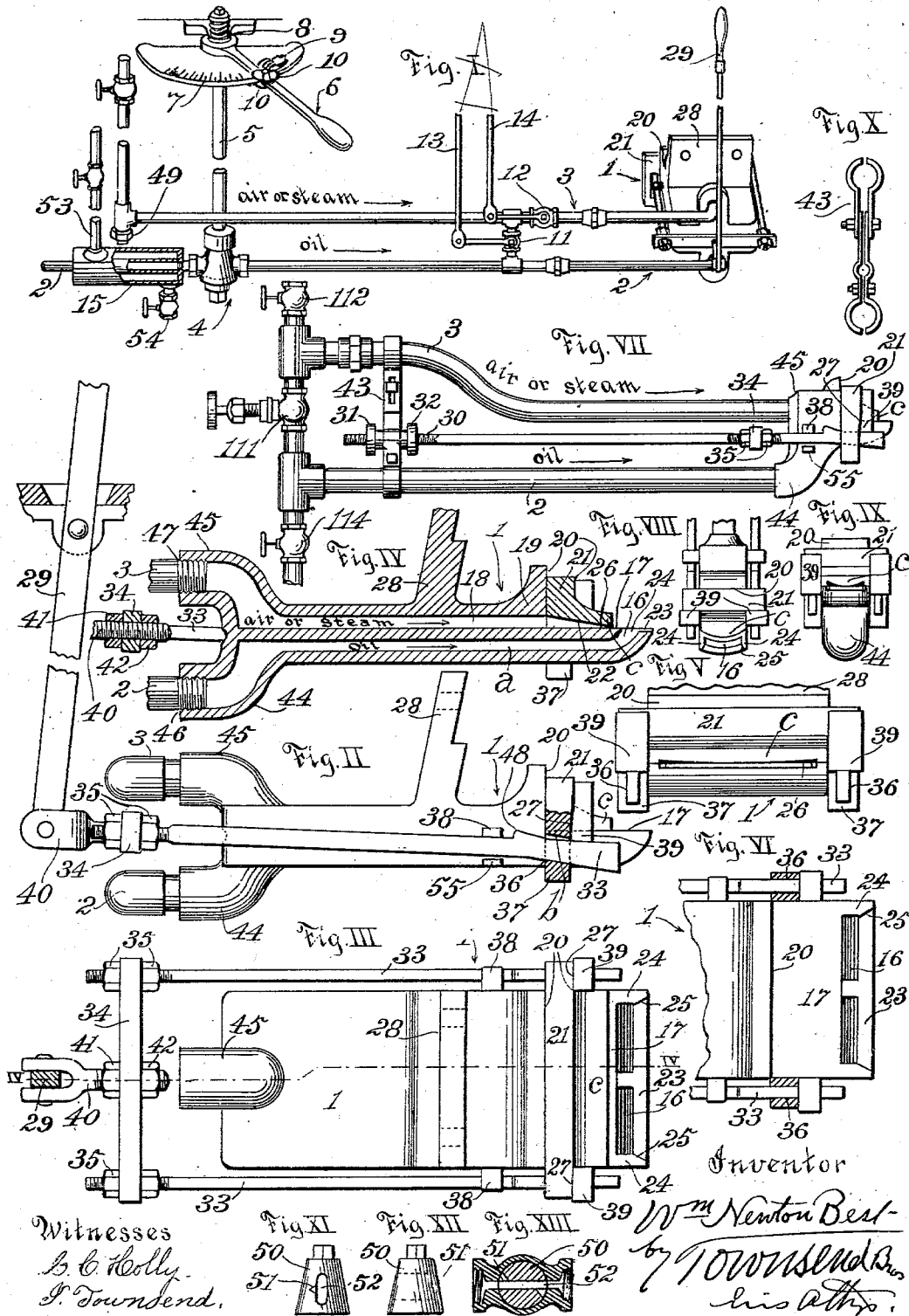


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W. N. BEST.
HYDROCARBON BURNING APPARATUS.
APPLICATION FILED MAY 29, 1902.

NO MODEL.



UNITED STATES PATENT OFFICE.

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OF CALIFORNIA.

HYDROCARBON-BURNING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 752,195, dated February 16, 1904.

Application filed May 29, 1902. Serial No. 109,545. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM NEWTON BEST, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Hydrocarbon-Burning Apparatus, of which the following is a specification.

An object of this invention is to provide a superior apparatus for burning liquid hydrocarbon in locomotive and stationary furnaces and fire-boxes and in other places in which hydrocarbons are to be consumed.

One object of the invention is to provide means whereby the operation of the apparatus may be perfectly controlled with the greatest ease and convenience possible and whereby the apparatus may be operated from the deck of a locomotive or from any other position where the fireman or engineer may be stationed.

Another object is to provide for producing a uniform fire, filling the surface of the fire-box regardless of any canting of the engine or locomotive which may bring the nozzle of the burner out of a horizontal position.

Another object of the invention is to provide means whereby the fire may be reduced very low and yet will be retained with a wide flame which will cover the area of the furnace.

An object of the invention is to produce a superior flat fan-shape blaze and at the same time to so atomize the oil that perfect combustion is attainable.

Heretofore a difficulty to be overcome has been that when an oil-burning locomotive has been brought to a standstill, thereby necessitating the lowering of the fire to a minimum, the oil will run out or drip from the burner while the steam and oil are reduced to the minimum and will form in a pool on the bottom of the fire-box. By the present invention this difficulty is avoided and the fire may be turned down to any required extent and no dripping or running over of the oil will ensue.

Another object is to provide more nearly

perfect means whereby when the atomizer or atomizer-channel becomes clogged with any foreign substance or scale the nozzle may be opened and such foreign substance or scale may be removed and the nozzle again closed, free from any obstruction from the foreign substance or scale which may have accumulated and the removal of which is required.

Another object is that if the oilway becomes clogged by foreign substances, such as waste or residuum in the oil, the same can be removed by steam applied through the oil-pipe by diverting thereto steam which would otherwise be applied to the atomizer of the burner. Valved connections for such operation are so arranged that the clearing of the atomizer may be accomplished while the locomotive is in motion as well as while standing still and with stationary and marine boilers as well as with locomotives.

Another object of this invention is to provide means by which a combustible liquid can be so broken up and atomized by a force of steam or air that perfect combustion is obtainable, and by the peculiar formation of the mouth of the burner the oil after being struck by the steam or air will be carried to produce a fan-shaped blaze that may fill the furnace throughout its full width, keeping all points of the furnace up to the igniting temperature. So perfectly does this burner work that the igniting-point is within a few inches of the nose of the burner.

The accompanying drawings illustrate the invention.

Figure I is a fragmental view, partly in section, illustrating the invention as adapted for a locomotive. The atomizer is viewed from the rear. Fig. II is an elevation from the right of Fig. I, showing the atomizer and a portion of the lever for controlling the same. Fig. III is a plan of the atomizer shown in Fig. II. Fig. IV is a fragmental section on irregular line IV IV, Fig. III. Fig. V is a front elevation of the atomizer shown in Figs. I, II, III, and IV. Fig. VI is a view of the

front end of the atomizer, the movable nozzle-piece being removed to expose the end of the tablet. Fig. VII is an elevation of another form of the steam and oil connections and atomizer which form a part of this invention. This is a desirable form for marine and stationary boilers. Fig. VIII is a fragmental plan of the atomizer shown in Fig. VII, the connections being broken away to contract the view. Fig. IX is a front elevation of the atomizer shown in Figs. VII and VIII. Fig. X is a detail view of the brace for the adjusting device of the nozzle-piece shown in Fig. VII. Figs. XI, XII, and XIII are details of the oil-regulating valve.

Referring to the forms shown in Figs. I to VI, inclusive, 1 designates the atomizer; 2 and 3, the pipes, respectively, for supplying liquid fuel and an expansive fluid thereto; 4, a regulating and cut-off valve for the oil-pipe; 5, a valve-stem for valve 4, and 6 a lever for operating said valve-stem; 7, a graduated quadrant for said lever by which the operator can determine to a nicety the amount of oil admitted to the atomizer. In practical use on a locomotive the lever 6 and quadrant 7 will be located in the cab within reach of the fireman or engineer, as the case may be. 8 is a tension-spring to frictionally maintain the lever in any determined position. 9 is a temporary stop for the lever 6 to stop the lever in position to allow a minimum quantity of oil to be fed to the atomizer. This stop may be a spring-catch or a hinged attachment which will allow the lever 6 to be moved into position for entirely cutting off the oil. 10 designates a screw-clamp for clamping the quadrant-lever in closed position, so that it may not be accidentally opened when the fire is shut down. 11 is a valved connection between the steam-pipe 3 and the oil-pipe 2, and 12 is a valve in the steam-pipe 3 between the connection 11 and the atomizer 1, whereby when the valves 4 and 12 are closed and the valved connection 11 opened steam may be passed through the oil-pipe to the atomizer, thus to drive out any material which may clog the oil-passage in the atomizer. 13 and 14 are connecting-rods leading from the valves 11 and 12, respectively, to the cab (not shown) for the purpose of opening and closing said valves. 15 is a steam-chamber around the oil-pipe 2 between the source of supply (not shown) and the regulating-valve 4. The atomizer has an outlet 16 opening up through a tablet 17, which forms one wall of a steam-chamber 18 and extends forward beyond the other wall 19 of said chamber. 20 is a vertical way perpendicular to the tablet 17, formed in the wall 19, and is formed slightly tapering by means of inclined walls 27. The way extends clear across the wall 19. A movable nozzle-piece 21 is mounted on the way 20 to move toward and from the tablet 17. The under face 22 of the nozzle-piece or lip 21 is inclined converging forwardly toward the tablet and terminating

near but rearward of the outlet 16. The tablet is recessed at 23, and the recess leads forwardly from the outlet 16 to the front end of the atomizer. 24 designates guards at the opposite sides of the outlet 16 and the extension 23 thereof formed by the recess in the tablet. Said recess has flaring side walls formed by the guards 24, which have oblique diverging walls 25, as shown in Fig. III, so that the substances in passing from the outlet 16 and from the nozzle over the recess 23 may flare or spread laterally. The guards 24 prevent the pressure of the expansive fluid from discharging any liquid fuel prematurely from the sides of the nozzle, and thus cause the fuel to be taken up, atomized, and driven forwardly in the desired fan shape into the fire-space where combustion is to take place. The guards prevent any dripping of the liquid over the sides of the nozzle and compels the fuel to take the requisite course. 26 designates the outlet-opening of the nozzle between the nozzle-piece or lip 21 and the face of the tablet. Said steam or air outlet 26 is wider at its edges than at the middle, so that a greater quantity of the expansive fluid will be emitted at the edges of the outlet than at the middle thereof, thereby supplying greater force at the edges for taking up and propelling the liquid fuel from the outlet.

In order to produce the perfect breaking up, atomizing, and spreading of the liquid fuel hereinbefore referred to, it is necessary to reduce that portion of the tablet over which the stem and oil pass approximately three sixty-fourths of an inch below that portion of the tablet over which the steam alone passes, the reduced portion or recess 23, which forms the final oil-outlet, being directly in front of the oil opening or outlet 16, through which the oil is emitted to the air or steam blast. The recess 23 gradually flares, increasing in width forwardly, leaving the sides and surface of the steam-tablet of the atomizer practically in one plane. Then by making the steam or air slot larger at each side than at the middle I am able to carry the steam or air combined with the atomized liquid fuel to produce the width of flame necessary to span the width of the furnace. It is to be understood that when the width of a fire-box or furnace is but three feet the atomizer-slot should not be so large in cross-sectional area at its edges as when the atomizer is for the furnace of a large boiler, which may be, say, eight feet in width. The slot of the nozzle must be appropriately enlarged on each side of the burner-lip for increasing the flow of oil at the edges of the blaze, so that fuel will be supplied for the increasing blaze as it widens.

The peculiar construction of the atomizer-lip and the means by which it can be raised is such that the sand now commonly used on oil-burning locomotives for cleaning the flues from soot cannot collect upon the burner and

give trouble when the atomizer-lip is raised to clear the atomizer-channel from any foreign substance, because the taper at 27 is so slight that it is impossible for sand to collect in the ways 20, and the construction is such that the force of steam or air can be used to clean the ways from dust, sand, or other foreign substance when the atomizer-lip is being lowered to its fixed position. The atomizer may be cleaned when the locomotive is in motion or at a standstill, at the will of the operator.

Should any foreign obstruction—such as sand, particles of waste, or other solid matter—collect in the oilway *a* of the burner, the same can be removed by closing the oil-regulating valve 4, then shutting the valve 12, and then opening blow-out valve 11, which may be done at the will of the operator in the cab.

28 is a lug on the atomizer for the purpose of carrying the burner in a fixed position and also to easily adjust the pitch of the burner by the use of liners, (not shown,) which can be placed between this lug and the rear sheet of boiler (not shown) when the lug does not slant sufficiently to give the desired pitch. By the use of this lug attachment the atomizer is held to the boiler at any desired pitch and may be removed without removing the apron of the ash-pan as is required by other burners.

In the locomotive-burner means are provided for raising and lowering the atomizer-lip by means of a lever 29 in the cab. It is to be understood that, if desired, the lip may be operated by a set-screw and nuts 30, 31, and 32, as shown in Fig. VII.

I provide superior means for operating and adjusting the atomizer-lip by two wedge members 33, each being independent of the other and adjustably mounted on a cross-bar 34 by means of nuts 35. The wedge members 33 play in ways 36 in arms 37 of the nozzle-piece 21, which extend on the opposite sides of the body 1 of the atomizer and are held down by shoulders 38 39 on the body 1. The wedge members 33 are to be simultaneously moved to and fro by means of the bar 34, and said bar may be operated by any suitable connection. 40 designates such a connection adjustably connected with the bar 34 by set-nuts 41 and 42 and operated by the lever 29, which may extend up into the cab. By this wedge device, comprising the two independent rods 33, acting on the opposite sides of the nozzle-piece 21, each side of the nozzle-piece will be drawn down independently of the other side, thereby allowing the nozzle-piece to be forced into and perfectly held in its closed position. The set-nuts 35 enable the attendant to adjust the wedge device so that the bar 34 will act equally upon both of the members 33 while at right angles thereto, so that approximately the same strain is applied on each side of the nozzle-piece to bring it into and hold it in closed position.

Owing to the different varieties of locomotive and other fire boxes on which this apparatus may be applied, I do not limit myself to adjusting the device by means of a lever 29.

Another method of adjustment is shown in Fig. VII, in which the set-nuts 31 and 32 are employed, acting on the brace 43, which may be fastened to the atomizer-pipes 2 and 3.

The atomizer-body is desirably furnished with bosses 44 and 45, integral with said body, the same being respectively provided with screw-threaded perforations 46 47, communicating with the passages *a* 18 for the combustibles, such as liquid fuel and air, which are to be passed through the respective passages of the atomizer. By this arrangement the pipes 2 3 may be connected to the atomizer-body with great ease and convenience, and by means of this construction I avoid the necessity which often occurs of cutting away the deck-castings of locomotives as now constructed.

One or both walls of the nozzle-way 20 may project up above the gate or nozzle-piece 21 when the same is in closed position, so that said nozzle-piece will not have to be raised above the top of said way in order to fully open the nozzle. This projecting wall serves as a guard to prevent any accidental placing of the atomizer in such a position that fixed external objects might interfere with the working of the nozzle-piece 21. The inclined face 48 of the wedge device 33 is intended to act on the wall of the way 36 to start the nozzle-piece away from the tablet 17 when the members 33 are pushed forward. The members 33 are to have sufficient endwise play to allow the nozzle-piece 21 to be sufficiently opened for cleansing the atomizer. The connection 40 may be arranged to engage the body 1 to prevent the members 33 from moving too far forward.

When it is desired to cleanse the air or steam passage of the atomizer from any accumulations external to or inside the air or steam passage 18, the members 33 will be moved forward, thereby bringing the oblique face 48 against the upper wall *b* of the way 36, thereby starting the nozzle-piece away from the tablet 17, whereupon the force of the expandible fluid within the air or steam passage 18, acting upon the oblique face 22 of the nozzle-piece, will lift the same, at the same time removing from the passage and from around the outlet thereof any accumulations or foreign substances which may accumulate in the operation of the burner. Owing to the tapering form of the way 20, the air or steam will at the same time blow through said way and keep it clear, so that the nozzle-piece or lip may be closed down again. When it is desired to cleanse the passage *a*, the valves 4 and 12 will be closed and valve 11 opened, or, if desired, the valves 12 and 11 may both be opened, thereby simultaneously forcing steam or air through the two passages *a* and 18. 49 des-

ignates a drain-valve of any well-known construction to drain from the steam-pipe any water of condensation which may accumulate. Said valve may be placed at any point on the line of the steam connection leading to the atomizer-nozzle.

The cut-off valve 4 for the oil-supply is preferably formed with a tapering plug 50, having a notch 51 at one side of the passage 52 through said valve, so that when nearly closed the oil may be so accurately adjusted that the oil may be reduced to the minimum.

The oil-heater 15 is desirably placed on the opposite side of the valve 4 from the atomizer, so that the oil may be heated immediately before it is fed to the valve 4 and will be thin and fluid.

53 designates a valved steam-pipe leading into the oil-heater 15.

54 is a valved pipe to drain away the condensation from the oil-heater 15.

55 is a shoulder on the body of the atomizer to support the wedge members 33 when the latch or nozzle-piece is being raised.

The lever 6, as shown in Fig. I, holds the valve 4 nearly closed, and when the fire is cut down to the minimum the catch, stop, or guard attachment 9 lies upon the quadrant and the lever is pressed against it. In actual operation this is very important in order to regulate the flow of oil to the burner in accurate quantities. In going uphill or when the locomotive is in motion the lever is moved by the operator away from the stop or guard to open the valve 4, as required; but when the engine is stopped or is going downhill the operator moves the lever into the position shown, where it abuts against the guard.

In operation on locomotives it is difficult for a burner to be so operated that whenever the engine is used to pull its full tonnage over a grade and then the locomotive goes downgrade for several miles the fire in the fire-box may be reduced until it becomes a very small fire, and in order to do this with low gravities of oil I have provided the super-heater 15 to heat the oil easily up to about 120° Fahrenheit approximately. Then by means of the oil-regulating valve 4, the opening of which I file, as shown at 51 in Fig. XI, I can so regulate and reduce the quantity of oil that the desired small fire can be produced and regulated as required.

A difficulty heretofore on oil-burning locomotives and stationary boilers has been the uneven distribution of heat. That is obviated in this burner, which is so constructed that it makes a fire that will span the full width of the fire-box. As the air is taken in from below the fire, any uneven distribution of the heat caused by the imperfectly-constructed burners that do not fill the requirements in actual practice of the forced intermittent draft of a locomotive or the draft in

large boilers would cause the flues and side sheets to leak. By the peculiar construction of this oil-burning apparatus I overcome these difficulties by so atomizing the oil as it passes out of the oil-orifice in quantities regulated by the oil-regulating valve causing the blaze to span the width of the furnace, so that the air admitted from beneath must pass through flame, as the fire-box is filled with flame, causing perfect combustion, keeping all points of the fire-box up to the igniting temperature, and again evenly distributing the heat through the flues, and as a result I overcome the difficulties of uneven expansion.

The peculiar construction of this burner allows the pipes to be assembled in a very small space, and in the locomotive-burner this is often very desirable in order to escape deck-castings and at the same time reduce the number of pipe-fittings and reduce the rigid strain on pipe.

The valve connection 11 may be applied between the atomizer and the valve 4 of one of the supply-pipes and connected with the other supply-pipe on the side of the valve 12 opposite the atomizer, as shown in Fig. I. In Fig. VII the valves 111, 112, and 114 may be manipulated in substantially the way set forth for valves 11, 12, and 4 for cleaning the atomizer.

The lip *c* of the nozzle-piece 21 may be straight across, as shown in Fig. III, or semi-circular, as shown in Fig. VIII, and the oil-outlet 16 may be formed to correspond with the form of said lip.

The nozzle-piece lip *c* desirably terminates on a line approximately three-sixteenths of an inch rearward of the opening 16 in the tablet through which the oil issues, so that the issuing steam or air is directed across the outlet 16 and not down into it.

I may employ various forms of construction in carrying out my invention and do not limit my invention to the exact form shown.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. A hydrocarbon-burner having an oil-outlet and a steam or air nozzle behind said oil-outlet and arranged to discharge across said outlet, the mouth of which nozzle is reduced in cross-sectional area at the middle.

2. A hydrocarbon-burner having an oil-outlet and a steam or air nozzle behind said oil-outlet and arranged to discharge across said outlet, the side walls of said outlet being flared outwardly and forming an open-topped recess beyond the nozzle, the said steam or air nozzle being reduced in cross-sectional area at the middle.

3. A hydrocarbon-burner having an open-topped oil-outlet opening in a determined plane, and a nozzle for an expansive fluid behind said oil-outlet and arranged in nearly the same plane to discharge across said outlet; and

raised guards at the side of said outlet to limit the lateral flow of the liquid and fluid mingled therewith.

4. A hydrocarbon-burner furnished with a passage having an oil-outlet in one plane and a nozzle behind said outlet and arranged in nearly the same plane to discharge across said oil-outlet, and guards at the edges of the oil-outlet, forming an open-topped recess, flaring toward the discharge end.

5. An atomizer having an outlet, a tablet, the face of which is recessed to form the discharge portion of said outlet, and a passage, one wall of which is formed by the tablet; and a nozzle-piece slidably mounted on a guideway at substantially right angles to said passage and arranged to move toward and from the tablet to form therewith an adjustable extension of the passage, the mouth of which can be opened.

6. An atomizer having a steam-outlet, and an oil-outlet, a tablet forming one end of the atomizer, said tablet having a passage which is a continuation of the oil-outlet and terminates in an open-topped recess in the tablet, a guideway at substantially right angles to said steam-passage, a nozzle-piece slidably mounted on said guideway and movable toward and away from the tablet and forming an adjustable wall forming part of the steam-passage.

7. An atomizer having a steam-outlet, and an oil-outlet, a tablet forming one end of the atomizer, said tablet having a passage which is a continuation of the oil-outlet and terminates in an open-topped recess in the tablet, a guideway at substantially right angles to said steam-passage, a nozzle-piece slidably mounted on said guideway and movable toward and away from the tablet and forming an adjustable wall forming part of the steam-passage, the inner face of said nozzle-piece converging toward the end of the tablet.

8. An atomizer having a passage, one wall of which extends beyond the other wall and is provided with an outlet which opens there-through and into an open-topped recess to one end of said wall; a movable nozzle-piece covering part of said passage and covering a part of the space above the extended portion of said wall; and means for holding said nozzle-piece toward the wall extension and for moving it away from the same.

9. An atomizer having a passage, one wall of which extends beyond the other wall and is provided with an outlet which opens there-through and extends in a recess to one end of said wall; a movable nozzle-piece for closing over a part of the space above the extended portion of said wall; and a wedge device for holding said nozzle-piece toward the wall extension and for moving it away from the same.

10. An atomizer having a passage, one wall of which extends beyond the other wall and is provided with an outlet which opens there-through and extends in a recess to one end of

said wall; a movable nozzle-piece for closing over a part of the space above the extended portion of said wall; a wedge device for holding said nozzle-piece toward the wall extension and for moving it away from the same, and a lever for moving said wedge device.

11. An atomizer having an outlet for a fluid, an outlet for an expansible fluid arranged to discharge across said first-named outlet, guideways perpendicular to the second outlet, a nozzle-piece sliding in said ways and forming a part of the second outlet, and means for moving the nozzle-piece laterally of the outlet of which it forms a part, and means for securing it in a determined position.

12. An atomizer having an oil-outlet and a steam or air nozzle arranged to discharge across said outlet, guideways perpendicular to the steam-outlet, a nozzle-piece sliding in said ways and forming an adjustable extension of the steam-outlet, and means for moving said nozzle-piece, laterally of the steam-outlet.

13. The combination of an atomizer having two passages terminating in outlets, one of which discharges across the other, slideways at the sides of said atomizer, shoulders at the sides of said atomizer, a nozzle-piece sliding in said ways and furnished with arms embracing the sides of said atomizer, and means for moving said nozzle-piece in said ways and for holding the same in a determined position.

14. The combination of an atomizer having two passages terminating in outlets, one of which discharges across the other, slideways at the sides of said atomizer, shoulders at the sides of said atomizer, a nozzle-piece sliding in said ways and furnished with arms embracing the sides of said body, and means engaging said arms for moving said nozzle-piece in said ways and for holding the same in a determined position.

15. The combination of an atomizer having two passages terminating in outlets, one of which discharges across the other; a movable nozzle-piece forming a part of one of said passages and over said outlet which discharges across the other; and a wedge device outside of said passages for operating said nozzle-piece.

16. An atomizer having a passage, the floor of which is extended to form a tablet, a nozzle-piece above said tablet and movable laterally thereof, arms on the nozzle-piece provided with ways, and wedge members on each side of the tablet and mounted in said ways for operating the nozzle-piece.

17. An atomizer having a passage, the floor of which is extended to form a tablet, a nozzle-piece above said tablet and movable laterally thereof, arms on its nozzle-piece provided with ways, wedge members on each side of the tablet and mounted on said ways, and a lever for actuating said wedge members.

18. An atomizer having a passage, the floor of which is extended to form a tablet, a nozzle-

piece above said tablet and movable laterally thereof, arms on the nozzle-piece provided with ways wedge members on each side of the tablet and mounted on said ways, and a lever 5 adjustably connected with said wedge members for operating the same.

19. An atomizer having ways, a passage, the floor of which is extended beyond the passage, and shoulders at the sides of said atomizer; a nozzle-piece moving in said ways and 10 having ways; and wedge devices sliding in the ways of the nozzle-piece and engaging said shoulders and provided with inclined faces for engaging the walls of said ways, respectively, 15 to move the nozzle-piece toward the tablet and allow it to move therefrom.

20. An atomizer having a passage, a floor extending beyond the open end of the passage, a nozzle-piece mounted above the floor 20 extension and movable laterally of the floor extension, and provided with a lip on its dis-

charge end which converges toward the floor extension, arms on the nozzle-piece, said arms having ways, and wedge members mounted in said ways for adjusting said nozzle-piece. 25

21. The combination of an atomizer; a nozzle-piece movable thereon; movable members on opposite sides of the atomizer provided with oblique faces for operating the nozzle-piece; a bar through which said members extend; nuts adjustably fastening the members on the bar; and an operating device connected with the bar. 30

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Los Angeles, in the county of Los Angeles and State of California, this 23d day of May, 1902. 35

WILLIAM NEWTON BEST.

Witnesses:

JAMES R. TOWNSEND,
JULIA TOWNSEND.