No. 741,707. PATENTED OCT. 20, 1903.

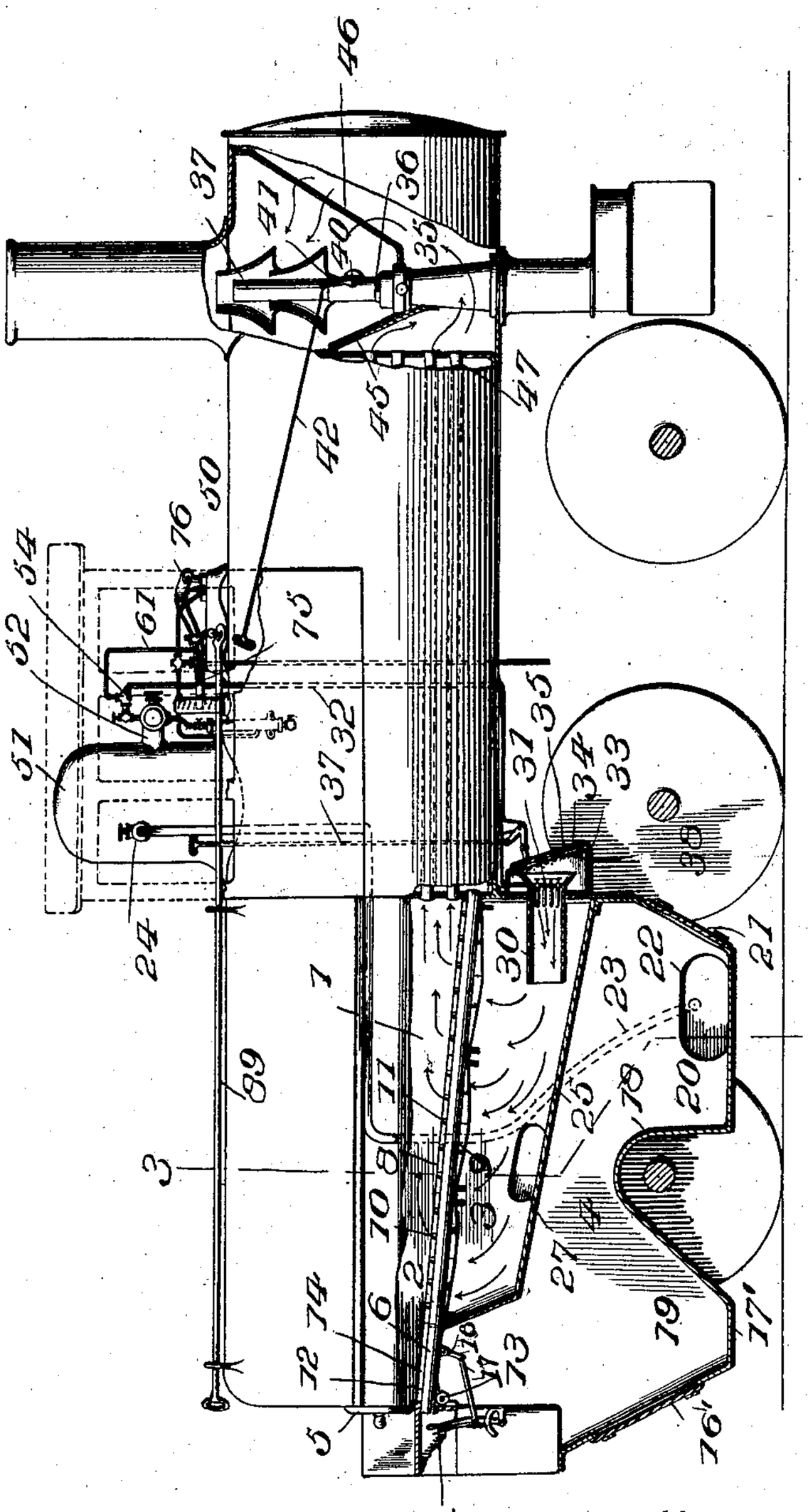
H. E. PARSON.

LOCOMOTIVE.

APPLICATION FILED JULY 22, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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NO MODEL. 3 SHEETS—SHEET 2.

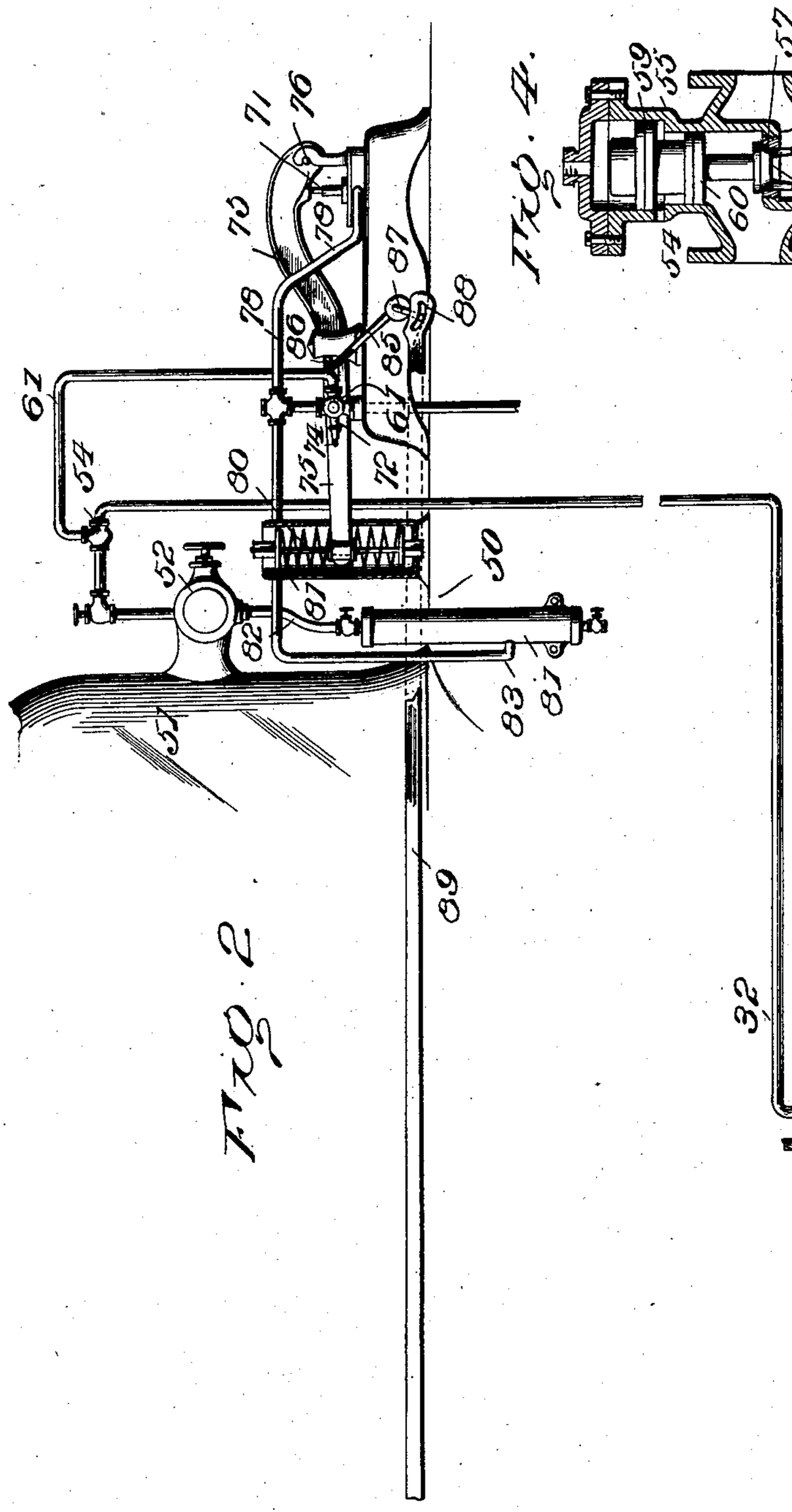

FIG. 2.

FIG. 4.

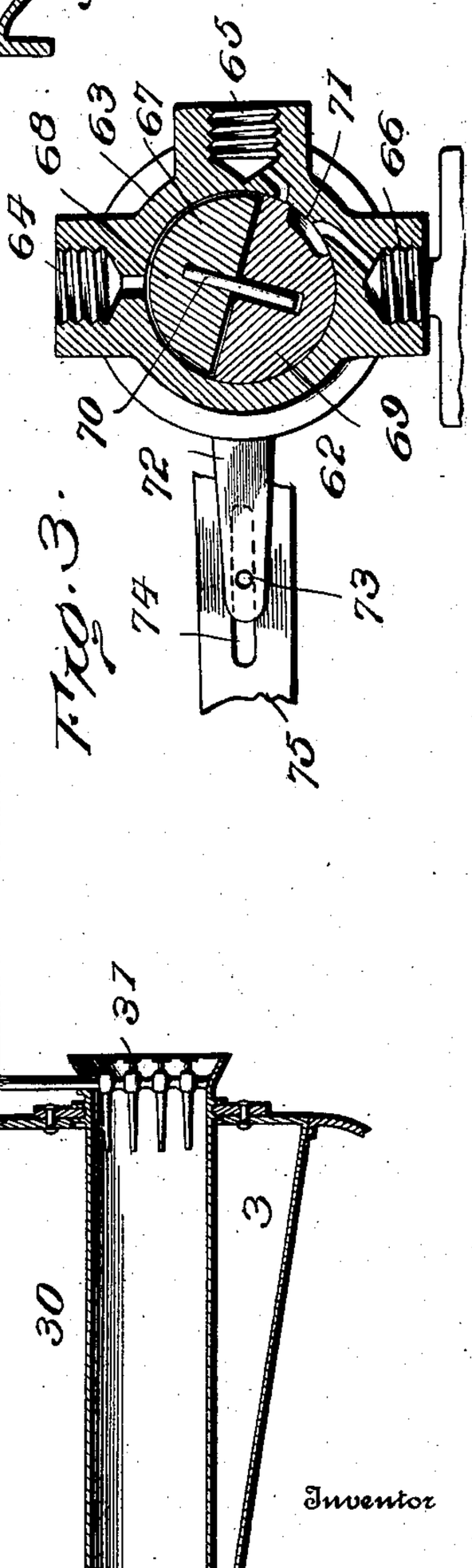

FIG. 3.

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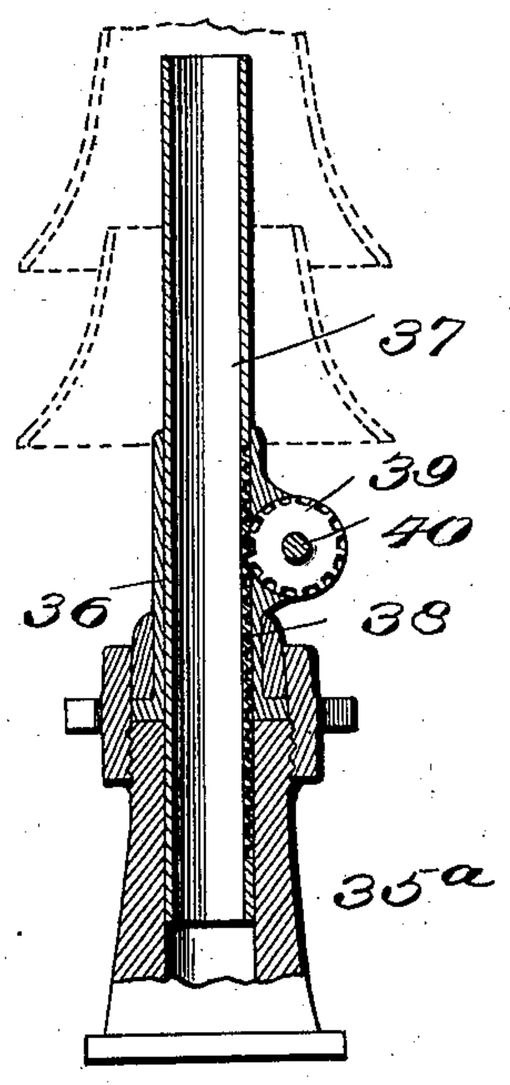
NO MODEL. 3 SHEETS—SHEET 3.

Fig. 5.



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No. 741,707. Patented October 20, 1903.

UNITED STATES PATENT OFFICE.

HENRY E. PARSON, OF BROOKLYN, NEW YORK.

LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 741,707, dated October 20, 1903.

Application filed July 22, 1902. Serial No. 116,586. (No model.)

To all whom it may concern:

Be it known that I, HENRY E. PARSON, a citizen of the United States of America, and a resident of the borough of Brooklyn, city and State of New York, have invented certain new and useful Improvements in Locomotives, of which the following is a specification.

This invention relates to improvements in locomotives, and has particular reference to the construction and operation of the means employed for increasing the grade of combustion in the fire-box and automatically regulating the same by boiler-pressure.

In the practical application of my invention it is essential that a substantially closed fire-box be used. Also ready and convenient means must be provided for the disposition of the ashes. To do this, an auxiliary ash-receptacle is placed under the grate, and into this receptacle air and steam are simultaneously injected. With such an arrangement few, if any, ashes fall into the receptacle, and in order to accommodate the ashes a swinging grate-section is located adjacent the termination of the ash-receptacle, and under the swinging grate is the ash-pit, the latter also extending under the auxiliary ash-receptacle. The ash-pit is, like the fire-box, of the closed type, so that when the ashes are dumped from the swinging grate the forced draft is not interfered with.

Forcing draft into a closed fire-box to promote combustion is quite old in the art; but I have found that merely forcing air or steam, or both, to the fire and then depending on the natural draft to draw it through the fuel is insufficient to give the desired results. The action of the air, &c., under these conditions tends to either drive out the gases in an unmixed state or else the gases lag above the fire, which tends to keep down the combustion. The result of this poorly-mixed gas and air is to generate smoke-gases, which are of such volume that it is almost an impossibility to produce a high grade of combustion.

I have discovered that in order to force air, &c., into the fuel a regulating means must be provided to coact with the forced-draft mechanism to draw the forced draft through the body of the mass of fuel. It is a fact that attempts in this direction have been made, but without any material degree of success. The failure is due to the fact that no unity of action existed between the air introduced and the means used for drawing it out, for if too much or too little air be forced into the fire destructive results are sure to follow; so, also, with the air drawn from the fire.

It is one of the important objects of my invention to provide means whereby a unitary action of the forced-draft mechanism and the air-withdrawing mechanism can be regulated and maintained at all times.

Another essential requirement for improving the grade of combustion in a locomotive fire-box is the means employed for regulating the injection of the forced draft. Owing to the continual rocking movement of the engine when traveling, it has heretofore been impossible to regulate forced-draft devices by boiler-pressure; but I have found that exceedingly important results can be obtained by utilizing the boiler-pressure for this purpose and have accordingly constructed and arranged my automatic regulating device so that the rocking and jolting of the engine assists the parts to perform their functions. The operative parts of this device are arranged in such manner that the jolting of the engine will not have any evil effects on the opening and closing of the respective valves. This enables me to inject a predetermined amount of forced air, &c., into a locomotive fire-box and draw it through the fuel with a predetermined pull, the degree of heat generated being controlled automatically by the boiler-pressure. If a heavy load should be applied, the injectors will remain open and a full force of steam and air will be introduced to the fuel, while, on the other hand, if the load varies necessarily the steam-pressure will do so likewise. Under these conditions, of course, the injectors must work in accord therewith. The result is that under normal conditions the steam-pressure is maintained at approximately a predetermined point without the disadvantage of forcing the fire except when it is required.

In the drawings, Figure 1 is a side elevation of a locomotive, parts being broken away to more fully disclose the invention. Fig. 2 is an enlarged detail side elevation of my improved automatic boiler-pressure regulator

and its connection with the injectors. Fig. 3 is a vertical section of a cut-off valve. Fig. 4 is a vertical section of an automatic valve. Fig. 5 is a vertical section of a conventional means for increasing or decreasing the pull of the draft.

The numeral 1 indicates a fire-box; 2, the grate; 3, the auxiliary ash-receptacle, and 4 the usual ash-pit. The fire-box is of the closed type and is provided with the usual feed-door 5. The grate 2 comprises a plurality of water-tubes 6, communicating in the usual manner with two water-legs. Experience has demonstrated that while water-tubes may be utilized advantageously as a grate many prevalent weaknesses not present in the ordinary grate must be overcome before the same lasting results can be obtained. I have therefore devised detachable grate-sections 8, which are grooved along their outer edges 9 to conform to the contour of the tubes. While the contour of the grooves is the same as the tubes, it is to be noted they do not touch, the space between the two members being maintained by a bar being rigidly positioned under each end of the sections 8 to support the latter. The grooved edges of the sections 8 are further provided with a plurality of upwardly-tapered grooves 10, and when the sections are put in place these grooves form rows of regular and uniformly-arranged tapering openings 11, and in order to strengthen the sections a zigzag rib projects downwardly and runs intermediate certain of the openings without in any wise interrupting them.

It is known in this art that protection for water-tubes used as a grate is a necessity, and trials have been made with a view of surmounting the difficulties; but as far as I am aware I am the first to form grooves in the concave edges of the sections to form one of a prearranged series of tapered air-inlets. Inasmuch as this feature is the subject-matter of a concurrent application, filed July 22, 1902, Serial No. 116,587, it is thought this brief description is sufficient, especially in view of the fact that it is to be here claimed only in combination with other elements to be hereinafter enumerated.

The form of grate just described terminates a short distance from the feed-door, and between the feed-door and the sections 8 I provide a swinging section 12, hinged at 13, which may be either constructed of individual finger-like pieces or in one casting.

14 represents the fingers of the swinging section, which are adapted to closely fit in the spaces intermediate the tubes and form approximate alinement with the said sections 8.

A hand-lever 15, having suitable locking devices thereon, is pivoted to the frame of the locomotive, and connecting the lever and an arm 16, depending from the swinging section 12, is a connecting-link 17. As the fire progresses and ashes appear they are gradually worked forward by the fireman and are accumulated on the swinging section 12, and when the accumulation at this point reaches the stage of interference with the proper handling of the fire the fireman grasps the handle 15 and pulls it toward him, whereupon the ashes fall into the ash-pit. This operation is carried on without disturbing the fire at all, and when it is remembered that practically, all, if not all, of the ashes are disposed of in this manner the importance of such an operation without stopping the locomotive or affecting the fire will be readily comprehended. It is to be borne in mind that the grate-sections 8 have openings, and the reason ashes do not fall through these openings is because of the forced draft passing therethrough. The fingers 14 fit the spaces between the tubes nicely, forming a dead space, for it will be remembered that there is no forced draft at this point.

My ash-pit 4 possesses several details which I consider important, in combination with the grate and the auxiliary ash-receptacle, and I will now point them out in detail. The ash-pit, like the fire-box, is of the closed type and is provided with a door 16′. The bottom 17′ of the pit is arched at 18 to accommodate one of the axles and also to provide a front and rear compartment 19 and 20 for the ashes. Compartment 19 is directly under the swinging grate 12 and receives the ashes therefrom when the lever 15 is operated. After the operation of dumping several times takes place and the compartment 19 is choked, the fireman opens the door 16′ and forces the ashes over the arch 18 into the compartment 20, where they are stored until such time that they may be conveniently removed through a door 21. However, instead of removing the ashes in this manner I may eject them from the compartment by steam taken direct from the engine. A door 22 is conveniently located opposite a pipe 23, the other end of said pipe being tapped into the steam-dome. A valve 24 enables the operator to control the blast of steam, which of course will have to be of sufficient force to dislodge and blow the ashes out of the opening 22, and here is where the arch 18 serves an important function, in that it substantially prevents the steam being directed toward that portion of the compartment 19 which communicates with the fire-box at the swinging grate. The steam-blast then being directed toward the opening 22, and the arch and walls of the pit forming a trough, it is evident the compartment 20 can be cleaned at any time during which the engine is in motion.

The auxiliary ash-pit figures considerably in the organization of the elements forming my invention, and it consists of a partition 25 interposed between the grate 2 and the ash-pit 4. Partition 25 inclines upwardly from the front of the fire-box toward the feed-door and terminates at the juncture of the

swinging section 12 and the sections 8, making a receptacle, which is located directly under said sections 8.

It has been stated that approximately no ashes fall into the auxiliary ash-receptacle, due to the forced draft; but there will be an accumulation of dust, &c., which has to be removed once in a while. A door 27 affords a convenient means for this purpose.

In the front of the auxiliary ash-receptacle is a tube 30 of sufficient size, which has a flange or the like to receive fastening-bolts for securing it in position. A plurality of injectors 31 are mounted in the open front end of the tube and are connected to a steam-pipe 32, which forms one of a train of pipes forming a part of the automatic steam-regulator and which will be described farther on. A box-like structure 33 is built around the open end of the tube 30 and has in it a series of openings 34, adapted to be covered by a damper 35, having openings and intermediate connecting portions corresponding to those of the box 33. The damper is connected to a rock-shaft coupled at one end to a rod 37, whose upper end is in convenient reach of the engineer or fireman, or both. A screen 38 is placed over the openings 34 to prevent foreign matter from entering the tube and choking it. Thus the volume of air admitted to the tube to be mixed with the steam coming from the injectors is minutely regulated, and by careful judgment the operator can gage the fire under certain conditions by this means, for it must be remembered that the conditions constantly arising in keeping a fire in a locomotive are vastly different from those of a stationary engine. These unusual conditions can be attributed to various causes—such, for instance, as the change of load, the condition of the road-bed, &c.

I have said the partition 25 inclined toward the rear of the fire-box. It will be noted that the tube 30 is positioned to direct the mixture of steam and air against the partition, and it is this relationship which enables me to spread the blast, that the whole mass of fuel may receive a portion of it—that is to say, the blast striking the incline will have a tendency to, first, spread out, and, secondly, rise, and a certain portion of it is directed toward the rear of the fire. The blast being exceedingly strong and as it is spread out and up, obviously the whole receptacle is charged with a forced draft which is seeking its exit through the numerous tapered exits 11 to the fuel. As the size and regular relative location of these exits are proportionate to the tube, the fuel soon becomes honeycombed and the gases ejected therefrom. At this point I desire to state that according to my theory of promoting combustion with the present improvements the air is injected into the bed of fuel, which drives out and releases the gases, and to prevent these liberated gases being converted into smoke-gases I deem it highly expedient to draw them away from the bed of fuel—that is to say, I utilize the exhaust-steam to coact with the escaping gases, which is so regulated that the molecules thereof are rapidly drawn from their point of liberation, and in transit a series of resistances between the forced draft and the molecules of gas takes place, tending to break the molecules into finer particles, whereupon they readily become ignited, and a high grade of combustion is produced. By forcing the draft into the fire and then pulling it out by force I find I successfully prevent the gases lagging, and as they are susceptible to frictional resistance from the time they are generated until they are intermixed with air sufficient to ignite them the formation of smoke-gas is prevented. This, of course, means that all the generated gases are consumed. Consequently all the available heat from the fuel is obtained.

The means about to be described to regulate the influence of the exhaust-steam on the draft is of somewhat conventional form, and I wish it to be distinctly understood that I do not desire to limit myself to the particular construction shown.

35ª represents the base of the usual exhaust-pipe and has connected to it by suitable joints an extension 36. A telescopic extension 37 slides in the base and the extension 36 and is provided with a series of teeth 38, engaged by a pinion 39, mounted on a shaft 40. The shaft 40 extends outside the boiler and has an arm 41, which is connected to an operating-handle 42, disposed in convenient reach of the operator. A pair of bell-shaped deflectors are mounted around the extension 37, and as the latter is raised or lowered the pull of the draft is increased or decreased accordingly.

45 represents the usual deflector to direct the escaping heat and cinders to and through the sieve 46 as they come from the tubes 47; but as this action and construction is so well known in the art it is not deemed necessary to describe it further.

To increase the pull of the draft, the operator draws the handle 42, which rocks the shaft 40 and its gear, lowering the extension 37, allowing the force of the exhaust-steam to more readily take hold of the escaping heat and deliver it to the stack. Should it be desired to decrease the pull on the fire, the handle is reversely operated, which raises the extension 37 out of the field of the escaping heat, and the pull thereon is correspondingly reduced. Such an arrangement gives the operator perfect control of this important feature, and any variation of the fire can be readily cured by carefully adjusting the extension with relation to the deflectors.

The various regulators thus far described are manual and require careful adjustment before the fire is under perfect control; but in addition to these adjustments I have provided an automatic apparatus subject to the boiler-pressure which determines the stopping and starting of the injectors. The ap-

paratus now about to be described is covered by a separate application filed May 3, 1902, Serial No. 105,810; but in order to adapt it to a locomotive certain vital changes have been made, and in order to give a comprehensive understanding of the operation in view of these changes I will describe the whole system in detail.

50 represents the boiler, 51 the steam-dome thereof, and 52 the main steam-pipe connected therewith. Steam-pipe 32 of the injectors 31 is connected directly to the main steam-pipe 52; but the passage of steam therethrough is controlled by an automatic valve 54. Valve 54 comprises a casing 55, having a partition 56, in which is a valve-seat 57. The valve proper, 58, has a head or flange 59 at the upper end and an intermediate flange 60, which is smaller than the flange 59, the latter, however, being larger than the valve 58. An exhaust-opening is formed in the casing between the flanges 59 and 60, while there is an opening at the top above the top flange 59, with which a pipe 61 communicates. Pipe 61 leads to a valve 62 of peculiar construction, which also is claimed in a copending application filed May 3, 1902, Serial No. 105,809.

63 represents a casing having three openings 64, 65, and 66. A rocking valve 67 is mounted in the casing and is composed of two parts 68 and 69, the latter being seated in a cut-out portion of the former and is guided by a pin 70. The part 68 fits the casing loosely for the passage of the steam to the part 69, the latter being forced to its seat in the casing by the action of the steam thereon. A groove 71 in the part 69 connects the openings 65 and 66 at the appropriate time. On one end of the valve-stem is a lever 72, bearing a pin 73, designed to fit in a slot 74 of slightly greater width than the diameter of the pin in a lever 75, which is pivoted at 76 to a suitable stand. The lever 75 is raised and lowered by a piston and rod 77, operated by steam or water from a pipe 78. The opposite end of the lever has a guide therein through which passes a rod 80, and between each side of the lever and disks fastened to the rods are coiled buffer-springs 81, the tension of each being sufficient to normally hold the lever in a predetermined position, but not positive enough to prevent a slight vibration due to the pulsations of the steam-pressure on the piston-rod 77.

81 designates a condenser which is connected at the top by a valved pipe 82 with the main steam-pipe 52, and the pipe 78 connects with the lower portion, as at 83.

The springs are adjusted to cause them to give sufficiently to permit the predetermined steam-pressure to elevate the lever 75, which rocks the valve 67 and shuts off communication between the valve 54 and the exhaust-port 66 and opens communication between the pipe 78 and the valve 54, whereupon the steam acting on the flange 59 forces the valve 58 to its seat and shuts off the injectors. When the pressure of steam falls below normal, the piston and rod 77 will fall under the downward pressure of the upper spring and carry with it the valve-arm 72, which rocks the valve and opens communication between the top of the valve 54 and the exhaust-port 66, which allows the boiler-pressure to act on the flange 60 of said valve 54 and lift it from its seat. The turning of the valve 67 also shuts off communication between the pipe 78 and pipe 61 to prevent the escape of steam and water from the condenser.

The devices thus far described are either automatic or are located in convenient reach of the engine or fireman in the cab of the engine; but there are times when it is imperative that the fireman control the automatic regulator when he is feeding fuel to the fire, and to this end I have arranged a lever which may be operated to either open or close the valve 63. A lever 85 is fulcrumed on the base and has a crank formed at each end. One, 86, works in a slot in the lever 75, while the other, 87, plays in a slot 88 of a radius struck from the mounting of the lever 85 in an operating-rod 89. The action of the lever 75 will in no way affect the movement of the rod 89 because of the shape of the slot. However, should the fireman desire to raise or lower the lever 75 the operating-rod 89 is pulled to or from him until the wall of the slot 88 strikes the crank 87, whereupon the lever 85 is rocked and the desired movement of the parts is imparted.

The parts thus constructed and arranged, the operation of my invention is substantially as follows: Suppose the normal steam-pressure to be fifty pounds and the fire to be burning under the influence of the natural draft, steam having been cut off from the injectors. The various regulators are carefully adjusted to admit the proper proportion of air to the tube 30 and to exert a like equal pull at the exhaust-pipe 36. As the engine proceeds the variations incident to grade, load, &c., reflect on the pressure of steam, which causes the piston and rod 77 to flutter up and down. It is for this reason that the slot 74 is made a trifle larger than the pin 73. This prevents the steam being cut off at each trifling fluctuation. Inasmuch as the fluttering of the lever 75 is constant, a gentle hammering on the arm 72 is effected, and the movement of the valve 67 is gradual in either direction. Immediately the boiler-pressure drops below normal the piston and rod 77 drops, which moves the valve 67 and places ports 65 and 66 in communication, whereupon valve 58 is lifted by the steam and the injectors are started and the fire is increased, and hence the boiler-pressure. When normal pressure is reached again, the piston-rod raises the lever and closes the ports 65 and 66 and opens communication between ports 64 and 65, and steam and water impinge the flange 59 and

close the valve, and the injectors are stopped. The sensitiveness of the automatic regulator is subject to the force of the blast as well as the pull of said blast through the fuel, and while the one is dependent on the other to accomplish the desired result it is important that the adjustment of the springs be regulated to act in unison therewith; so, also, is it important that the grate structure be especially designed to assist to improve the grade of combustion to coact with the before-mentioned elements, for without the peculiar arrangement described the devices to force in and pull out the draft would fail.

I am aware it is old to employ the broad principles herein enumerated to accomplish certain ends in boiler structures; but I am not aware of these same elements being combined and assembled to work on a locomotive. To this end I have varied the details of construction to accord with the circumstances and conditions, and as a result I am enabled to control to a nicety the introduction of a blast, as well as control its being pulled out, and at the same time the generation of steam is regulated by boiler-pressure.

What I claim as new is—

1. In combination, with a locomotive and means for supplying a blast to the fuel therein, of an automatic regulator to control the blast, means having connection with the regulator and adapted for constant fluttering by the steam pulsations or by the movement of the locomotive without affecting the regulator, said means being operable to move the regulator by the boiler-pressure resultant from a variation from a predetermined point.

2. In combination with a locomotive and means for supplying a blast to the fuel therein, of a regulator-valve to control the blast, means to operate said valve by direct boiler-pressure, and means to permit said valve-operating means to be constantly fluttered by the steam pulsations in the boiler or by a movement of the locomotive without affecting the valve, except on a variation from a predetermined point of the pressure within the boiler.

3. The combination with a locomotive and a blower, of a valve to control the power supplied to the blower, an automatic regulator for said valve, means for operating said regulator by boiler-pressure, said operating means being arranged to permit its constant fluttering under the influence of the steam pulsation or the movement of the locomotive without affecting the regulator except on variation of the boiler-pressure from a predetermined point.

4. The combination with a locomotive and a blower therefor, of a valve operable by direct boiler-pressure to control the power-supply to the blower, a regulator for said valve, means for operating the regulator by direct boiler-pressure, said means being arranged to permit constant fluttering thereof under the influence of the steam pulsation or the movement of the locomotive without affecting the regulator except on variation of the boiler-pressure from a predetermined point.

5. In combination with a locomotive, a blower therefor, and a pipe to supply power to the blower, of a valve within the pipe and controlled by direct boiler-pressure, a regulator for said valve, means to operate the regulator by boiler-pressure, and means to permit the regulator-operating means to be constantly fluttered by the steam pulsations in the boiler or by movement of the locomotive without affecting the regulator except on variation of the boiler-pressure from a predetermined point.

6. The combination with a locomotive, a blower therefor and a pipe for supplying power to the blower, a valve in said pipe controlled by boiler-pressure, a regulator for said valve, a lever operable by boiler-pressure, a loose connection between the lever and the regulator to permit the lever to constantly flutter without affecting the movement of the regulator except on the operation of the lever by boiler-pressure.

7. The combination with a locomotive, a blower therefor and a pipe for supplying power to the blower, a valve in said pipe and operated by boiler-pressure, a lever operable by boiler-pressure, a regulator for said valve placed in operative relation to the lever, a loose connection between the lever and the regulator, and springs bearing on opposite sides of the lever, the said loose connection and springs permitting the lever to flutter without affecting the movement of the regulator except on the operation of said lever by boiler-pressure.

8. The combination with a locomotive, a blower therefor and a pipe for supplying power from the locomotive-boiler to the blower, of a valve in said pipe controlled by boiler-pressure, a lever operable by boiler-pressure, a regulator placed in operative relation with the lever, a loose connection between the lever and the regulator for permitting the lever to flutter without affecting the regulator except when the boiler-pressure operates said lever, and means for manually operating said lever irrespective of the boiler-pressure.

9. The combination with a fire-box, a grate, a closed ash-pit, a receptacle below the grate, means for injecting a blast into said receptacle, means for regulating said blast by boiler-pressure, independent means for admitting and regulating the admission of air with the blast, and means for drawing the blast through the fuel.

10. In combination with a fire-box, a grate, a closed ash-pit, a closed receptacle beneath the grate, means for injecting a blast in the said receptacle, means for regulating the said blast, independent means for admitting and regulating the admission of air with the steam

of the blast, means for drawing the blast through the fuel, and means for controlling said latter means.

11. In combination with a fire-box, a grate, a closed ash-pit, a closed receptacle beneath the grate, means for injecting a blast in the said receptacle, means for regulating the said blast, independent means for admitting and regulating the admission of air with the steam of the blast, means for drawing the blast through the fuel by use of the exhaust, and means for regulating the exhaust for said purpose.

Signed at New York city, county and State of New York, this 15th day of July, 1902.

HENRY E. PARSON.

Witnesses:
PAUL BONYNGE,
EMMA W. FINLAYSON.