No. 676,536. Patented June 18, 1901.

R. FERGUSON.

FIRE KINDLER OR SIMILAR APPARATUS FOR MIXING AIR AND FLUID.

(Application filed Dec. 23, 1899. Renewed Nov. 30, 1900.)

(No Model.) 2 Sheets—Sheet 1.

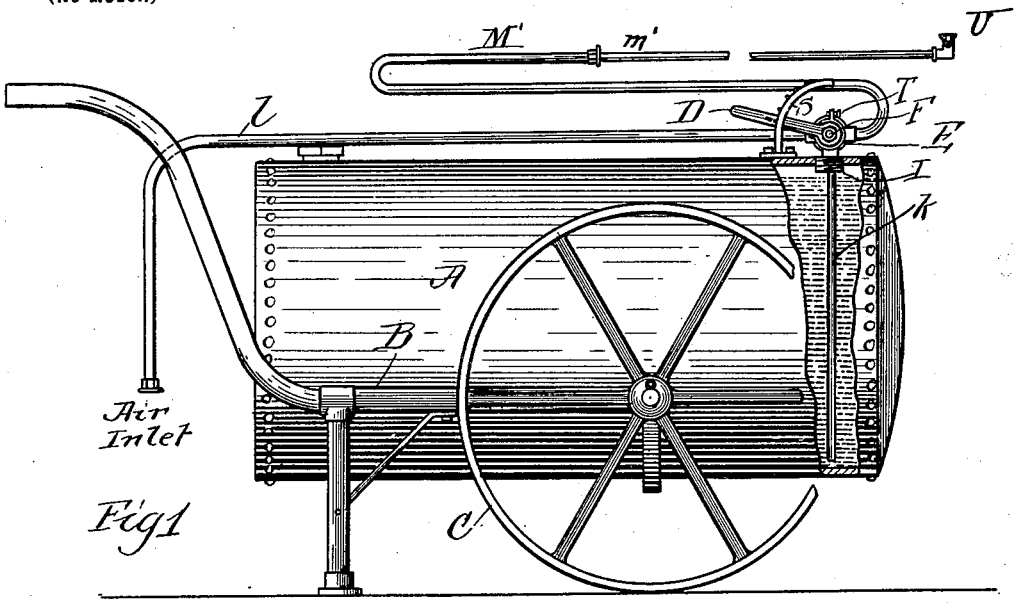


Fig 1

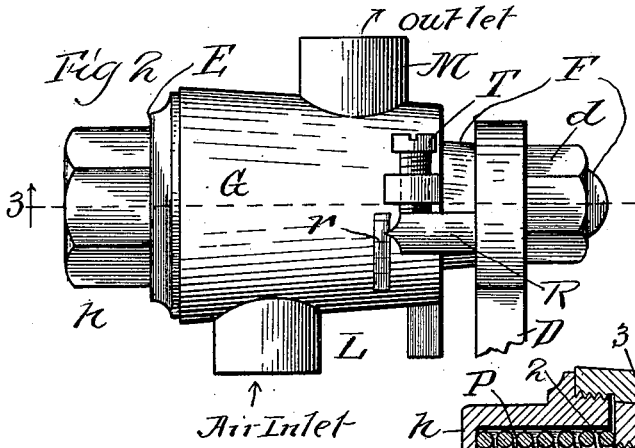


Fig 2

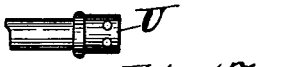


Fig 17.

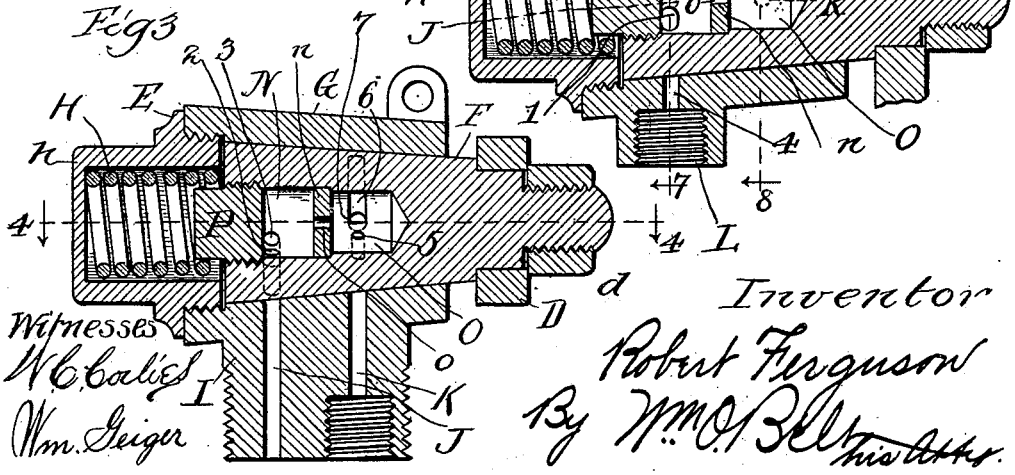


Fig 4

Fig 3

Witnesses
W. C. Cables
Wm. Geiger

Inventor
Robert Ferguson
By Wm. O. Bell
his Attys.

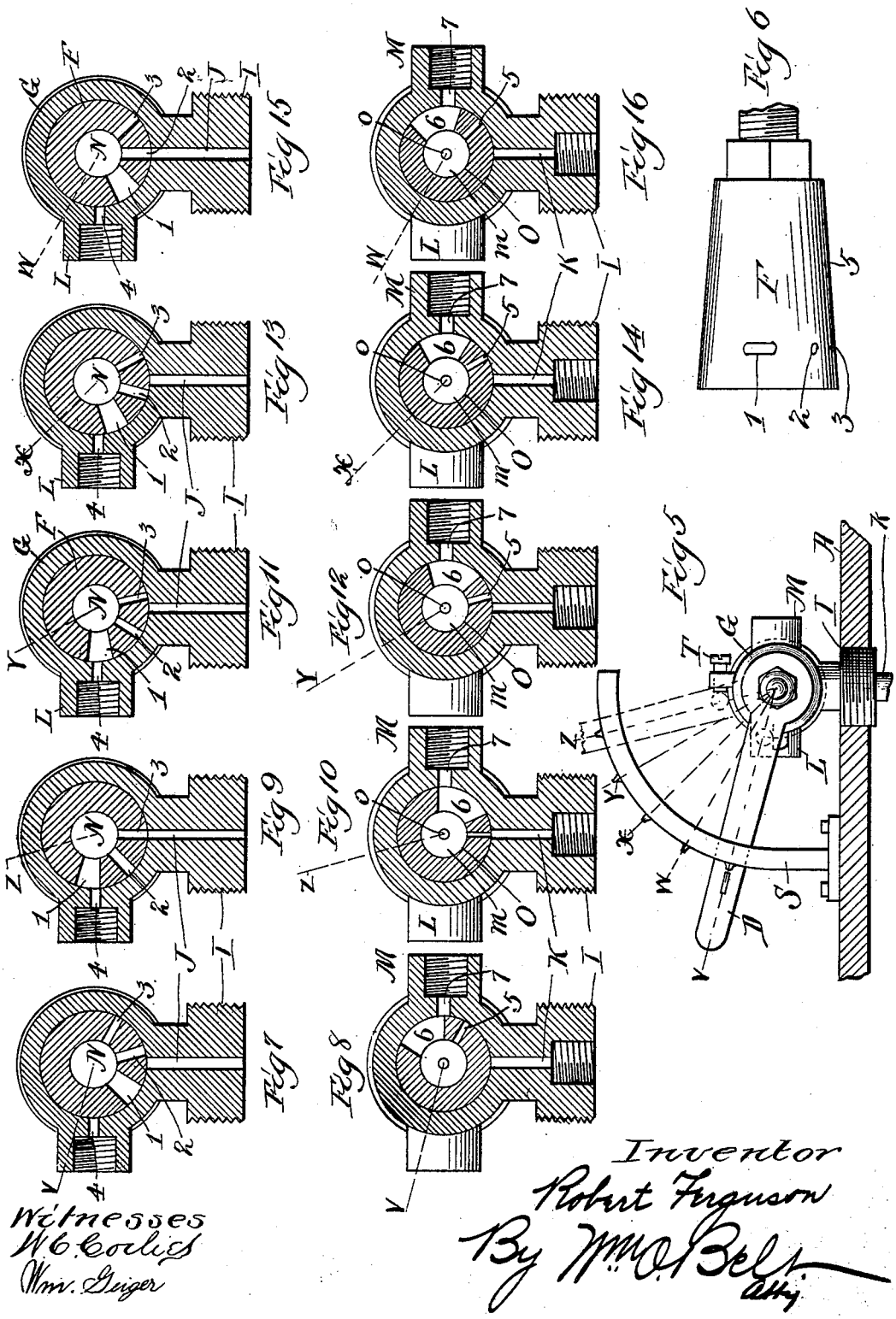
No. 676,536. Patented June 18, 1901.

R. FERGUSON.

FIRE KINDLER OR SIMILAR APPARATUS FOR MIXING AIR AND FLUID.

(Application filed Dec. 23, 1899. Renewed Nov. 30, 1900.)

(No Model.) 2 Sheets—Sheet 2.



Witnesses
W. C. Coles
Wm. Geiger

Inventor
Robert Ferguson
By Wm. O. Belt
Atty

UNITED STATES PATENT OFFICE.

ROBERT FERGUSON, OF ST. PAUL, MINNESOTA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO WILLIAM M. SIMPSON, OF CHICAGO, ILLINOIS.

FIRE-KINDLER OR SIMILAR APPARATUS FOR MIXING AIR AND FLUID.

SPECIFICATION forming part of Letters Patent No. 676,536, dated June 18, 1901.

Application filed December 23, 1899. Renewed November 30, 1900. Serial No. 38,139. (No model.)

To all whom it may concern:

Be it known that I, ROBERT FERGUSON, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Fire-Kindlers or Similar Apparatus for Mixing Air and Fluid, of which the following is a specification.

My invention relates to certain new and useful improvements in apparatus for mixing air and a fluid and supplying the same under pressure for various uses.

The invention is particularly adapted to kindling fires in locomotives, and I have therefore for convenience and simplicity shown this application of the invention in the drawings, although it will be distinctly understood that the invention may be adapted and used in setting tires, straightening frames, and in all other connections where a machine-shop blowpipe is now or may be employed and also in other connections.

One object of this invention is to provide a simple and inexpensive apparatus which can be readily moved about as occasion demands and easily manipulated to control the mixing of the air and fluid in the desired proportions and the discharge of the saturated air for any purpose.

Other objects of the invention are to accomplish the feeding of fluid from a tank or other source of supply and mixing it with air under pressure, to provide for cleaning out the parts after the apparatus has been used, to remove surplus fluid, and to permit the confined air in the fluid-supply to escape, so as to relieve the supply of air-pressure.

Another object is to provide an apparatus which can be used for kindling fires in locomotives without opening the fire-box door by applying the burner under the grate, thereby causing the flame to pass up through the green coal and quickly start a brisk fire in the fire-box under the natural draft of the locomotive.

A further object is to provide a novel valve for an apparatus of this character which can be manipulated by a single lever to accomplish all or any of several results, to wit: the admission of air to the fluid-tank to force the fluid therefrom and to mix the fluid with air before it is discharged, to cause the air to pass through the apparatus without entering the tank, or to shut off the air entirely and permit the air under pressure in the tank to blow off; and a further object is to provide a valve with an air-chamber and a mixing-chamber and connect it with an air-supply and a fluid-tank, so that the air may be caused to pass into the air-chamber and the tank and force the fluid from the tank into the mixing-chamber, where it will be mixed with air passing from the air-chamber and then discharged under pressure.

My invention has in view also to mix air and a fluid together in a simple and accurate manner, so that a fuel will be produced in proper proportions for securing superior combustion without wasting the fluid, to regulate the supply of air, and thereby control the proportions of air and fluid as they are mixed, and to accomplish many other important results, which will fully appear hereinafter.

In the accompanying drawings, Figure 1 is a side view showing my invention embodied in a portable locomotive fire-kindler, the fluid-tank being partly broken away to show the oil-pipe therein. Fig. 2 is a top plan view of the valve detached. Fig. 3 is a vertical sectional view of the valve on the line 3 3 of Fig. 2. Fig. 4 is a horizontal sectional view of the valve on the line 4 4 of Fig. 3. Fig. 5 shows an end view of the valve and indicates the different positions the operating-lever may have. Fig. 6 shows the valve-plug detached. Figs. 7 to 16, inclusive, are sectional views on the lines 7 7 and 8 8 of Fig. 4 and showing the valve in its different positions. Fig. 17 illustrates a burner which I may use.

Referring to the drawings, in which like characters of reference denote corresponding parts in all of the figures, A designates an ordinary tank or reservoir of any preferred size and construction for holding the fluid which is to be mixed with air and supplied as a fuel, and for convenience and to enable the apparatus to be easily moved from place to place as occasion requires I support this

tank in a skeleton frame B of any desired form and mount the same upon suitable carrying-wheels C. The form and character of the tank and its frame may be varied as desired, as my invention can be used with any kind of fluid-supply receptacle and whether it be portable or stationary.

The apparatus is operated entirely by the lever D of the valve E, and it is this valve which constitutes the principal feature of my invention.

The valve E consists of a tapered plug F, arranged within a body G, the lever D being secured on the projecting outer end of the plug by a nut *d*. This plug is held in place within the body by means of a spring H bearing against the larger end of the plug and inclosed within a cap *b*, screwed to the body. The body of the valve is provided with a downward extension I, having an exterior thread by means of which the valve can be screwed into an opening in the top of the tank, as shown in Fig. 1, and this extension is provided with a passage J for admitting air to the tank and a passage K for permitting the fluid to pass therefrom. The lower end of the passage K is enlarged and threaded to receive a pipe *k*, which extends down adjacent to the bottom of the tank. The body of the valve also has a connection L on one side for receiving the air-inlet hose *l* and an oppositely-disposed connection M for the discharge-hose M′, passages 4 and 7 being provided in said connections for a purpose hereinafter described. I may employ hose or flexible pipe of any description, or I may use ordinary jointed pipe, this being a detail of the invention which can be changed to suit different conditions.

The plug is provided with an air-chamber N and a mixing-chamber O, these chambers being separated by a partition *n*, having an opening *o*. A simple way of making these chambers is to bore a central opening in the plug and arrange the partition-plate therein against a shoulder, so as to divide the opening into the two chambers, and closing the central opening with a screw-head P. I reserve the right, however, to make these chambers and locate them in any other way and position that may be found suitable.

In that part of the plug containing the air-chamber N, I provide air-ports 1 2 3, which are adapted to register with the air-passage 4 and outlet-passage J in the valve-body, and in that part of the plug containing the mixing-chamber are the ports 5 and 6, which are adapted to register with the passages K and 7. To guide the operator in adjusting the lever, I provide a pointer R on the lever and a rib *r* on the valve-body, suitably marked, as shown in Fig. 2, or the lever may operate alongside a curved arm S, properly marked, as shown in Fig. 5. The rib or arm is provided with marks of a suitable character to indicate at what points the lever should be brought to open certain ports and passages, as will be fully described hereinafter. The screw T is provided to regulate the manner in which the port 1 shall register with passage 4 and control the supply of air entering the air-chamber by constituting a limit to the stroke or movement of the lever.

I will now proceed to describe the operation of my invention as embodied in a locomotive fire-kindler.

The tank being partially filled with a fluid, the apparatus may be moved up close to a locomotive and the hose *l* connected with an air-supply pipe. The burner U is arranged beneath the grate of the fire-box of the locomotive, and when the mixed air and fluid issuing from the burner is lighted the flame will extend up through the green coal and quickly ignite the same and produce a hot fire at once. The burner can be moved around beneath the grate, so as to ignite all the coal in the fire-box and start the fire burning briskly in all parts of the fire-box in a very short space of time. The air-pressure is used to force the fluid out of the tank and also to mix therewith and feed the mixture to the burner or elsewhere, and the admission of air to the air-chamber of the valve and to the tank, as well as the escape of fluid from the tank and the feeding of the mixed air and fluid, is controlled and governed entirely by the single lever D. In Fig. 5 of the drawings I have indicated the different positions to which this lever may be adjusted, the corresponding positions of the plug and its ports being shown in Figs. 7 to 16, inclusive. When the lever is in closed position V, Fig. 5, the plug will be in the position shown in Figs. 7 and 8, all ports being closed except the port 6, which only partly registers with the passage 7. If the lever is turned to the full limit of its upward movement and into open position Z, the plug will be arranged as shown in Figs. 9 and 10, with the ports 1 and 3 registering with the air-inlet passage 4 and outlet-passage J, respectively, the port 5 registering with the fluid-passage K and the port 6 registering with the mixture-passage 7. It will therefore be readily observed that when the lever is thrown to open position the air will pass through passage 4 and port 1 into the air-chamber N and a part of the air will pass down through the port 3 and passage J into the tank to force the fluid therein up through the pipe *k*, passage K, and port 5 into the mixing-chamber O, where the fluid is mixed with a portion of the air, which passes from the air-chamber into the mixing-chamber through the opening *o* in the partition, and the mixture is carried on out under pressure of the air through port 6, passage 7, and the hose M′ to the burner U or elsewhere. The area of the port 6 and passage 7 and the combined area of the openings in the burner should exceed the area of the opening *o* in the partition, so as

to provide a lower pressure of air in the mixing-chamber than in the tank and air-chamber, and thereby permit the fluid to flow up freely through the pipe *k*. The screw T may be adjusted to provide for a full or partial registering of the port 5 with passage 4, and thereby regulate the air-supply which enters the air-chamber, controlling the supply of fluid flowing from the tank and the proportions of air and fluid to be mixed together. Assuming that the fire has been properly kindled, the next step is to shut off the air-supply to stop forcing the fluid from the tank and, in fact, completing the operation of the apparatus as far as supplying mixed air and fluid is concerned. The air-supply can be cut off, of course, by throwing the lever down to closed position V at once; but that would leave the tank full of compressed air, so that if the valve should be accidentally turned to cause the port 5 to register even slightly with the passage K the mixture would escape unexpectedly and blow off through the burner. Besides, I desire to remove all surplus fluid from the mixing-chamber and the hose M′ when the operation is completed to keep them in a clean condition, and thereby promote the efficiency of the apparatus and also to prevent rotting the hose. I have therefore provided for moving the lever to position Y, Figs. 11 and 12, which results in closing the passages J K and permitting the air to pass directly from the air-chamber through the opening *o* into the mixing-chamber and thence into the hose M′. This will effectually free the mixing-chamber and the hose of all fluid remaining therein and keep them in a clean condition. If it is desired to cut off the air-supply and outlet-ports temporarily while the apparatus is still in use, the lever is thrown into position X, Figs. 13 and 14, in which all the ports will be lapped except the outlet 6. To permit the air which remains under pressure in the tank to escape, the lever is turned to position W, Figs. 15 and 16, in which the air-supply is cut off, and port 2 registers with passage J, so that the air in the tank may pass through passage J to the air-chamber and mixing-chamber and the port 6 and passage 7 to the hose M′ and escape therefrom, relieving the tank from air-pressure entirely. It will thus be observed that after my apparatus has been in use I am able to return it to its original condition without leaving compressed air in the tank and with the valve and hose free from fluid, which would clog the parts, rot the hose, and destroy the effectiveness of the apparatus if permitted to accumulate, and this is accomplished entirely by a simple manipulation of the valve-lever. The different movements constitute, in effect, a continuous cycle of operation for the apparatus, which is usually followed; but the movements are not limited to this order, and they may be performed wholly independent of each other. The lever may be regulated by the adjusting-screw to govern the volume of air admitted to the air-chamber, and in this way the proportions of air and fluid which are mixed together are controlled and maintained.

It has heretofore been customary to insert the burner of a fire-kindler in the fire-box of a locomotive through the door and direct the flame down upon the coal; but this method has many disadvantages. I arrange my burner under the grate, leaving the fire-box door closed, and the flame extends upward through the coal under the natural draft of the fire-box and the pressure of the air in the hose. The air and fluid become thoroughly intermingled and mixed in the mixing-chamber and the hose M′, and thereby promote the combustion, while at the same time reducing the quantity of the fluid used. I prefer to have the burner U carried by a piece of pipe *m′*, connected with the hose M′, and it may be constructed in any desired shape and character to suit the particular application of the invention. As shown in Fig. 17, I prefer to provide two holes in the upper side of the burner, so that the flame will be directed upward into the coal, and this burner may be constructed in any desired manner, as in Fig. 1 or Fig. 17, or otherwise.

It will be obvious to those skilled in the mechanical arts that my invention can be put to a great variety of uses besides those herein mentioned, the only change involved in most instances being in the kind of burner employed. My improved valve may also be used in many other relations where it is desired to mix air and a fluid, and I reserve the right to use it with the parts described and with any and all other parts and for any other purpose to which it may be applicable.

Instead of providing a burner U the pipe M′ or the hose *m* may be connected to any other part which may be desirable and the mixed air and fluid carried off to a distant point.

It will be apparent from the foregoing description and the drawings that my improved apparatus as embodied in a fire-kindler is exceedingly simple and can be operated without the exercise of any special skill to kindle a fire in a locomotive quickly and in a thorough manner. The apparatus is manipulated by a single lever, and the construction is such that it is practically impossible to operate the apparatus improperly or for the apparatus to get out of order.

I may use any kind of volatile oil in the tank, crude oil being preferred, and the pressure should be sufficient to force the oil from the tank in the desired quantity; but I may use a gas in the tank, in which case, the gas being under pressure, it would not be necessary to pass the air from the air-chamber into the tank until the gas therein had reached a very low pressure, whereupon the air could be turned into the tank to force the gas there-

from. Instead of air I may also use any other gas, which would be conducted into and through the valve in the same manner heretofore described.

Having thus fully described the invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a liquid-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve being provided with an air-chamber in which the volume of air entering the valve is adapted to be divided, and a mixing-chamber in which liquid from the tank is mixed with compressed air from the air-chamber, substantially as described.

2. The combination with a liquid-fuel tank, of a valve connected with the tank and with a source of compressed-air supply, said valve having an air-chamber and a communicating mixing-chamber, both of said chambers having communication with the tank, so that the air passing into the air-chamber will be divided and a portion enter the tank to force the fluid therefrom, while a portion passes into the mixing-chamber to mix with the fluid coming from the tank, substantially as described.

3. The combination with a liquid-fuel-supply tank, of a valve connecting with the tank and with a source of compressed-air supply, said valve having an air-chamber and a communicating mixing-chamber and adapted to direct a portion of the compressed-air supply into the tank to force the liquid into the mixing-chamber, where it is mixed with a portion of the air entering the mixing-chamber from the air-chamber, and a delivery-pipe connected with said mixing-chamber, substantially as described.

4. A valve provided with an air-chamber and a communicating air and liquid mixing chamber and a delivery-outlet for the mixing-chamber, in combination with a compressed-air supply connected with the air-chamber and a liquid-supply having independent connections with the air and mixing chambers, substantially as described.

5. A valve provided with an air-chamber and an air and liquid mixing chamber, a partition located between said chambers, and having an opening therein, in combination with a compressed-air supply connected with the air-chamber and a liquid-supply having independent connections with the air and mixing chambers, and a delivery-outlet for the mixing-chamber of greater area than the opening in the partition, substantially as described.

6. A valve provided with an air-chamber having an air-supply connection and an air and liquid mixing chamber provided with a delivery-outlet, a partition located between said chambers and having an opening therein, and a liquid-fuel tank connected with the valve and having independent communication with the air-chamber and with the mixing-chamber, substantially as described.

7. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve being provided with an air-chamber communicating with the air-supply and the tank, and a mixing-chamber communicating with the tank and having an outlet, and a partition located between said chambers and provided with an opening so that a portion of the air entering the air-chamber may pass into the mixing-chamber while a portion of the air passes into the tank, substantially as and for the purpose described.

8. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a plug provided with a central opening, a partition located in said opening and dividing the plug into an air and a mixing chamber, said air-chamber having communication with the air-supply and the tank, and the mixing-chamber having communication with the tank and an outlet, and the partition being provided with an opening so that the air entering the air-chamber may be divided to pass into the mixing-chamber and into the tank, and a burner connected with the outlet from the mixing-chamber and provided with openings for the discharge of the mixed air and liquid, the combined area of said openings being larger than the opening of the partition-plate, substantially as described.

9. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a body provided with an inlet and an outlet passage and with independent passages leading to and from the tank, and a plug operating within the body and provided with ports to register with the passages, substantially as described.

10. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a body provided with two pairs of inlet and outlet passages, and a plug operating within the body and having a number of ports disposed in relation to each pair of inlet and outlet passages, and adapted to be adjusted to register therewith, substantially as described.

11. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a plug provided with an air-chamber and an air and liquid mixing chamber, and ports communicating therewith, and a body inclosing said plug and having an independent inlet and outlet passage for each of said chambers, substantially as described.

12. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply,

said valve comprising a body provided with passages leading to and from the air and liquid supplies and a plug operating within the body and provided with ports adapted to register with said passages, and means for adjusting the plug to turn on, shut off, or change the direction of the air flowing through the valve, substantially as described.

13. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and comprising a body having an air-inlet passage communicating with a source of compressed-air supply, air and liquid passages communicating with the tank, and a delivery-outlet passage, and a plug operating within the body and provided with an air-chamber and a communicating mixing-chamber, said plug being provided with ports 1 and 3 to register with the air inlet and outlet passages, and ports 5 and 6 to register with the liquid and delivery outlet passages, substantially as described.

14. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and comprising a body having an inlet-passage communicating with a source of compressed-air supply, air and liquid passages communicating with the tank, and a delivery-outlet passage, and a plug operating within the body and provided with an air-chamber and a mixing-chamber, said plug having three ports communicating with the air-chamber and adapted to be registered with the air inlet and outlet passages in the body, and two ports communicating with the mixing-chamber and adapted to be registered with the liquid and delivery outlet passages in the body, substantially as and for the purpose described.

15. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and comprising a body having an air-inlet passage communicating with a source of compressed-air supply, air and liquid passages communicating with the tank, and a delivery-outlet passage, and a plug operating within the body and provided with an air-chamber and a mixing-chamber, said plug being provided with a port 3, a larger port 1 and an intermediate port 2 communicating with the air-chamber and adapted to register with the air inlet and outlet passages in the body, and a port 5 and a larger port 6 communicating with the mixing-chamber and adapted to register with the liquid and delivery outlet passages in the body, substantially as described.

16. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and having an air-chamber and a mixing-chamber, a partition between said chambers provided with an opening, an air-inlet leading to said air-chamber, a delivery-outlet from the mixing-chamber, and means for directing the air through the valve to the tank to force the liquid into the mixing-chamber and through the delivery-outlet, or to shut off the air-supply from the tank and cause the air to pass directly through the air and mixing chambers to the delivery-outlet, or to shut off the air-supply and permit the compressed air in the tank to escape, substantially as described.

17. The combination with a liquid-fuel tank, of a valve connected therewith and having an air-inlet and an air-outlet, a liquid-inlet and a delivery-outlet, and a plug provided with ports to register with the air-inlet and liquid-inlet and air-outlet and delivery-outlet so that by manipulating the plug the air may be directed into the tank to force the liquid therefrom, or be shut off from the tank and directed through the valve, substantially as described.

18. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, the said valve comprising a body and a plug provided with a compressed-air chamber intermediate of the air-supply and the liquid-tank and a mixing-chamber receiving liquid from the tank and air from the air-chamber, and an outlet for the mixed air and liquid, substantially as described.

19. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a body having air inlet and outlet passages, a liquid-inlet passage and a delivery-outlet passage for the mixed air and liquid, and a plug operating within the body and having an air-chamber and a connecting mixing-chamber, ports communicating with the air-chamber and adapted to register with the air-passages and ports communicating with the mixing-chamber and adapted to register with the liquid-passage, and means for operating said plug, substantially as described.

20. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a body and a plug provided with passages and ports through which the air and liquid pass, and a device for operating said valve to cause the air to pass into the tank and also to mix in the valve with the liquid forced from the tank by the air which passes therein, substantially as described.

21. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a body and a plug provided respectively with passages and ports adapted to be registered with each other at different times for directing the flow of air and liquid through the valve, and a device for operating said valve and controlling the registration of the passages and ports to direct the air into the tank and also into the liquid forced from the tank to be mixed therewith, or to cause the air to pass directly

through the valve without entering the tank, or to shut off the air-supply and open the air-passage to the tank to permit the air therein to escape, substantially as described.

22. The combination with a liquid-fuel-supply tank, of a valve connected with the tank and with a source of compressed-air supply, said valve comprising a body, a plug, a lever for operating the same, and an adjustable screw device forming a stop for and limiting the movement of said lever, substantially as described.

ROBT. FERGUSON.

Witnesses:
LILLIAN A. WASON,
OTTO KUEFFNER.