

April 21, 1931.

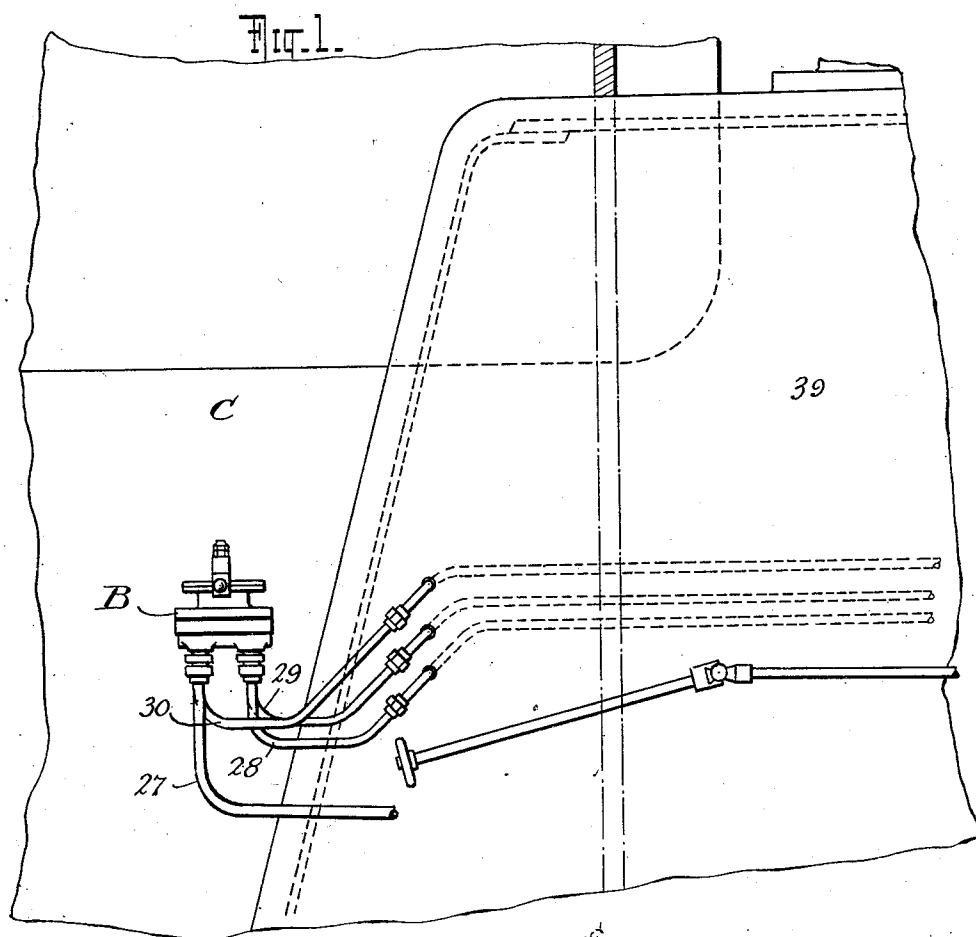
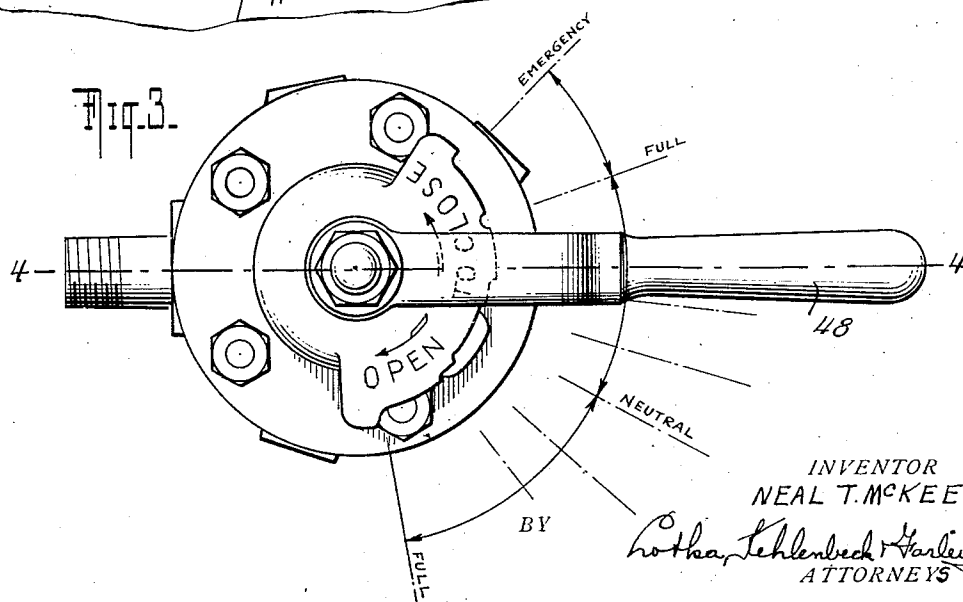
N. T. McKEE

1,801,441

THROTTLE VALVE

Filed June 20, 1923

4 Sheets-Sheet 1



April 21, 1931.

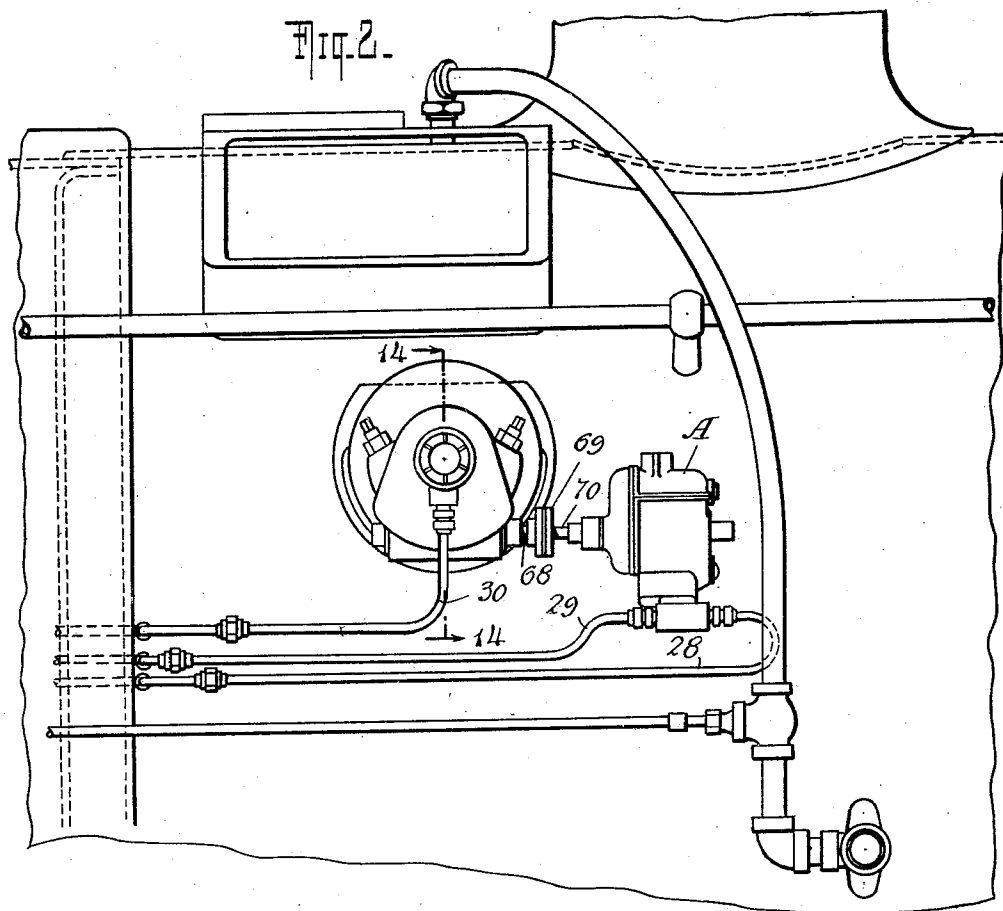
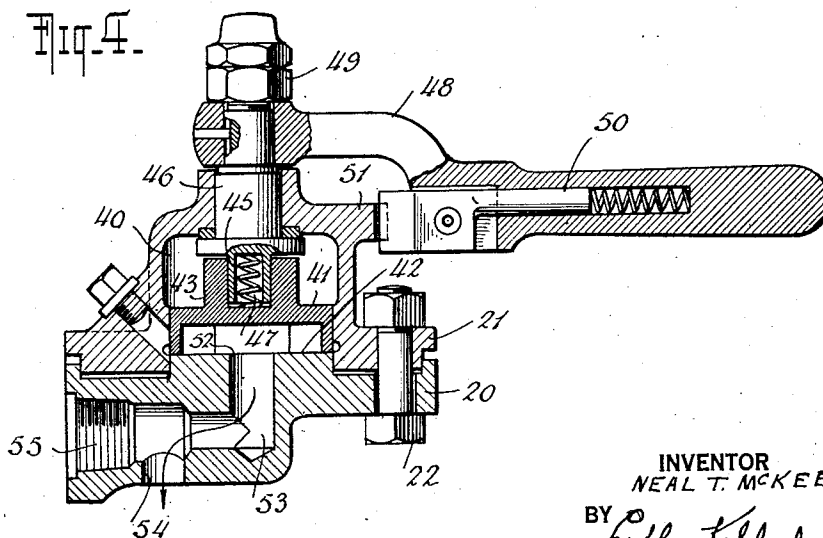
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THROTTLE VALVE

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4 Sheets-Sheet 2



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THROTTLE VALVE

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Fig. 5.

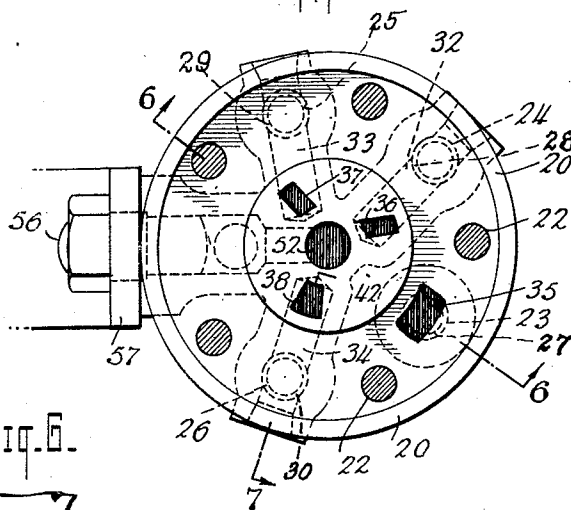


Fig. 6.

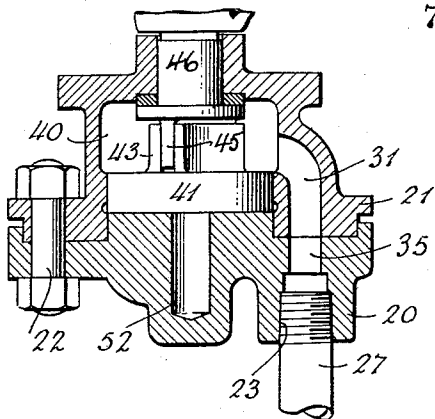


Fig. 7.

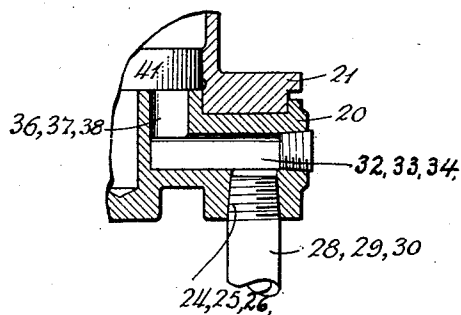


Fig. 8.

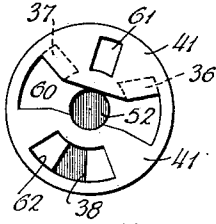


Fig. 9.

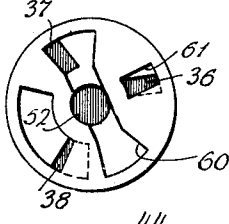


Fig. 10.

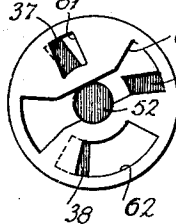


Fig. 11.

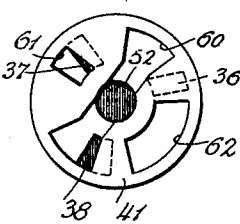


Fig. 12.

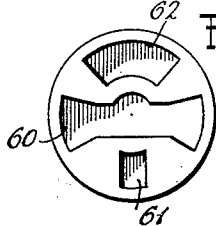
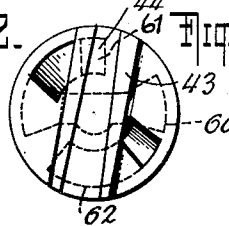


Fig. 13.



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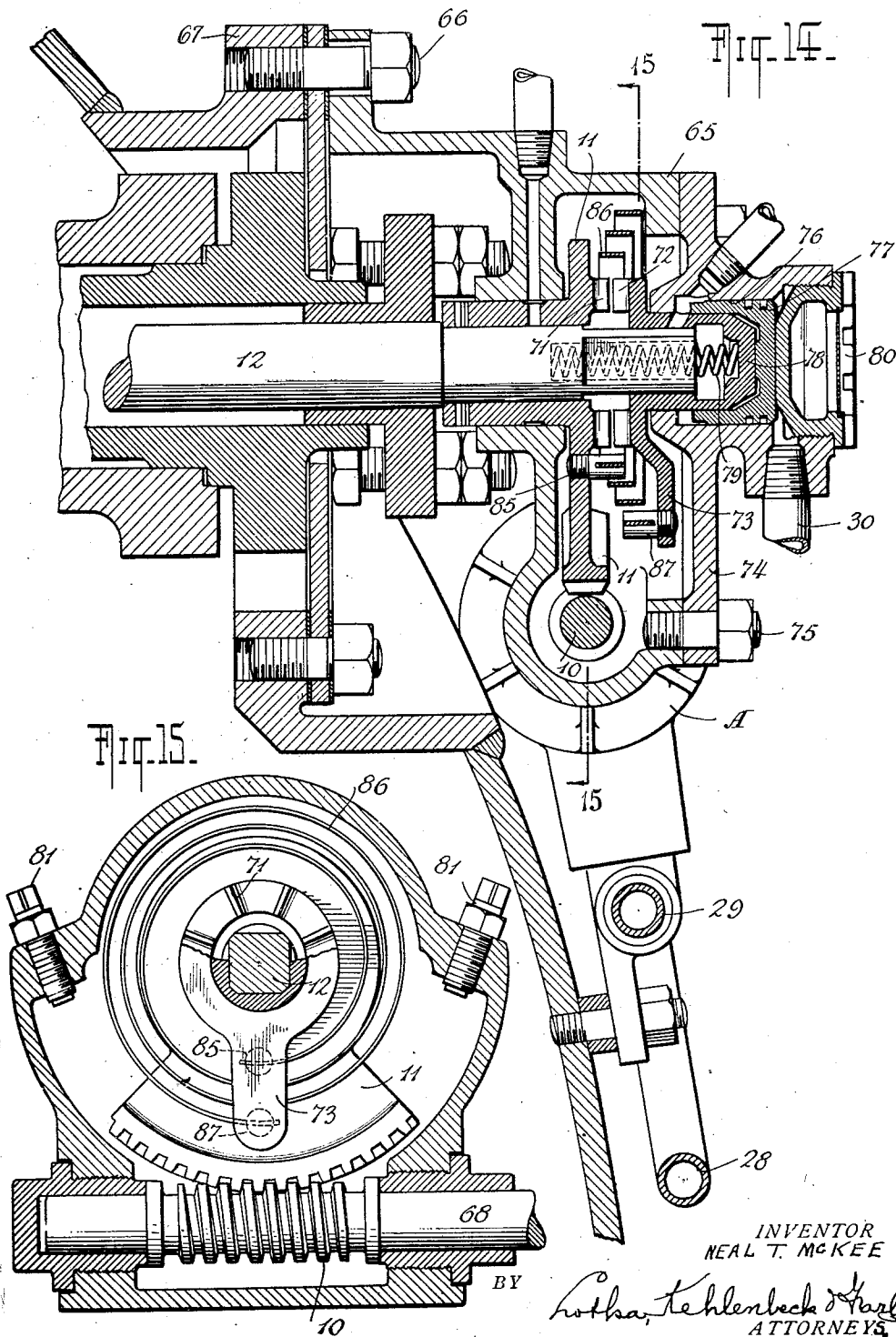
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THROTTLE VALVE

Filed June 20, 1928

4 Sheets-Sheet 4



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THROTTLE VALVE

Application filed June 20, 1923, Serial No. 286,841.

This invention relates to throttle valve operating means for engines and particularly for locomotive engines. The more advanced engineering practice of the present day is toward the use of higher and higher steam pressures and with locomotives using such high pressure steam much greater physical effort is required of the engineman for manipulating the throttle lever to set the throttle valve against the force of the high pressure steam than is required with the lower pressure steam locomotives formerly in use. As it is frequently necessary for the engineman, and particularly in times of impending danger, to be able to operate the throttle valve quickly, it becomes a matter of considerable importance to provide means which will enable the throttle valve of a locomotive using high pressure steam to be set quickly and easily.

The principal object of the present invention is to provide a new and improved construction by means of which the throttle valve of a locomotive may be actuated by power means, the operation of which power means is controlled by the manipulation of a small, easily actuated lever located in a conveniently accessible position, as for example, in the cab of the locomotive.

Another object of the present invention is to provide an installation of a power means for a locomotive throttle valve and a manually operable control therefor capable of being readily installed not only upon a new locomotive in the course of construction thereof but also upon existing locomotives.

A further object is to so construct the installation that the manually operable control means may be set by a single movement for opening or closing the throttle under normal operating conditions, and in addition, may be set to close the throttle to an emergency position in which a rapid closing of the throttle valve will be insured even though there should be a failure of the power means to operate.

The above and other objects of the present invention will appear more fully from the following more detailed description and

by reference to the accompanying drawings forming a part hereof wherein Fig. 1 is a fragmentary side elevation of the cab portion of a locomotive, the locomotive parts being shown somewhat diagrammatically and showing the location and arrangement of the manually operable control for a throttle operating means constructed in accordance with the principles of my invention; Fig. 2 is a similar view of the front portion of a locomotive showing the power operated means and the connection thereof to the throttle valve; Fig. 3 is a plan view of the manually operable control; Fig. 4 is a vertical section taken substantially on the line 4—4 of Fig. 3; Fig. 5 is a plan view of the lower casting or casing of the control valve shown in Figs. 3 and 4 and showing the location of the valve ports provided in such casting; Fig. 6 is a section taken substantially on the line 6—6 of Fig. 5; Fig. 7 is a fragmentary sectional detail taken on the section line 7 of Fig. 5 and illustrating the construction of the lower casting and the conduits formed therein which connect with certain of the valve ports shown in Fig. 5, the section along three of said conduits and ports being similar; Figs. 8, 9, 10 and 11 are diagrammatic views showing the relative positions of the ports of the manually operable control valve and the ports of the valve casing for different set positions of the control lever; Fig. 12 is an inverted plan of the control valve; Fig. 13 is a plan view of said valve; Fig. 14 is a sectional detail taken substantially on the line 14—14 of Fig. 2 and showing the connection of the power operating means to the throttle valve shaft and Fig. 15 is a section on the line 15—15 of Fig. 14.

The invention briefly consists in the provision of a suitable power actuated device connected to the throttle valve shaft. A satisfactory constructional example as shown in the drawings consists of a compressed air motor A (Fig. 2) preferably of the type commonly employed for air drills. This motor is connected, by means of a worm 10 and worm gear segment 11 to the throttle valve shaft 12, the constructional details of

which connection will hereinafter be more fully described. The air motor A is of the reversible type and air under pressure, supplied for example from the main air tank of the locomotive, is admitted to such motor under the control of a manually operable valve B (Fig. 1) the operating handle of which may be set to various positions to secure the desired results as will be presently described.

In the particular constructional example disclosed, the air motor A is located immediately adjacent to the throttle valve shaft, while the control valve B is shown as mounted in the cab C of the locomotive. The constructional details of the control valve as shown in Figs. 3 to 13 inclusive will first be described. As shown in Figs. 4 to 6 of the drawings, the valve B comprises a lower casing 20 and an upper casing or bonnet 21, said casing members being secured together by any suitable means, such as the bolts 22. The lower casing member is provided with a plurality of threaded apertures 23, 24, 25 and 26 to which the pipes 27, 28, 29 and 30 are respectively connected. The apertures 24, 25 and 26 communicate with conduits 32, 33 and 34 shown in dotted lines in Fig. 5 and said conduits terminate respectively in ports 36, 37 and 38, while the aperture 23 communicates through a port 35 with a conduit 31 formed in the upper casing member as shown in Fig. 6. The pipe 27 is the supply pipe by means of which air under pressure, from any suitable source, such as the main compressed air tank of the locomotive is admitted to the valve casing. The pipes 28, 29 and 30 lead from the valve casing and extend along the side of the locomotive, said pipes preferably passing, for the greater part of their length, under the lagging 39 provided about the wall of the locomotive boiler. The front ends of the pipes 28, and 29 are connected to the air motor A and serve to admit air to the motor for causing the same to be operated in the proper directions to open and close the throttle valve respectively. The pipe 30 is connected at its front end to a casing presently to be more fully described.

As shown most clearly in Fig. 4 of the drawings the casing members 20 and 21 define an air chamber 40 to which air is admitted from the pipe 27 through the port 35 and conduit 31 and in which chamber is mounted a disk valve 41 of the type commonly employed for air brake systems. The lower face of said valve seats upon a valve seat 42 provided on the lower casing member 20. Projecting upwardly from the upper face of the valve 41 is a pair of ribs 43 spaced apart to provide a groove 44 in which is received a non-circular extension 45 of the control valve shaft 46 which is

journalled in a central bearing provided in the upper casing member 21. The extension 45 of the shaft 46 is preferably provided with a recess in which is seated a spring 47 that serves to hold the lower face of the valve 41 to the valve seat 42. The shaft 46 projects outwardly of the upper casing member 21 and has keyed to it an actuating handle 48, lock nuts 49 being provided to hold the handle on the shaft. Slidably mounted within the handle 48 is a spring-pressed pawl 50, the outer end of which is adapted to engage with any one of a plurality of recesses or shoulders formed in a horizontally extending web 51 of the upper casing member 21.

As hereinbefore described, the lower casing member 20 is provided with a plurality of ports 36, 37 and 38 which ports, it will be noted by referring to Fig. 5, are formed in the valve seat 42 of said casing member. In addition to the ports 36, 37 and 38, said valve seat is also provided with a central port 52 which, as shown in Figs. 4 and 5 of the drawings, communicates with the conduit 53, the latter leading to the atmosphere through the aperture 54 formed in the bottom of the casing member 21. For convenience of installation the horizontally extending branch of the conduit 53 is counter-bored and screwthreaded as indicated by the reference character 55, for the purpose of receiving a stud 56 by means of which the valve casing may be secured to any suitable support, such as the bracket, indicated by the reference character 57 in Fig. 5 of the drawings.

The valve disk 41 is provided at its under face with an elongated recessed port 60, see Figs. 8 to 12 inclusive, which port serves to establish communication between the ports 36, 37 and 38 and the central port 52 when the control handle 48 is set in certain predetermined positions presently to be more fully described. In addition to the port 60, the valve 41 is also provided with a pair of through ports 61, 62, which, when brought into registry with the valve ports 36, 37 and 38, permit the air under pressure which enters the valve chamber 40 through the supply pipe 27 and conduit 31 to pass to the pipes 28, 29 and 30 respectively. The various positions occupied by the valve 41 for the different settings of the control handle 48 and the course or passage of the fluid through said valve for such positions will be hereinafter described more fully in connection with the description of the apparatus as a whole.

Coming now to the description of the throttle valve shaft operating means: As hereinbefore pointed out the throttle valve shaft 12 is operated preferably by means of a compressed air motor A. In accordance with the usual construction of throttle

valves for high pressure locomotives, the valve shaft 12 is provided with a plurality of projecting cam levers (not shown) which operate successively a plurality of throttle valves. As the constructional details of the throttle valves form no part of the present invention and as such constructions are well known and common, such valves and the cam levers for operating them have not been shown in the drawings. It is sufficient to state that with the prior constructions the throttle valve shaft extends out through the side wall of the boiler and has secured to it any suitable operating means such as a lever which is connected with the usual throttle lever so as to cause the valve shaft 12 to be rotated to set the valves in the desired position when the throttle lever is actuated. With the present invention instead of securing a lever to the projecting end of the throttle valve shaft 12 and connecting the said lever to the usual throttle lever, the projecting end of the shaft 12 extends into a casing or bracket 65 suitably secured by means of the studs 66 to a stuffing box assembly 67, the latter being flanged and suitably secured to the boiler shell. The casing 65 forms a gear housing for the worm 10, hereinbefore referred to, and worm gear segment 11. The worm 10 is secured to, or formed integral with, a drive shaft 68 which is connected by means of a flexible coupling 69 with the driving shaft 70 of the air motor A. The gear segment 11 is rotatably mounted upon the reduced outer end of the throttle valve shaft 12 and the outer face of said segment is provided with clutch teeth 71 adapted to engage with co-operating clutch teeth 72 provided upon a clutch member 73, the latter being non-rotatably keyed to the shaft 12 but slidable longitudinally thereof.

A cover 74 secured to the casing 65 by studs 75 has formed therein a cylinder 76 in which is slidably mounted a piston 77; the inner end of the piston 77 is bored out to fit over a projecting boss 78 preferably integral with the clutch member 73. Said boss 78 and the outer end of the shaft 12 are bored to provide a housing for a spring 79 the ends of which abut against the inner end of the bore of the shaft 12 and the inner end of the boss 78, said spring thereby serving normally to hold the clutch member 73 pushed outwardly with its clutch teeth 72 out of engagement with the clutch teeth 71 of the worm gear segment 11. The outer end of the cylinder 76 is closed by a cylinder head 80, the inner end of which serves as a stop for limiting the outward movement of the clutch member 73.

Air under pressure is admitted to the cylinder 76 by means of the pipe 30, hereinbefore referred to, and when such air is admitted to the cylinder, the pressure thereof

moves the piston 77 against the action of the spring 79 so as to cause the clutch member 73 to move inwardly and bring its clutch teeth 72 into meshing engagement with the clutch teeth 71 of the gear segment 11. Adjustable stop screws 81 are screwed into the casing 65 and serve to limit the extent of movement of the gear segment 11 as shown most clearly in Fig. 15.

The operation of the parts so far described is as follows: Let it be assumed that air under pressure is supplied to the valve B through the supply pipe 27, such air passes through the conduit 31 (see Fig. 6) and into the chamber 40 of said valve. If now the control handle 48 of the valve is set in the neutral position the valve 41 will occupy the position shown in Fig. 8 of the drawings. As shown in Fig. 8 the port 62 of the valve 41 is in alignment with the port 38 of the valve casing member 20. The ports 36 and 37 of the casing member are closed. The central port 52 of the valve casing member is however always in communication with the elongated central port 60 of the valve 41. With the valve set as above described, the air which passes into the chamber 40 above the valve disk 41 will flow through the ports 62 and 38 to the conduit 34 of the lower valve casing member 21. From the conduit 34 the air flows through the pipe 30 to the cylinder 76 and the pressure of such air will force the piston 77 inwardly thereby causing the clutch member 73 to be moved inwardly and the teeth 72, 71 to be brought into co-operating engagement.

If the engineman wishes to open the throttle, the control lever is moved in the clockwise direction indicated in Fig. 3 of the drawings, thus bringing the port 61 of the valve 41 into registry with the port 36 of the valve casing as shown in Fig. 9. This will permit the air to pass from the chamber 40 through the ports 61, 36 to the conduit 32 from whence it flows through the pipe 28 to the air motor A to cause said motor to be rotated in a direction such that the throttle valve shaft 12 will be rotated, by the worm 10 and gear segment 11, in a direction to open the throttle valve. It will be noted that the valve port 62 is of such length that when the port 36 is fully opened there will still be communication between the ports 62 and 38 and consequently, during all the time the port 36 is opened, air under pressure will be maintained in the pipe 30 and cylinder 76 to hold the clutch member 73 in engagement with the gear segment 11. It will also be noted from the showing of Figs. 8 and 9 that the ports of the valve seat of the lower casing member and the ports of the valve 41 are so arranged that when the port 61 starts to uncover the port 36, or shortly before the port 36 is opened, the elongated port

60 is brought into registry with the port 37 of the valve casing. The elongated port 60 forms the exhaust port of the valve, this port being at all times in communication with the central port 52. The port 52 it will be remembered communicates with the atmosphere through the conduit 53 and aperture 54. Therefore, when the port 60 is brought into registry with any of the ports 36, 37 or 38 any fluid under pressure in the air lines with which such ports communicate, will exhaust through the port 52 and conduit 53 to the atmosphere.

If it is desired to close the throttle, the control handle 48 is moved in the counter-clockwise direction indicated by the arrow in Fig. 3. Fig. 10 of the drawings shows diagrammatically the relative positions of the valve and valve casing ports when the throttle 48 is set substantially to the full closing position. It will be noted from Fig. 10 that the port 62 is in registry with the port 38, the port 61 is in registry with the port 37 and the port 60 is in registry with the port 36. Under these conditions, air under pressure will obviously be maintained in the pipe 30 and cylinder 76. Air under pressure from the chamber 40 will pass through the port 61 of the valve 41 to the port 37 from whence it will flow through the conduit 33 and pipe 29 to the air motor A, thereby causing the direction of rotation of the air motor to be reversed, that is to say, to cause the motor to rotate in a direction opposite to that in which it was rotating when the air was admitted thereto through the pipe 28. This reversal of the direction of the air motor A obviously will cause the throttle valve shaft 12 to be turned, through the worm 10 and worm gear segment 11, in a direction to close the throttle.

As there are times when it is necessary that the throttle valve be closed almost instantly, I have provided what I term an emergency position of the valve B. The position of the control handle 48 for "emergency" is as indicated in Fig. 3 of the drawings, obtained by throwing the control lever 48 in the counter-clockwise direction to the full limit of its travel. Assuming the control lever 48 to be set in the emergency position, the valve disk 41 is in the position shown in Fig. 11 of the drawing. As shown in such figure the port 60 of the valve disk 41 is in communication with the port 38. The port 36 is closed and the port 37 is in communication with the port 61. Under these conditions, air in the pipe 30 and cylinder 76 will be exhausted through the port 52, conduit 53 and aperture 54 to atmosphere. The air pressure being relieved in the cylinder 76, the clutch member 73 and piston 77 will therefore be moved by the action of the spring 79 to bring the clutch teeth 72, 71 out of engagement, the parts

being as shown in full lines in Fig. 14. The pressure of the steam will ordinarily be sufficient to cause the throttle valves to close and to bring about the rotation of the throttle valve shaft 12 to throttle closed position. In order however that closing of the throttle will be absolutely insured in the emergency position of the control valve, the following means is preferably provided: The gear segment 11 is provided with a stud 85 in which is secured one end of a coiled leaf spring 86, the other end of said spring being secured to a similar stud 87 screwed into the clutch member 73. As soon as the air pressure is relieved in the cylinder 76 and the clutch teeth 72, 71 pass out of engagement, the shaft 12 will be quickly rotated by the action of the leaf spring to permit the throttle valves to close, rotation of the gear segment 11 being prevented by its engagement with the worm 10 and said gear segment acting as a reaction support for the leaf spring. The clutch member 73 obviously will be rotated by the action of the spring and as the clutch member is keyed to the shaft 12, the latter will be moved in the closing direction as above described. As a further precaution, and in order to prevent the action of the spring from being communicated through the gear segment 11 to cause rotation of the worm 10, which, if permitted, it will be noted, by referring to Fig. 11, that the port 37 of the valve casing is slightly open when the control handle is set in the emergency position. This will permit the air to be admitted to the pipe line 29 to cause the air motor A to be rotated slowly in the throttle closing direction and therefore to bring about a movement of the worm 10 opposite in direction to that which would be produced by the action of the leaf spring 86 if the pitch of the worm 10 and worm gear teeth were sufficient to allow rotation of the gear segment to be communicated to the worm.

It will be seen by referring to Figs. 8 to 11 inclusive of the drawings that relative shapes and locations of the opening and closing ports 36, 37 of the valve casing and the port 61 of the valve disk are such that a very gradual opening of the ports 36 and 37 can be secured. Therefore, a very small amount of air can be permitted to flow through either of the pipes 28, 29 to secure a very slow rotation of the air motor A and consequently a very gradual opening or closing movement of the throttle valves.

While I have shown the power means for operating the throttle valve as a compressed air motor of the air drill type, it will be understood that the invention is not limited in its application to the use of this particular type motor. It will likewise be understood that while the invention has been de-

scribed as operated preferably by compressed air, steam or other fluid under pressure could obviously be employed if desired.

It will further be noted that the principles of the present invention permit the employment of a valve capable of being manipulated by the exercise of but a small amount of physical exertion and that said valve may be located at a control station remote from the throttle valve. The power means, namely the compressed air motor, is preferably located at a point immediately adjacent to the throttle valve shaft and while this location is preferred, the invention however is not limited to the particular locations of either the control valve or the power means shown in the drawings as obviously such locations could be departed from without departing from the principles of the invention. It will likewise be understood that many other changes, variations and modifications could be resorted to.

I claim:

1. In a locomotive, a throttle valve and an actuating shaft therefor, a fluid pressure motor and gearing connecting it with said shaft, said gearing including a disengageable clutch, means for normally urging said clutch towards disengaged position, and a fluid pressure actuated device for holding said clutch in engagement against the action of said means.

2. In a locomotive, a throttle valve and an actuating shaft therefor, a fluid pressure motor and gearing connecting it with said shaft, said gearing including a disengageable clutch, means for normally urging said clutch towards disengaged position, a fluid pressure actuated device for holding said clutch in engagement against the action of said means, and means for actuating said shaft to throttle closing position automatically upon release of the pressure in said fluid pressure actuated device.

3. In a locomotive, a throttle valve and a rotary actuating shaft therefor, a rotary fluid pressure operated motor, gearing connecting said shaft and motor, said gearing including a disengageable clutch, and means for automatically holding said clutch in engagement when said fluid pressure motor is actuated.

4. In a locomotive, a throttle valve and an actuating shaft therefor, a reversible fluid pressure actuated motor, gearing connecting said shaft and motor, a manually operable control valve for admitting fluid under pressure to said motor, and means under the control of said control valve for causing the throttle valve to be moved to closed position independently of said motor.

5. In a locomotive, a throttle valve and an actuating shaft therefor, a fluid pressure actuated motor for moving said throttle valve to opened or closed position under

normal operating conditions, means additional to said motor for closing said throttle under emergency conditions, and a single manually operable control for governing the actuation of both said motor and said additional means.

6. In a locomotive, a throttle valve and an actuating shaft therefor, a fluid pressure actuated motor for moving said throttle valve to opened or closed position under normal operating conditions, means additional to said motor for closing said throttle under emergency conditions, and a single manually operable control having a neutral position in which said motor and additional means are inactive, said control being movable in one direction from said position to cause said motor to open the throttle valve and in a reverse direction from said position to cause said motor to close said valve, and said control in addition being movable to an extreme position in said reverse direction to cause said motor to be inoperative for actuating said throttle and to cause said additional means to function.

7. In a locomotive, a throttle valve and an actuating shaft therefor, a reversible fluid pressure motor and gearing connecting it with said shaft, said gearing including a clutch, resilient means for urging said clutch towards disengaged position, a fluid pressure actuated cylinder and piston operatively associated with said clutch, a control valve, and connections therefrom to said motor and to said cylinder.

8. In a locomotive, a throttle valve and an actuating shaft therefor, a reversible fluid pressure motor and gearing connecting it with said shaft, said gearing including a clutch, resilient means for urging said clutch towards disengaged position, a fluid pressure actuated cylinder and piston operatively associated with said clutch, a control valve and connections therefrom to said motor and to said cylinder, said control valve having a plurality of ports, through which and said connections, when said valve is set to cause actuation of said motor, fluid under pressure is permitted to flow simultaneously to said motor and to said cylinder whereby said clutch will be engaged when said motor is operating.

9. In a locomotive, a throttle valve and an actuating shaft therefor, a reversible fluid pressure motor and gearing connecting it with said shaft, said gearing including a disengageable clutch, resilient means for urging said clutch towards disengaged position, fluid pressure actuated means for normally holding said clutch in engagement, a single manually operated control for governing the admission of fluid to said motor and said means, and means for automatically and instantly actuating said throttle valve

to closing position when the flow of fluid under pressure to said clutch actuating means is cut off.

10. In a locomotive having a throttle valve and an actuating shaft therefor, a fluid pressure actuated motor and gearing connecting it with said shaft, said gearing including a gear segment rotatably mounted on said shaft and provided with clutch teeth, a clutch member non-rotatably but slidably keyed to said shaft, resilient means for urging said clutch member away from said gear segment and a fluid pressure actuated device for normally holding said clutch member in engagement with said clutch teeth.

11. In a locomotive having a throttle valve and an actuating shaft therefor, a fluid pressure actuated motor and gearing connecting it with said shaft, said gearing including a gear segment rotatably mounted on said shaft and provided with clutch teeth, a clutch member non-rotatably but slidably keyed to said shaft, resilient means for urging said clutch member away from said gear segment, a fluid pressure actuated device for normally holding said clutch member in engagement with said clutch teeth, and a single manually operable valve for governing the admission of fluid under pressure to said motor and said fluid pressure device.

In testimony whereof I have hereunto set my hand.

NEAL T. McKEE.

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