Feb. 28, 1939. W. T. HANNA 2,148,461

REGULATING MECHANISM FOR LOCOMOTIVE STOKER ENGINES

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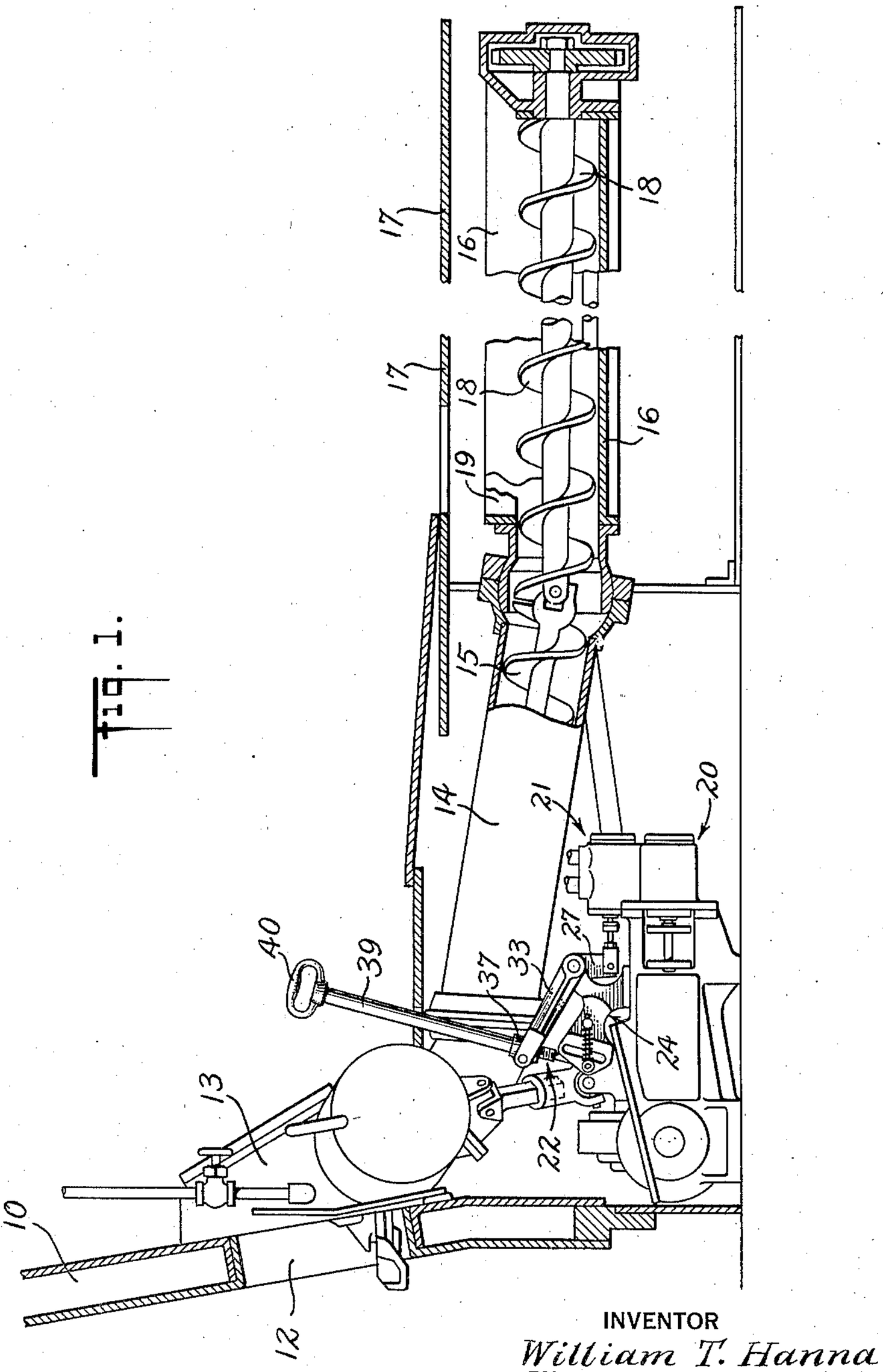

Fig. 1.

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Fig. 3.

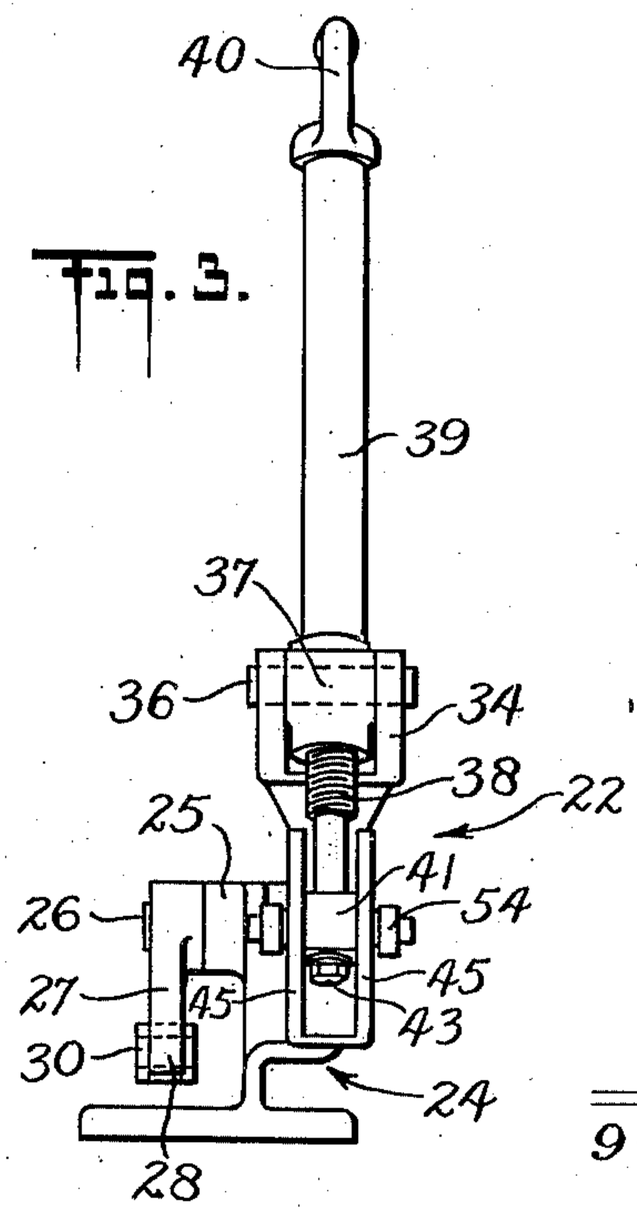

Fig. 2.

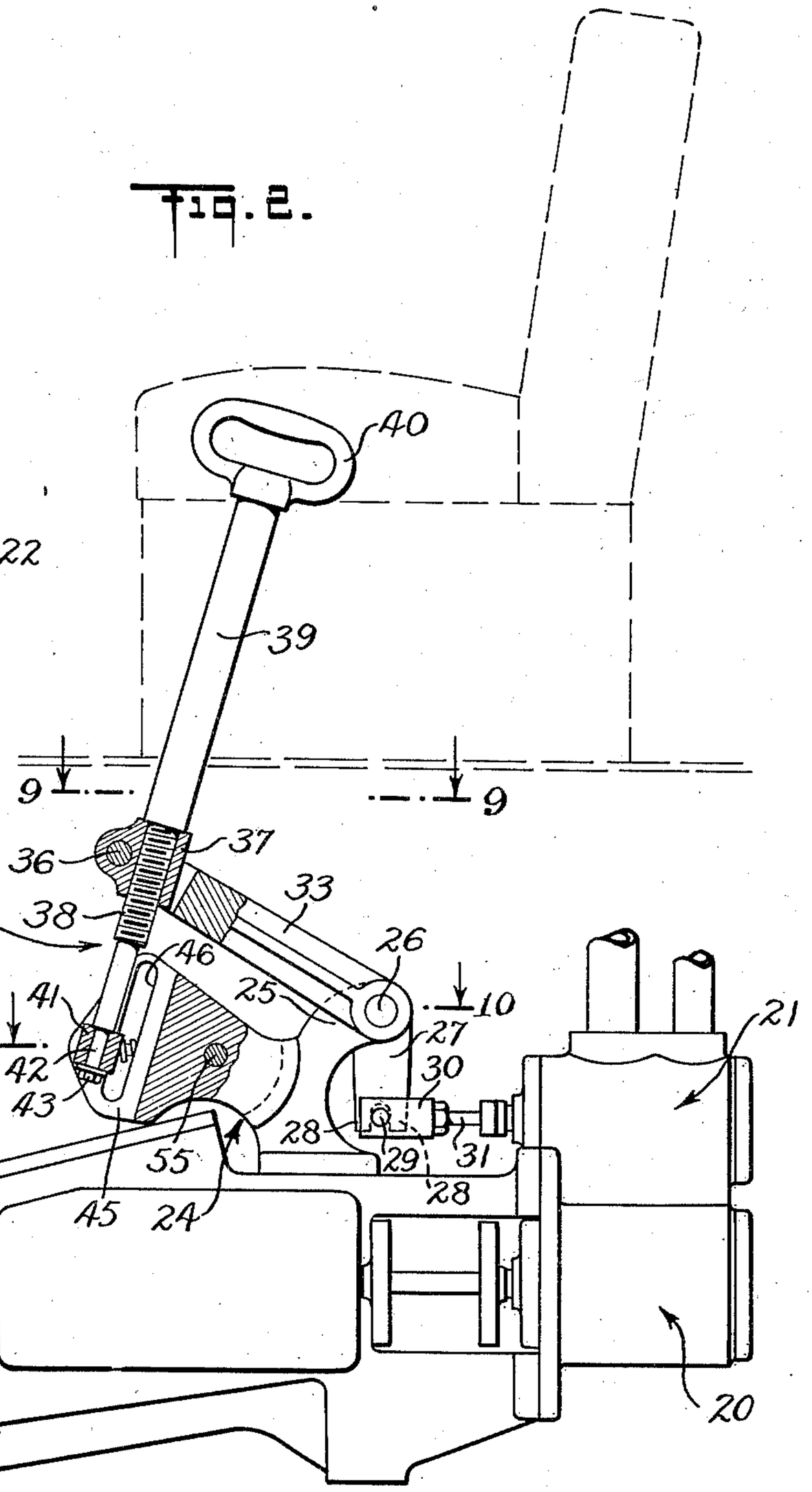

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Fig. 4.

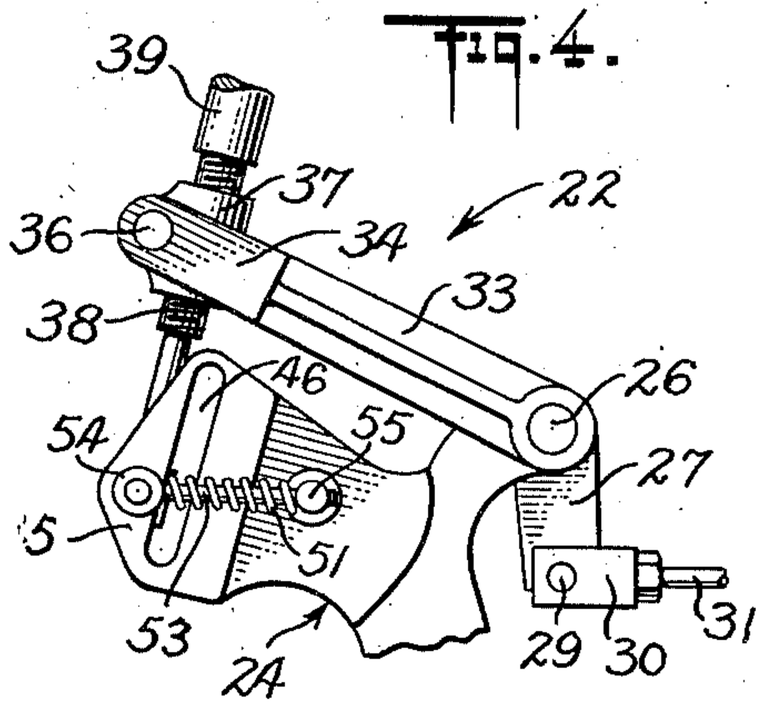


Fig. 5.

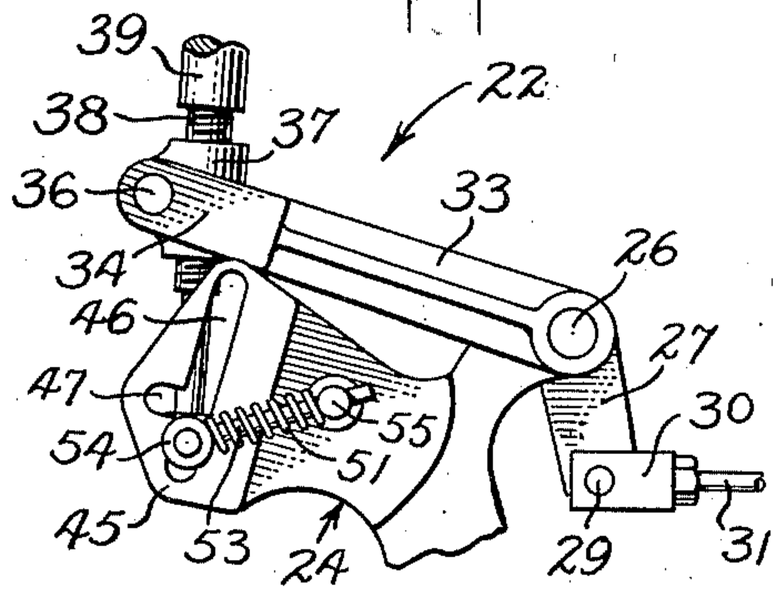


Fig. 6.

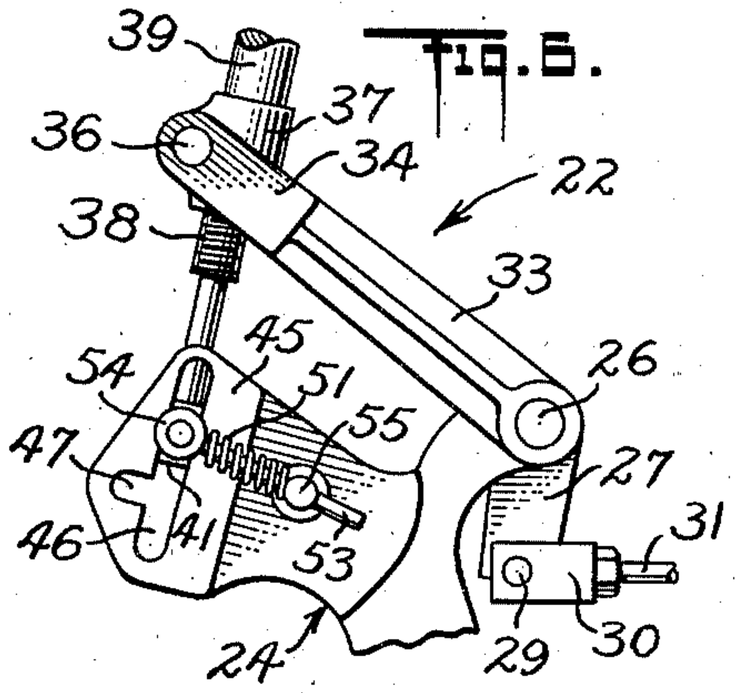


Fig. 7.

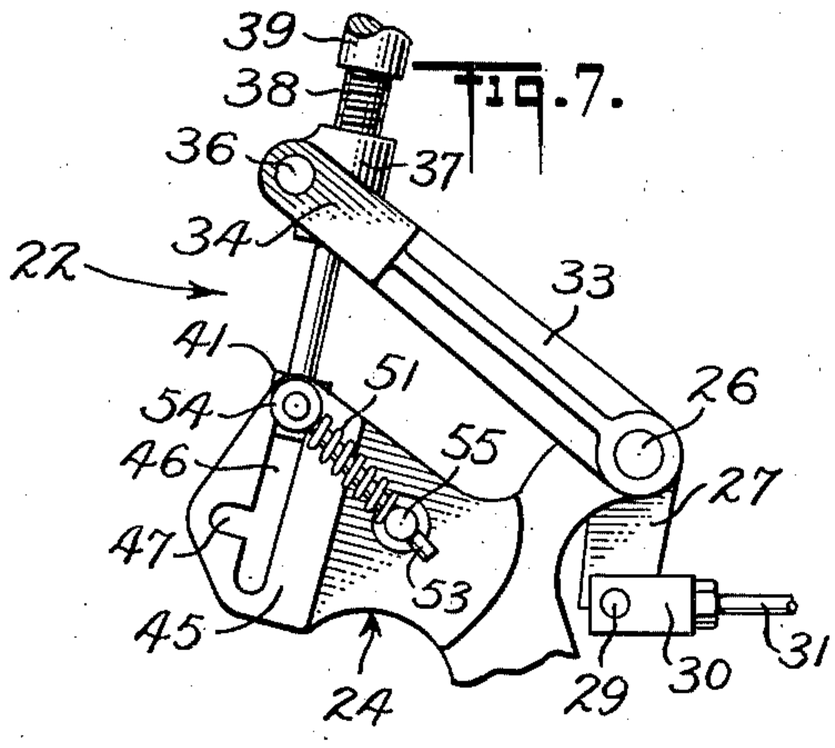


Fig. 9.

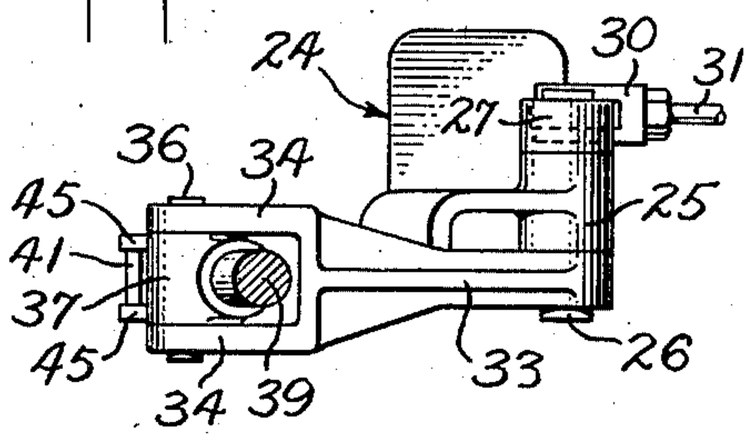


Fig. 8.

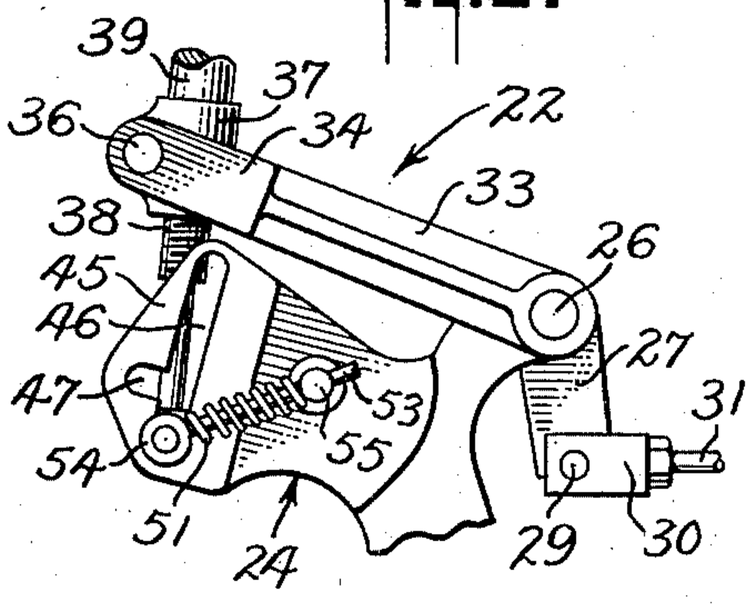
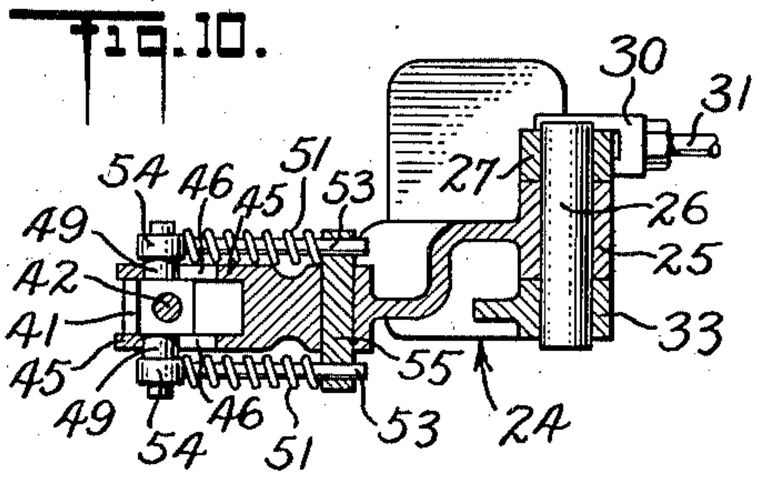


Fig. 10.



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REGULATING MECHANISM FOR LOCOMOTIVE STOKER ENGINES

William Thompson Hanna, Cincinnati, Ohio

Application January 5, 1935, Serial No. 496

10 Claims. (Cl. 121—138)

This invention pertains to control mechanism for engines, for example, of the type driven by the flow and expansion of a fluid, and more particularly to control mechanism for an engine driving a stoker.

In the present embodiment chosen to illustrate the invention, the control is applied to a steam engine driving a locomotive stoker. Many unusual demands are made on an engine used for this purpose because of factors such as continually varying conditions of short duration superimposed on varying conditions of longer duration. Locomotives are generally stoked with "run-of-mine" coal consisting of lumps of various sizes, pieces of stone, iron, wood, etc. The lumps flow from the locomotive tender into a hopper where they are crushed by a crusher driven by the engine. Thence the crushed fuel is conveyed by mechanism (driven by the engine) to the locomotive fire-box where it is distributed over the fire-bed.

Usually, while a locomotive is making a "run", there are parts of the "run" where for a considerable period of time the load demand on the locomotive is approximately constant although it may be different for each part. During this period the fuel demand is also constant and so is the demand on the stoker engine. Consequently, control mechanism which can readily and accurately move the necessary parts against friction and inertia, to supply the stoker engine with the amount of steam comparable to the then existing demand on the locomotive is desirable.

In the present embodiment one part of the control mechanism is capable of fine manual adjustment, with accuracy and ease, to move frictionally held, relatively heavy parts to the proper position, and is designed to remain so set until conditions change, when it is again readily adjustable to a new position. And this is accomplished smoothly without over-adjustments which might raise the fuel flow above or reduce it below that desired.

If such a fine adjustment is not readily obtainable the fireman in charge will be called upon to execute a tedious manipulation of the control mechanism to arrive at the desired point of adjustment. This consumes time and interferes with his other duties. Indeed, in some instances he may be forced to leave the control out of adjustment and cause a fuel waste.

But over such a period of uniform fuel demand an exceptionally large lump, or foreign materials, such as rocks, pieces of iron, etc., in the coal may slow up or stop the crusher and stoker, and to clear the stoker of these obstructions the full capacity of the driving engine should be available immediately. Then once the obstructions are overcome, the previously existing setting and conditions should be immediately re-established. If this rapid adjustment is not available, the engine and stoker may be stopped before sufficient pressure is supplied to the engine to clear the obstruction; and then when it is cleared there may be a sudden oversupply of fuel to the firebox, causing smoke and loss of fuel before the engine is throttled to the desired adjustment.

The mechanism of the present embodiment is capable of this rapid adjustment and readjustment. Indeed it is an object of the present invention to provide a control mechanism which meets these desirable conditions of operation. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and in the scope of the application which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of the various possible embodiments of this invention;

Figure 1 shows partly in elevation and partly in vertical longitudinal section a locomotive stoker mechanism, an engine for driving the stoker, and engine control mechanism embodying the present invention;

Figure 2 is an enlarged view of the control mechanism, all the parts being shown in neutral position;

Figure 3 is a rear elevation of the control mechanism of Figure 2;

Figure 4 is a detailed elevation of the control mechanism with the fine adjustment mechanism moved with the valve to an intermediate forward-speed position, and the release mechanism in neutral position;

Figure 5 is a view similar to Figure 4 but showing the release mechanism moved to extreme forward-speed position.

Figure 6 is a detail showing the fine adjustment mechanism in neutral position but the release mechanism moved to extreme reverse position;

Figure 7 is a detail showing the fine adjustment mechanism in full forward-speed position but the release mechanism in full reverse-speed position;

Figure 8 is a detail showing the fine adjustment mechanism in neutral position but the release mechanism in full speed forward;

Figure 9 is a horizontal section taken on line 9—9 of Figure 2; and

Figure 10 is the horizontal section taken on the line 10—10 of Figure 2.

Corresponding reference characters refer to corresponding parts throughout the several views of the drawings.

Turning now to the left side of Figure 1 of the drawings, a locomotive stoker such as might be run by an engine controlled by my invention is illustrated as attached to a back head 10 of a locomotive having a firing opening 12. Communicating with firing opening 12 is a housing 13 of the stoker provided with mechanism for distributing over the fire-box fuel flowing through the housing. The housing 13 is supplied with fuel by a suitable conduit 14 and screw conveyer 15, communicating with a hopper 16 mounted beneath floor 17 of the locomotive tender. The hopper 16 also has a screw conveyer 18 and crushing mechanism 19 for crushing fuel prior to its passage to conduit 14. An engine generally indicated at 20, and described in detail in my Patent No. 1,969,265, drives the various moving parts of the stoker through suitable connections. Rotation of screw conveyers 18 and 15 causes fuel to move from the tender through hopper 16, past the crusher 19, through the conduit 14, and into the housing 13, whence it goes to the fire-box.

As above mentioned, fuel usually used for locomotives comprises "run-of-mine" coal containing lumps of various sizes, the crushing of which causes momentary increased power demands on the engine. Except when a general congestion results caused by extremely large lumps or foreign material, an especially designed throttling valve, shown covered by a housing and generally indicated at 21, varies the power output of the engine to maintain a substantially constant operation of the engine at any desired speed regardless of small variations in the power demand. This throttling valve, as described fully in my said Patent No. 1,969,265, meets the varying power demand and maintains the desired operation of the motor by a novel arrangement for throttling the intake and exhaust steam flowing to and from the stoker engine.

For accomplishing a fine adjustment of this valve as desired against the usual relatively high starting friction, or for moving it quickly to full forward or reverse positions when the occasion demands, I have shown for purposes of illustrating my invention control mechanism generally indicated at 22. This control mechanism will now be described in detail.

Referring to Figures 1 and 2, mounted above the engine cylinders and the gear mechanism is an upwardly projecting support generally indicated at 24, and provided, as shown at the right side of Figures 2, 9 and 10, with a bearing support 25 in which is rotatably mounted a shaft 26 forming part of a bell crank arrangement. Secured as by a key to the far end of shaft 26 is a crank 27 bifurcated at its lower end to form yoke arms 28 which receive a pin 29 preferably mounted between arms of a yoke bar 30 preferably secured as by nut and screw to rod 31 extending from the throttling valve 21. Thus, rotation of shaft 26 produces through this pin and yoke connection a horizontal reciprocation of the throttling valve. Other types of mechanical connection may, of course, be used.

Secured to the end of shaft 26 opposite crank 27 is a second crank 33 forming the last member of a bell crank arrangement comprising cranks 33 and 27, and shaft 26. The support 24 previously described is preferably cut away and bent at the base to leave ample space for the movement of crank 33. This crank is preferably bifurcated at its free end to form yoke arms 34 between which is pivotally mounted, as by means of a pin 36, an internally threaded nut 37. This nut receives a threaded portion 38 of an operating lever 39 having at its upper end a handle 40 preferably extending above the floor of the locomotive and to a point conveniently accessible to the fireman's seat. The lower end of lever 39 is releasably secured to the base or support 24 in such a manner that the lever may be freely turned about its longitudinal axis by the handle 40 to thread the nut 37 up or down threaded portion 38 of the lever 39, thereby bodily moving the nut and pivoting the bell crank arrangement about shaft 26. This movement of the nut and bell crank produced by turning the lever 39, shifts the horizontal position of valve 21. With this control mechanism it is possible to execute a fine adjustment of the valve. For purposes of description this fine adjustment mechanism will be hereinafter referred to as the micro-adjustable mechanism.

The lower end of lever 39 is releasably secured to support 24 by a cubical block 41 (Figures 2 and 10) bored to receive in a loose fit a reduced portion 42 on the lower end of lever 39. The block 41 is held in position on lever 39 by means of a nut and washer 43.

Referring again to the support 24, the upwardly extending portion opposite the bearing 25 is bifurcated and provided with yoke arms 45 constructed to receive between them, in a sliding fit, the block 41. To limit the movement of the block 41 between the yoke arms, each arm has an elongated slot 46 and a hollow recess notch 47, preferably perpendicular to the elongated slot. For registering with these slots, block 41 has sidewardly extending detents 49. These detents slide in the slots 46. It is thus seen that the movement of the lower end of the lever 39 is limited by the movement of block 41, but that the lever may be freely rotated about its longitudinal axis or pivoted about an axis formed by the pin 36. However, the end of the lever 39 is normally releasably secured in one position with respect to the support 24. This position is the one assumed when the detents 49 are in the recess notches 47.

The detents 49 are held in the recesses 47 (Figure 4) by compression springs 51, mounted over guide rods 53 preferably rotatably attached to the detents, Figure 10, by collars 54 to which the rods are suitably rigidly attached. The other ends of the rods slide through holes provided in opposite sides of a pin 55 mounted in a suitable hole in support 24.

The secured end of manipulating lever 39, however, may be released by pushing handle 40 and the lever forwardly pivoting it about pin 36 in crank 33, to compress springs 51 and release or disengage the detents 49 from the locked position in the recesses 47. With the detents free of the recesses 47, lever 39 may be bodily pulled up to move the throttling valve into full reverse position (Figures 6 and 7), or may be pushed down to move the throttling valve into maximum forward position (Figures 5 and 8).

Referring to Figures 1 and 2, the throttling control mechanism valve 22 is shown in neutral position, i. e., it is completely shutting off the steam to the engine. The nut 37 is threaded to the top of the threads 38. Now to open the valve to supply steam to cause the engine to

move ahead, the valve is moved to the right as viewed in these figures. As it is moved farther from neutral position, the steam supplied to the engine is increased and the engine speed is increased to the desired point. The valve is thus moved, against the friction of the packings, etc., by the micro-adjustable mechanism, i. e., by turning handle 40 in a counter-clockwise manner. This causes nut 37 (Figure 4) to thread down the lever 39, the reduced end 42 turning freely in the block 41, now locked with the lever 39, by detents 49 in their respective recesses. As the nut threads down, it carries the crank 33, which rotates shaft 26 and crank 27 in a counter-clockwise manner and forces valve 21 to the right. The high mechanical advantage obtained between the nut 37 and lever 39, and the long crank arm 33 and short arms 27, enables the operator to set the valve to a fine adjustment.

If now after the parts have been adjusted as described, the stoker is slowed or stopped by a momentary congestion, the operator has only to grasp handle 40, push it forward pivoting lever 39 about pivot 36 to release the lower end of the lever. Then (Figure 5) by pushing down he may move the lever down and place the valve in full speed forward position for as long as is desired. It is noted that the detents do not move to the lowermost end of slot 46 when the mechanism is in this position of adjustment (i. e., with the micro-adjustable mechanism set in an opened position) because the nut 37 has already been moved part way about pin 26 in support 24, and the remaining movement to put valve 22 in full speed forward would not take the detents to the base of the slots. In Figure 8 the mechanism is shown in full speed forward with the micro-adjustable mechanism in neutral position. Note that now the detents are at the base of the slots which are made sufficiently deep to permit of this full speed forward position from neutral position.

Returning now to the adjustment shown in Figure 2, or for the adjustment shown in Figure 4, if it is desired, the operator may release the mechanism to move it to full speed reverse as shown in Figure 6. Note here that the detents do not rise to the top of the slots because the nut 37 starting from neutral or half speed forward position does not have to be raised as much as when starting from full speed forward position. Figure 7 shows the reverse position when the micro-adjustment is set for full speed forward.

After the parts have been thus released for the emergency they are immediately reset to normal locked position of adjustment by pulling up or pushing down on the lever 39, as the case may be.

As various embodiments might be made of this invention, and as various changes might be made in the construction herein described, all without departing from the scope of the invention, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In an engine control for a locomotive stoker, in combination, a steam engine, and a throttle valve controlling the rate of supply of steam to the engine movable to extreme positions of full speed ahead, full speed reverse, and to intermediate forward positions, manually operable micro-adjustable valve operating means for effecting fine adjustments of said valve in said intermediate forward positions, and manually operable valve operating release mechanism operating from a normally locked position to move quickly the valve to either of its extreme positions to place the engine in full speed forward or full speed reverse as the emergency may require and thus manually operative to return automatically the valve to the position determined by the micro-adjustable means setting existing before the manually operable release mechanism was operated.

2. In an engine control for a locomotive stoker, in combination, an engine for driving the stoker, a throttle valve controlling the supply of steam to the engine and movable to extreme positions of full speed forward and full speed reverse and to intermediate forward positions, manually operable micro-adjustable valve operating means for effecting fine adjustments of said valve in said intermediate forward positions and manually operable valve operating means superimposed on said micro-adjustable means operative from a neutral position to move freely the valve to either of its extreme positions independently of said micro-adjustable means without disturbing the adjustment of said micro-adjustable means upon return of said manually operable superimposed means to its neutral position.

3. In an engine control system for a locomotive stoker, in combination, an engine for driving said stoker, and a throttle valve controlling the application of power to the engine, manually operable means for positioning said valve comprising a manually operable lever, a bell crank one end of which is mechanically connected to said throttle valve, and the other end of which is adjustably secured by a threaded engagement to the lever intermediate its ends, whereby rotation of said lever adjusts the relationship between said lever and bell crank and changes the position of the throttle valve, and means for securing said lever against axial movement during the adjustment of said threaded engagement but releasable to free the lever to move the bell crank through the threaded adjustment but independently of the threaded adjustment.

4. In an engine control system for a locomotive stoker, in combination, an engine for driving said stoker, a throttling valve controlling the application of power to the engine, manually operable means for positioning said valve comprising a manually operable lever, a bell crank system mechanically connected at one end to said throttling valve, adjustable means having a high mechanical advantage connecting the other end of said bell crank to said manually operable lever, said adjustable means being operable by said lever to adjust the position of said bell crank with respect to said lever to change the position of said throttling valve, and means for releasably securing said lever against movement other than that necessary for the operation of said adjustable connecting means but being releasable to free said lever to move said bell crank and adjustable connecting means as a unit independently of movement effected by adjustment of said adjustable means.

5. In an engine control system for a locomotive stoker, in combination, an engine for driving said stoker, a throttling valve controlling the application of power to the engine, manually operable means for positioning said valve comprising a manually operable lever, a bell crank system mechanically connected at one end to said throttling valve, adjustable means having a high mechanical advantage connecting the other end

of said bell crank to said manually operable lever, said adjustable means being operable to adjust the position of said bell crank with respect to said lever to change the position of said throttling valve, and emergency release mechanism for moving said bell crank and adjustable connecting means as a unit independently of the operation of said adjustable means to adjust the position of the bell crank with respect to the lever.

6. In an engine control system for a locomotive stoker driving engine, in combination, a control valve for controlling the steam to said engine, a lever pivoted to a framework support and having pivotal connection with mechanism operating said valve, a manually operable lever for adjusting the position of said first named lever, said second named lever being pivotally mounted on and having an adjustable threaded connection with respect to said first named lever, means on said manually operable lever normally engaging a notch provided in the framework support but releasable from said notch to slide in a slot also provided in said framework and extending from both sides of said notch.

7. In an engine control system for a locomotive stoker driving engine, in combination, a control valve for controlling the steam to said engine, a first lever pivotally connected with mechanism for operating said valve, a manually operable lever having an adjustable threaded connection with said first lever, means on said manually operable lever normally engaging a notch provided in a framework support but movable from said notch to slide in a slot also provided in said framework and extending from both sides of said notch, and means for relatively supporting said first lever and said manually operable lever with respect to said framework so that both adjustment of the threaded connection between said manually operable lever and said first lever and movement of said manually operable lever with respect to said slot moves said valve.

8. In an engine control system for a locomotive stoker driving engine, in combination, a control valve for controlling the steam to said engine, a lever pivoted to a framework support and having pivotal connection with mechanism operating said valve, a manually operable lever for adjusting the position of said first named lever, a sleeve pivoted on said first named lever, said manually operable lever being threaded into said sleeve, and means on said manually operable lever normally engaging a notch provided in the framework support but releasable from said notch to slide in a slot also provided in said framework and extending from both sides of said notch.

9. In an engine control system for a locomotive stoker driving engine, in combination, a control valve for controlling the steam to said engine, a lever pivoted to a framework support and having pivotal connection with mechanism operating said valve, a manually operable lever for adjusting the position of said first named lever, a sleeve pivoted on said first named lever, said manually operable lever being threaded into said sleeve, means on said manually operable lever normally engaging a notch provided in the framework support but releasable from said notch to slide in a slot also provided in said framework and extending from both sides of said notch, and spring means for resiliently holding said means in said notch against accidental movement therefrom.

10. In an engine control for a locomotive stoker, in combination, a steam engine, a throttle valve controlling the supply of steam to the engine, manually operable adjustable means for effecting fine adjustments of said valve, and manually operable release mechanism operating from a neutral position to move the valve quickly to extreme positions and then manually operative to return automatically the valve to the position determined by the adjustable means setting existing before the manually operable release mechanism was operated.

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