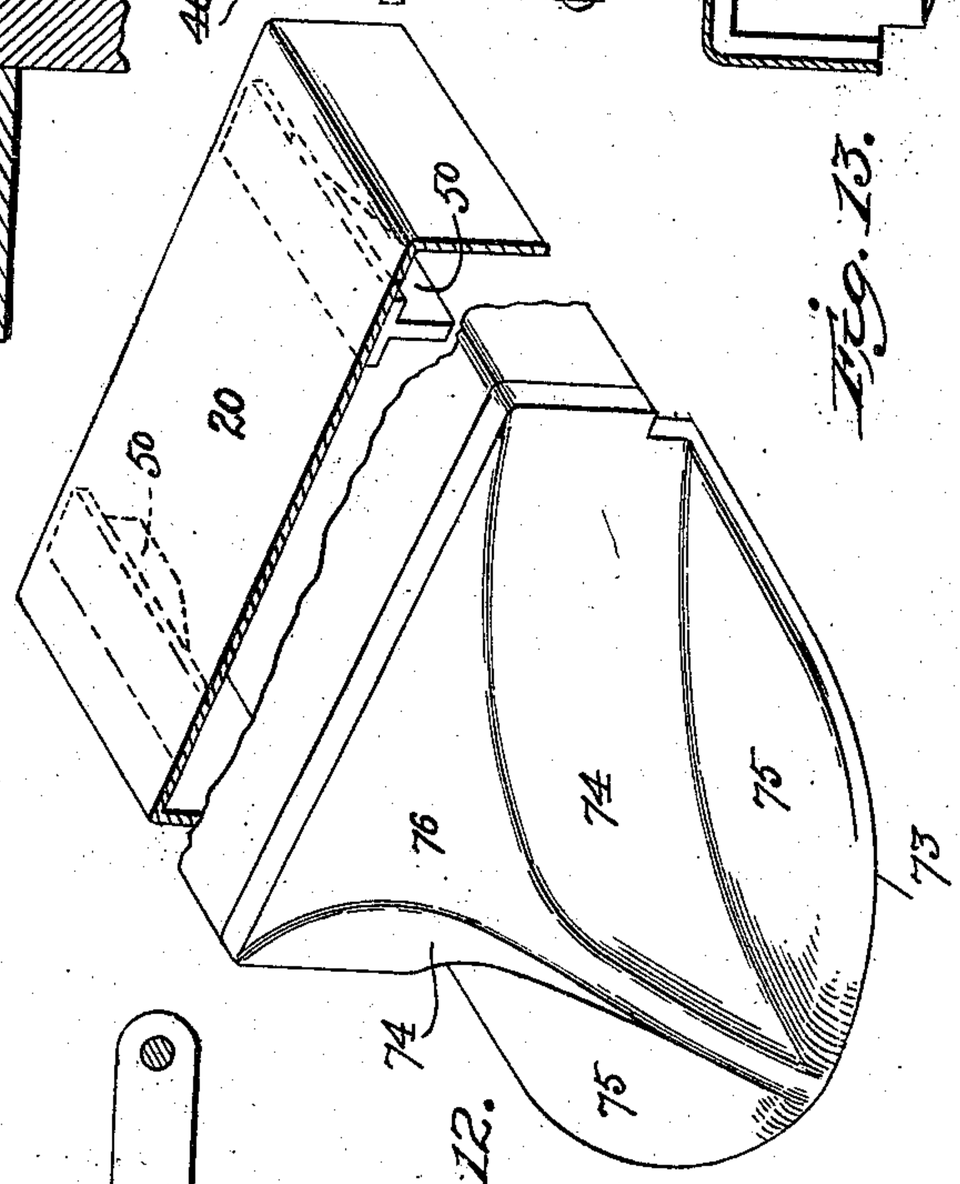


Fig. 12.

Fig. 8.

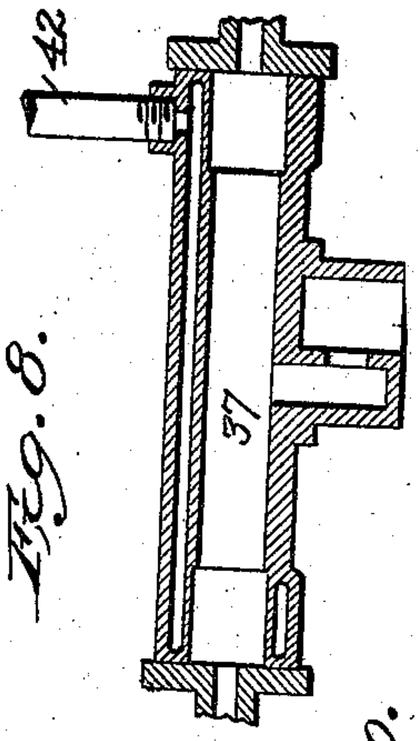
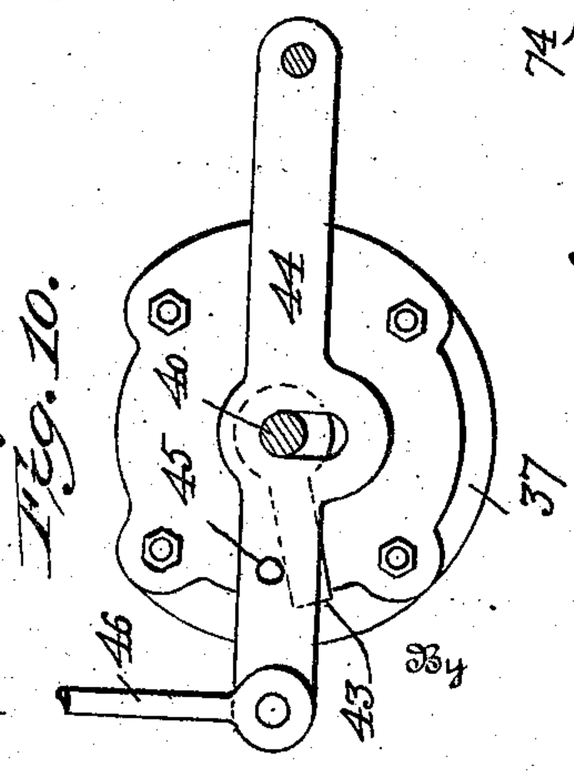


Fig. 10.



Witnesses

Edwin L. Yewell

Thomas Durant

Inventor

William H. Strouse

By Church & Church

his Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM H. STROUSE, OF OSKALOOSA, IOWA, ASSIGNOR TO W. H. STROUSE MANUFACTURING COMPANY, OF OSKALOOSA, IOWA, A CORPORATION OF IOWA.

MECHANICAL STOKER.

No. 840,723. Specification of Letters Patent. Patented Jan. 8, 1907.

Application filed February 19, 1906. Serial No. 301,826.

To all whom it may concern:

Be it known that I, WILLIAM H. STROUSE, a citizen of the United States, residing at Oskaloosa, in the county of Mahaska and State of Iowa, have invented certain new and useful Improvements in Mechanical Stokers; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures of reference marked thereon.

This invention relates to mechanical stokers of that type adapted particularly, though not exclusively, for use on locomotive-engines, the objects of the invention being to provide a simple and practical form of stoker well calculated to withstand rough usage and to handle with equal facility all grades of fuel, which stoker may be applied to or used in connection with locomotive fire-boxes as at present constructed without material alteration in the fire-box itself or the parts associated therewith.

A further object of the invention is to provide a stoker which will automatically and under effective manual control distribute the fuel uniformly over the entire grate-surface.

The invention consists in certain novel details of construction and combinations and arrangements of parts, all as will be now described, and pointed out particularly in the appended claims.

Referring to the accompanying drawings, Figure 1 is a side elevation, partly in section, of a stoker embodying the present improvements mounted in position before the front wall of a locomotive-furnace, which front wall is shown in section. Fig. 2 is an elevation looking at the outer end of the stoker, certain non-essential parts being omitted or broken away. Fig. 3 is a detail sectional elevation showing the door-frame and door with the bed of the stoker in section. Fig. 4 is a top plan view of the parts shown in Fig. 1, with the hopper, reciprocatory plunger, and stoker-door frame omitted, the front wall of the furnace being shown in horizontal section. Fig. 5 is an elevation, partly in section, through the reciprocatory plunger and its operating cylinder and piston, this view also showing the valves for controlling the admission and exhaust ports of the cylinder. Fig. 6 is a vertical section on the line 6 6 of Fig. 5. Fig. 7 is a detail vertical section through the opposite end of the valve and valve-chest from that shown in Fig. 6. Fig. 8 is a horizontal section through the valve-chest alone, the valves being omitted. Fig. 9 is a detail vertical section through a portion of one end of the operating-cylinder to show the supplemental inlet ports and valves. Fig. 10 is an enlarged elevation of one end of the valve-chest to illustrate details of the valve-operating mechanism. Fig. 11 is a plan view, partly broken away, showing further details of the valve-operating mechanism. Fig. 12 is a perspective view, partly broken away, of the reciprocatory plunger. Fig. 13 is a transverse section through the plunger to show the head or nose in rear elevation.

Like reference-numbers indicate the same parts in all the figures.

A fragment of the front wall of a locomotive fire-box having the usual fire-door or fuel-opening therein is indicated in the accompanying drawings by the number 15. The stoking mechanism of the present invention is adapted to be brought into registry with the fuel-opening and in such relation that the fuel will be carried through the opening and projected by the stoking mechanism into the fire-box and evenly distributed over the grate-surface. The stoking mechanism is preferably removably mounted in front of the fire-box, for which purpose the body or main operating parts are preferably carried on a frame 16, having casters or wheels 17 to facilitate the movements to and from the fuel-opening. When in place, it is locked rigidly to the front of the fire-box by lugs 18, passing through openings in side flanges of the frame, as shown in Figs. 2 and 3, cotters or pins being passed through the lugs 18 to retain the stoking mechanism in position. The frame 16 embodies a bed having ways or guides 19, Fig. 3, for a reciprocatory plunger 20, the forward portion of the bed 19 being curved downwardly at the center, as shown in Fig. 3, and extended within the fuel-opening in the form of a projection 21, the side flanges and edges of which register with a temporary door-frame 22, in which a door 23 is hinged near its upper edge. The door 23 is when in

its closed position inclined to the vertical, as best shown in Fig. 1, and inwardly-projecting flanges 24 on the door-frame 22 serve as the side walls between which the door is adapted to pass when swinging from its closed to its open position, or vice versa. The door itself is preferably made relatively light in order to overcome the effects of inertia and momentum, and it is maintained in its closed position with its lower edge against the projection 21 of the frame by a spring 25, anchored at its upper end and connected at its lower end with a crank-arm 26 on the pintle of the door. The door-frame, together with the door, are preferably held in position by a hinge-plate 27, Fig. 3, to which the door-frame is connected by a horizontal pin 28, the opposite side of the frame being held by a hook and staple 29, whereby, when desired, the door-frame, together with the door, may be lifted to disengage the hook and staple 29 and then turned away from the opening to permit of free access to the fire-box without the necessity of moving the stoking mechanism proper.

Surmounting the forward portion of the frame 16 and surrounding the fuel-opening is a hopper 30, into which the fuel is dumped by any suitable means, such as a conveyer or by shoveling, and this hopper is preferably removably held in place by fastenings or hooks 31 at each side. The relation of the hopper and door 23 is preferably such that when the hopper is filled or partially filled with fuel and the plunger retracted the fuel will pass down in front of the plunger, and by reason of the inclination of the door the fuel will not cause a sufficient pressure against the door itself to open the same, and at the same time by reason of such inclination of the door the body of fuel lying in front of the plunger will be partly within the fuel-opening of the furnace, and forward movement of the plunger will cause the immediate opening of the door with an expenditure of the least possible power.

Power mechanism is provided for giving the plunger a rapid reciprocation from its retracted position (indicated in Fig. 1) forwardly until its nose or fuel-projecting end passes into the fire-box to a greater or less extent, as desired by the fireman or as required by the configuration of the fire-box or fuel conditions of the grate. The power mechanism referred to is preferably in the form of a cylinder 32, located in rear of the nose of the plunger well up within the side flanges of the rear end of the plunger and a piston 33, working in the cylinder and connected by a rod 34 with the central web 35 in the nose of the plunger. Steam for reciprocating the piston is admitted through inlet and exhaust ports 36 from a valve and steam chest 37, to which steam is supplied from the boiler through a pipe 38, leading to a throttle-valve 39 on one side of the steam and valve chest. While any desired type of valve for controlling the admission and exhaust ports may be employed, that adopted for illustration in the present device is an oscillatory valve having a valve-rod 40, projecting at each end of the valve-chest, and valve-heads 41, adapted by the oscillation of the rod to put the ports 36 alternately into communication with the live-steam space of the valve-chest, as shown in Fig. 7, or with the exhaust-port 42, as shown in Fig. 6. Thus when the valve-stem is oscillated in one direction the port 36 at one end of the cylinder is open to steam from the boiler and that at the opposite end is open to exhaust, and vice versa.

To effect the automatic operation of the valve in accordance with the movements of the plunger, the valve-stem is provided with projecting arms 43 at its opposite ends, and vertically-swinging levers 44, pivoted at opposite sides of the frame, are provided with pins or projections 45 for coöperation with the arms 43. Extending vertically from the free ends of the levers 44 are links 46, connected at their upper ends with long levers 47, located on opposite sides of the cylinder, as shown in Fig. 4, one pivotally mounted in the frame at 48 near the outer end of the cylinder and the other pivotally mounted in the frame at 49 near the inner end of the cylinder. Depression of one or the other of the levers 47, it is thus obvious, will move the valve in one direction or the other, and in order to effect the depression of the levers in accordance with the movements of the plungers the said plunger is provided with oppositely-arranged inclines 50 at its rear end, (see Figs. 1 and 12,) which inclines are adapted to contact with movable projections or blocks 51 on the levers 47, said blocks or projections 51, as shown in Fig. 4, being located near the free ends of said levers, but capable of a movement thereon to vary the stroke of the plunger, as will be presently described.

Obviously antifriction-rollers may be mounted on the projections 51, and in operation as the plunger reaches the outer extreme of its movement the incline 50, coöperating with the projection 51, depresses the lever 47, thereby shifting the valve to change the relation of the inlet and exhaust ports, so that the piston will be advanced, and as the plunger reaches the opposite extreme of its movement the other lever 47 is similarly depressed to reverse the valve and cause the piston and plunger to move in the opposite direction, these movements being continued so long as the proper relation of the parts is preserved.

It is obvious that by making the projections 51 movable on the levers 47 the valve may be caused to shift at different points in the stroke of the plunger, and this is utilized, first, to vary the forward movement of the

plunger as desired in order to project the fuel a greater or less distance into the fire-box, and, secondly, to insure the stopping of the plunger when its motion is to be arrested only when in its retracted position.

To shift the projection 51, controlling the forward movement of the plunger, it is connected by a link 52 (shown in dotted lines in Fig. 1) with an arm 53 on a rock-shaft 54, carrying on its outer end a hand-lever 55, adapted to be locked in adjusted position by an ordinary locking-pawl coöperating with a segment 56 on the frame. Obviously by moving the hand-lever 55 the projection 51 will be shifted, and as this hand-lever controls the forward movement of the plunger it preferably has a relatively wide range of movement, so that the plunger may be projected much or little, as desired.

For shifting the projection 51 at the outer end of the cylinder it is connected by a link 57 with an arm 58 on a hand-lever 59, journaled on the rock-shaft 54, and this hand-lever 59, in addition to controlling the position of the projection 51, is also adapted to control the throttle-valve 39, for which purpose the said throttle-valve is provided with a crank-arm 60, the crank end of which projects through a slot 61 in the lever 59. The relation of the parts is preferably such that as the lever 59 is moved in a direction to close the throttle-valve and cut off steam from the valve-chest and cylinder such movement will prior to the closing of the valve shift the projection 51 out of range of the incline 50, and consequently when the plunger reaches the rear extreme of its movement the exhaust and admission valve will not be shifted, and the plunger will come to rest in this position just prior to the closing of the throttle.

As heretofore stated, the plunger is adapted to be operated at a relatively high speed, and hence provision for preventing undue shock at the ends of its movements is desirable. Practice has demonstrated that this can best be accomplished by admitting live-steam pressure in front of the piston just prior to the time when it reaches the extreme of its movement, and in the preferred construction this live steam, which serves as a cushion and as a means for arresting the movement of the plunger and piston, is admitted by a valve mechanism entirely independent of the valve mechanism heretofore described. As a most convenient arrangement the cylinder is provided with a long live-steam passage 62 in communication, through a pipe 63, Fig. 4, with the supply-pipe 65, leading from the boiler. At each end of the pressure-chamber 62 and in suitable housings 66 on the heads of the cylinder are valve-casings 67, having ports 68 leading directly into the ends of the cylinder. Piston-valves 69 are mounted in the valve-casings 67 and are adapted to close the ports 68 when in their inner position, as shown clearly in Fig. 9, under which conditions no steam can enter the cylinder from the live-steam chamber. Each valve is provided with a stem 70, projecting into the cylinder and in position to contact with the piston as the latter reaches extremes of its movement, whereby the valve will be opened for the admission of pressure in front of the piston. As shown in Fig. 9, the valve-casings 67 are provided with longitudinal grooves 71 to permit of the passage of steam past the valve 69 when the latter is pushed outwardly. Thus the valve itself may be accurately fitted to the casing and the necessity of employing bearings for maintaining the valve-stem in alinement is avoided.

To effect the proper distribution of the fuel thrust through the fuel-opening beneath the door, the forward end or nose of the plunger is given a configuration which will in a measure support the fuel or a portion thereof against dropping directly down and at the same time impart to the fuel or a portion thereof a lateral impulse, so as to effect distribution to the sides of the furnace. The formation of the preferred type of nose-piece for projecting the fuel is best shown in Figs. 12 and 13, and by reference to these figures it will be seen that the lower or under face 72 of the nose-piece is curved downwardly to conform to the curvature of the bed, as shown in Fig. 3. The forward edge of the nose-piece is curved or rounded, as shown at 73 in Fig. 12, while from the center of the forward edge two deflecting faces 74 curve upwardly and outwardly to the top and sides of the plunger. The base of the nose-piece forward of the curved deflector 74 and forwardly-extending flanges 75 constitute the supporting portion of the nose-piece before referred to, while the upwardly and outwardly curved deflecting-faces 74, which come substantially to a point at the center of the plunger, constitute the means for projecting the fuel laterally to the sides of the furnace, as before indicated.

To prevent any possibility of clogging and to facilitate the opening and closing of the door, the upper side or face 76 of the nose-piece is curved down to meet the base at the forward end, as shown in Figs. 1 and 5.

The steam connection between the pipes 38 and 65, the former being movable with the stoking mechanism and the latter being connected with the boiler, is preferably effected by a detachable coupling, as shown at 77, although it will be obvious that a flexible pipe or any well-known form of coupling may be employed, and in case the stoking mechanism is mounted permanently in position before the fire-box the steam connection may be of a permanent character.

In operation the throttle-valve is normally kept open sufficiently wide to effect a very

rapid reciprocation of the plunger entirely irrespective of the length of the throw, inasmuch as it is desired that the fuel shall be projected by the plunger as distinguished from being merely pushed forward and allowed to drop into the fire-box or being delivered to a separate and independent projecting or deflecting mechanism. Should an insufficient quantity of fuel reach the inner end of the fire-box, the range of movement given the plunger may be increased, and should the quantity of fuel at the front of the fire-box be insufficient the range of movement imparted to the plunger may be decreased without arresting its movements and without manipulation other than to change the time of shifting the valve by proper adjustment of the hand-lever 55.

Should it be desired, the hopper 30 may be removed from its position and the door, together with its frame, lifted and swung off to one side, thereby giving access to the furnace without the necessity of moving the body of the stoker, and, on the other hand, should it be desired to remove the stoker this may be accomplished by removing the pins from the lugs 18, disconnecting the steam-coupling 77, and drawing the whole stoking apparatus, including the hopper, away from in front of the furnace. The door-frame under such circumstances will remain in place, and the door itself swinging down into vertical position will close the fuel-opening, so as to prevent the access of air, or, if so desired, the door, together with its frame, may be removed by disconnecting its hinged plate 57 from the ordinary hinge-lugs on the furnace-front and the regular furnace-door substituted, as will be readily understood.

It will be noted that when the plunger is at rest, with the throttle-valve closed and the projection 51 at the rear end of the cylinder out of engagement with the incline 50, a reverse or forward movement of the lever 59 will first bring the projection 51 into engagement with the incline, thereby moving the admission and exhaust valve into proper position to admit pressure at the rear end of the cylinder, and thus the valve is, in effect, shifted manually to inaugurate the movements of the plunger. Should it be desired to manipulate the inlet and exhaust valve by hand, a hand-lever 80 is provided on the end of the valve-rod 40 to facilitate this operation.

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

1. In a mechanical stoker, the combination of a reciprocatory plunger having a fuel-projecting nose at its forward end provided with outwardly and rearwardly curved deflecting-faces and a power mechanism for imparting reciprocations to said plunger.

2. In a mechanical stoker, the combination of the reciprocatory plunger having a fuel-projecting nose at its forward end embodying outwardly and rearwardly curved deflecting-faces and fuel-supporting flanges projecting forwardly at the lower edges of said deflecting-faces; substantially as described.

3. In a mechanical stoker, the combination of a reciprocatory plunger having a fuel-projecting nose at its forward end embodying a downwardly-curved upper surface, laterally-curved deflecting-faces with their forward portions meeting at substantially the center of the nose and base-flanges integral with said nose and extending forwardly from the deflecting-faces.

4. In a mechanical stoker, the combination with the bed having the downwardly-curved forwardly-projecting portion, a reciprocatory plunger guided on said bed and having a fuel-projecting nose at its forward end provided with a downwardly-curved under surface and rearwardly and outwardly extending deflecting-faces, of a power mechanism for reciprocating said plunger, a hopper for supplying fuel in front of said plunger and a pivoted door through which the fuel is carried by the plunger; substantially as described.

5. In a mechanical stoker, the combination with the hopper, of the reciprocatory plunger working through the base of said hopper and having a fuel-projecting nose at its forward end embodying a downwardly-curved convex upper surface and laterally-inclined side faces and a door hinged at its upper edge and adapted to contact with the downwardly-curved upper surface of the plunger; substantially as described.

6. In a mechanical stoker, the combination with the door-frame, the door hinged thereto at its upper edge and supported in an inclined position when closed and a means for holding said door closed with a yielding pressure, of a plunger mounted to reciprocate in line with the door-opening and having a fuel-projecting nose at its forward end embodying a downwardly-curved convex upper surface with which the under edge of the door is adapted to contact; substantially as described.

7. In a mechanical stoker, the combination with the reciprocatory plunger having the fuel-projecting nose at its forward end and the cylinder and piston for moving said plunger, of a valve mechanism controlling the admission and exhaust ports of the cylinder, embodying an oscillatory valve, oppositely-arranged levers for oscillating said valve in opposite directions and coöperating inclines and projections on the plunger and levers respectively, for moving one or the other of said levers as the plunger reaches opposite extremes of its movements.

8. In a mechanical stoker, the combina-

tion with a reciprocatory plunger having a fuel-projecting nose at its forward end and a cylinder and piston for reciprocating said plunger, of a valve controlling the exhaust and admission ports of the cylinder and a valve-gear embodying an oscillatory valve-rod, oppositely-projecting arms on said rod, levers coöperating with said arms, oppositely-arranged levers extending substantially parallel with the line of plunger movement, links connecting said last-mentioned levers and valve-operating levers, and coöperating projections and inclines on the levers and plunger respectively for shifting one or the other of said levers as the plunger reaches the extremes of its movement.

WILLIAM H. STROUSE.

Witnesses:
W. H. KEATING,
J. E. WHITAKER.