H. A. DREFFEIN.

INJECTOR.

APPLICATION FILED NOV. 19, 1914.

1,321,996.

Patented Nov. 18, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

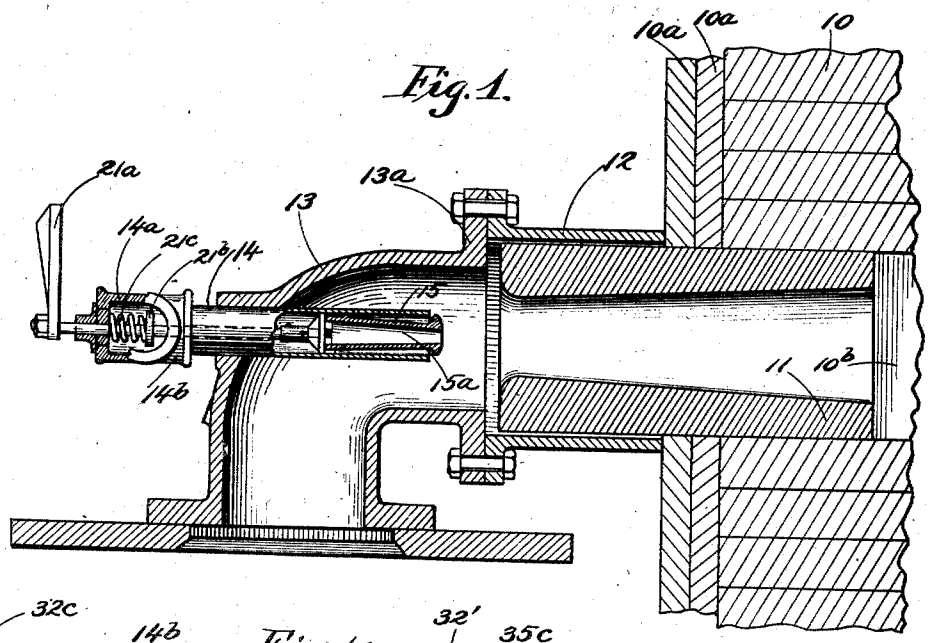


Fig. 1a.

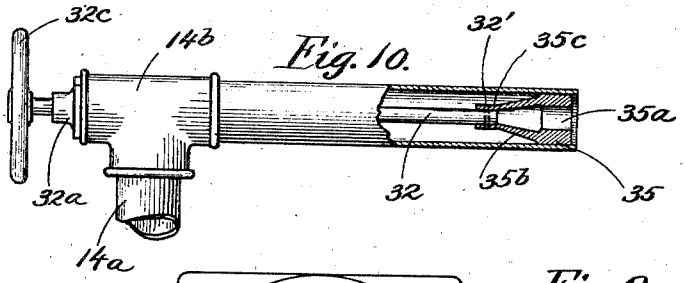


Fig. 2.

Witnesses:

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2 SHEETS—SHEET 2.

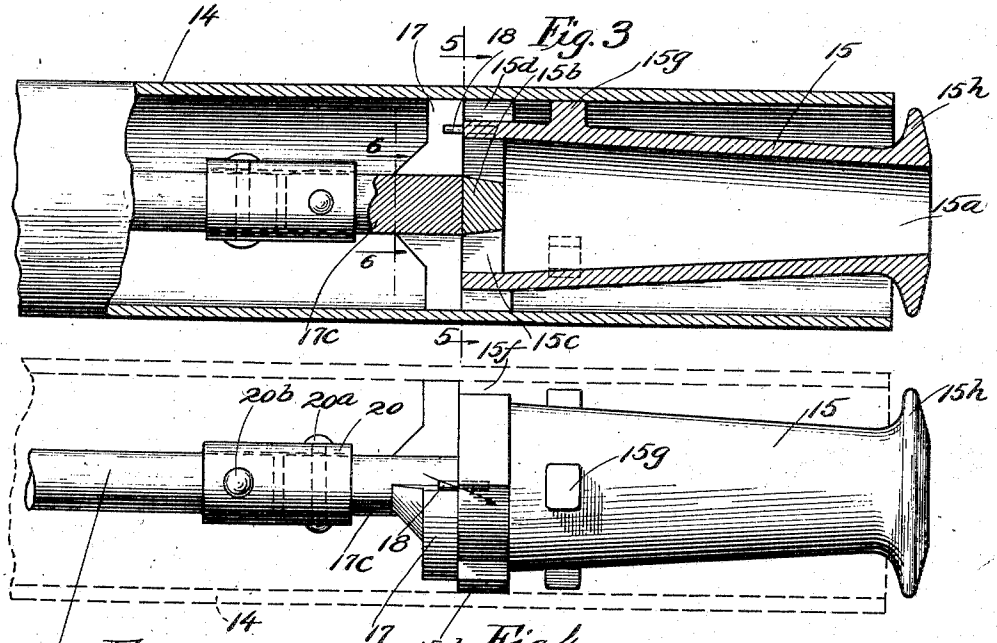


Fig. 3

Fig. 4.

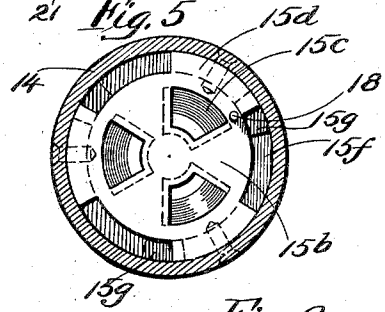


Fig. 5

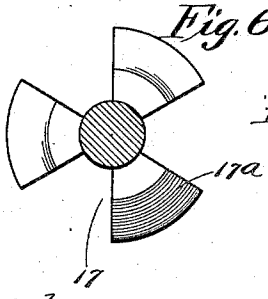


Fig. 6.

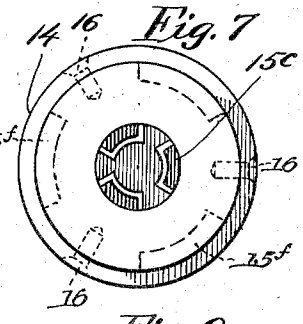


Fig. 7

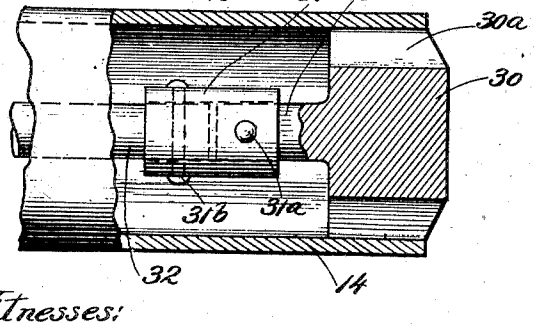


Fig. 8

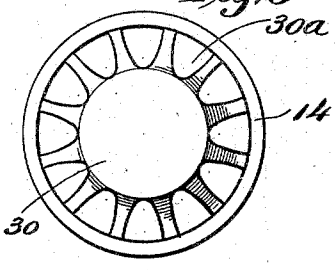


Fig. 9

Witnesses:

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UNITED STATES PATENT OFFICE.

HENRY A. DREFFEIN, OF CHICAGO, ILLINOIS.

INJECTOR.

1,321,996. Specification of Letters Patent. Patented Nov. 18, 1919.

Application filed November 19, 1914. Serial No. 873,071.

To all whom it may concern:

Be it known that I, HENRY A. DREFFEIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Injectors, of which the following is a specification.

This invention relates to improvements in injectors, and has for its object to provide a new and improved form of injector especially adapted for use in inducing gas or the like through a pipe, at the same time supplying air for mixture with said gas prior to combustion thereof.

An object of my invention is to provide such a form of injector capable of operation to vary the inducing effect of the air supply without varying the flow thereof. I have found that in the use of producer gas, for example generated from soft or bituminous coal, that I may dispense with scrubbers or the like and supply the raw gas directly to the burners. In order to do this I utilize the current of air which is needed for mixture with the gas prior to combustion. It is impracticable and impossible to supply such gas to the burner by the use of fans or the like, owing to the presence, in large quantities, of free carbon in gummy and sticky condition. By maintaining an uninterrupted line from the generators or producers to the burners I eliminate clogging thereof such as would obtain were fans or the like utilized. At the same time I reduce very appreciably the amount of power required in the operation of such systems by eliminating scrubbers, fans and the like. I am able to control the flow of this gas without the use of valves by varying the inducing effect of the air and at the same time I may keep the flow of air constant so as not to affect the combustion of the mixture. In other words I am able to regulate the flow of gas by varying the induction effect of the air without varying the flow of the latter.

I attain these and other objects by means of the construction described in the following specification and shown in the accompanying drawings, in which:

Figure 1 is a vertical section through the gas supply pipe and burner showing the air tube and nozzle partially in section;

Fig. 2 is a horizontal section through the gas pipe and burner;

Fig. 3 is a longitudinal section through the nozzle and air tube;

Fig. 4 is a side elevation of the nozzle, the air pipe being indicated in dotted lines.

Fig. 5 is a transverse section along the line 5—5 of Fig. 3;

Fig. 6 is a section taken along the line 6—6 of Fig. 3 showing the valve;

Fig. 7 is an end elevation of the air tube and nozzle looking at the end of the latter;

Fig. 8 is a longitudinal section through the modified form of nozzle;

Fig. 9 is an end elevation of the same; and

Fig. 10 is a view partially in section of still another form of nozzle.

Like numerals refer to like elements throughout the drawings, in which 10 indicates generally the wall of a furnace or the like and the outer sheathing plates 10^a. 10^b designates a burner opening in the wall 10 in which is inserted a burner 11 carried by the metal sleeve 12 located exteriorly of the furnace. This sleeve 12 is in turn secured by bolts or the like to a peripheral flange 13^b of a gas supply pipe 13 which is shown in the form of an elbow, see for example Fig. 1. This gas supply pipe 13 is intended to communicate with a supply of gas such as a gas producer or the like. Projecting through a suitable aperture into one arm of the gas pipe 13, is the air pipe 14 in communication with an air line 14^a arranged to supply air under pressure for mixture with gas prior to combustion thereof. Located in the air pipe 14 is the nozzle 15, see Figs. 1 to 7, inclusive, the same being constructed with a tapering internal bore 15^a provided at one end thereof with the wall 15^b having apertures 15^c therethrough communicating with the bore 15^a. The nozzle 15 is spaced from the inner wall of the tube or pipe 14 and is provided with the peripheral collar 15^d adjacent its apertured end, as shown in Figs. 3, 4 and 5, for example. This collar 15^d closely fits the interior of the pipe 14 and is secured to the latter by means of screws 16 or the like, as shown in Fig. 7. Apertures 15^f are provided in the collar 15^d, as shown in Fig. 5, these apertures being alternately arranged with respect to apertures 15^c and communicating with the space between the exterior of the nozzle 15 and the interior of pipe 14. In addition to being alternately arranged with respect to nozzle apertures 15^c, the collar apertures 15^f are each of an area equal to each of the nozzle apertures 15^c. In conjunction with the nozzle I provide a

rotatable valve 17, see Fig. 6, having the fan or sector shaped portions 17a. This valve 17 is adapted to closely abut against the apertured end of the nozzle 15, as shown in Figs. 3 and 4, and when at one extremity of its partial rotation this valve 17 will entirely close nozzle apertures 15c and fully open collar apertures 15f. A pin 18 projects from the apertured end of the nozzle 15 and is located so as to contact with the edge of one of the sectors 17a when the valve is at one extremity of its motion and with the edge of an adjacent sector when the valve is at the other extremity of its motion, as will be apparent. When the valve 17 is rotated to close the collar apertures 15f the pin is so located as to prevent absolute closure thereof, comparatively small openings through the apertures 15f being unclosed, as shown in Fig. 4, for a purpose to be hereinafter described. Lugs or blocks 15g project from the exterior of the nozzle 15 to the inner wall of the pipe 14 adjacent to and in alinement with these comparatively small openings, as is also shown in Fig. 4. At its outer end the nozzle 15, which projects slightly beyond the end of the pipe 14, is provided with a peripheral flange 15h, as shown in Figs. 3 and 4. The valve 17 is provided with the rearwardly extending stem 17e which is attached to a collar 20 by a rivet 20a or the like, there being a slight amount of play present between the stem 17e and collar 20. A rod 21 has one end similarly secured in the collar 20 by a second rivet 20b located at right angles with respect to rivet 20a. The end of this rod also is slightly spaced from the interior of collar 20 to permit a slight amount of play, the collar and its connections constituting a species of universal joint, ensuring alinement of the valve 17 in the tube 14. The rod 21 projects rearwardly through the air line T 14b and attached to its projecting extremity is the operating handle 21a. Extending between interior end of pipe 14 and a collar 21b carried by rod 21 is a coiled spring 21c, coiled around rod 21, as shown in Fig. 1, this spring serving to maintain the valve in close contact with the nozzle.

Assuming that a comparatively large proportion of gas is needed during a portion of the operation of the burner, the valve 17 will be moved to position fully opening nozzle apertures 15c in which position the maximum inducing effect of the air flowing through nozzle 15 will induce a maximum of gas through the gas pipe 13. At the same time small currents of air will pass through the small openings described above, in the collar apertures 15f, and these currents of air impinging upon lugs 15g will be diffused to completely fill the space surrounding the nozzle 15 and will flow out at the open end of the tube 14 preventing the eddying thereinto of gas such as would ordinarily occur and such as would ordinarily cause a precipitation of carbon or the like in the interior of the tube 14 at the end thereof.

Assuming that a minimum inducing effect is desirable without varying the amount of the air to be supplied for mixture, the valve 17 may be moved to the position completely closing the nozzle apertures 15c at the same time fully opening the collar apertures 15f; these latter being of cross sectional area equal to that of the nozzle apertures the flow of the air will not be restricted. The air flowing through the space around the nozzle 15, however, will have a greatly reduced induction effect, and to further reduce this effect I have provided the peripheral flange 15h which is so formed as to divert and diffuse the current of air flowing therearound, thereby reducing its velocity as it flows into the gas pipe and burner. As will be obvious the induction effect of the air may be varied between the two extremes described above according to the requirements of the burner.

In Figs. 8 and 9 I have shown a modified form of nozzle construction comprising a nozzle proper designated by numeral 30 and formed with a plurality of peripheral apertures 30a, the nozzle itself closely fitting the interior of the air pipe 14. This nozzle 30 is provided with the rearwardly extending stem 30b secured to the collar 31 by a rivet 31a. A rod 32 is likewise secured to the collar 31 by a rivet 31b and extends rearwardly through the T 14b of the air line 14a, passing through an internally apertured and threaded gland 32a, and being slidably mounted with respect thereto. An operating handle 32c is attached to the outer end of the rod 32 and sliding of the latter will operate to move the nozzle toward or from the end of the pipe 14 owing to the threaded engagement of the rod and gland, as will be obvious. As is a well known physical fact the location of the nozzle at varying distances from the end of the pipe 14 results in a variation of the induction effect of such nozzle without variation of the amount of air flowing therethrough. At the same time provision of a plurality of nozzle apertures 30a about the periphery of the nozzle 30 in lieu of a central aperture, increases the amount of induction obtainable and this form of nozzle is, therefore, especially adapted for use with low pressure systems.

Another advantage of this construction is that the location of these nozzle apertures 30a prevents the formation of carbon or similar deposits on the interior of the pipe 14 when the nozzle is moved away from the end thereof to lessen the induction effect of the air current.

In Fig. 10 I have shown still another modification similar to that shown in Figs. 8 and 9, except as to the form of nozzle generally indicated by numeral 35, the same being constructed with a central aperture 35^a and rearwardly extending arms 35^b terminating in a collar 35^c in which is secured the end of the rod 32, by a pin 32′ or the like. It will be apparent that movement of the operating handle 32^c will result in longitudinal movement of the nozzle 35, the induction effect being varied as the nozzle is positioned in the pipe 14, as in the case of the other forms described above.

While I have shown and described my invention with more or less particularity, I do not wish to be restricted to the form shown and described beyond the scope of the appended claims.

What I claim is:

1. In combination, a fuel supply pipe, an air supply pipe located in said fuel pipe, and a nozzle mounted in said air pipe and operable by the flow of air through said air pipe to induce gas through said gas pipe upon flow of air through said air pipe, said nozzle being spaced from said air pipe.

2. In combination, a fuel supply pipe, an air supply pipe located in said fuel pipe, a nozzle mounted in said air pipe and operable by the flow of air through said air pipe to induce gas through said gas pipe upon flow of air through said air pipe, said nozzle being spaced from said air pipe, and means to control flow of air around and through said nozzle.

3. In combination, a fuel supply pipe, an air supply pipe located in said fuel pipe, a nozzle mounted in said air pipe and operable by the flow of air through said air pipe to induce gas through said gas pipe upon flow of air through said air pipe, said nozzle being spaced from said air pipe, and means to control flow of air around and through said nozzle, said means being operable to approximately cut off flow of air around said nozzle when permitting full flow through said nozzle.

4. In combination, a fuel supply pipe, an air supply pipe located in said fuel pipe, a nozzle mounted in said air pipe and operable by the flow of air through said air pipe to induce gas through said gas pipe upon flow of air through said air pipe, said nozzle being spaced from said air pipe, and means to control flow of air around and through said nozzle, said means being adapted to approximately cut off flow of air around said nozzle when permitting full flow through said nozzle, and vice versa.

5. In combination, a fuel supply pipe, an air supply pipe located in said fuel pipe, a nozzle mounted in said air pipe and operable by the flow of air through said air pipe to induce gas through said gas pipe upon flow of air through said air pipe, said nozzle being spaced from said air pipe, means to control flow of air around and through said nozzle, said means being adapted to approximately cut off flow of air around said nozzle when permitting full flow through said nozzle, and means to prevent absolute cutting off of flow of air around said nozzle.

6. In combination with a gas supply pipe, an air tube located in said pipe, a nozzle located in said tube and spaced therefrom, said nozzle being provided with ducts communicating with the interior thereof, and ducts providing communication with the space between the exterior thereof and the interior of said tube, a valve operable to cut off flow of air through said nozzle ducts, said valve and ducts being so arranged that when flow through said nozzle is cut off air will flow therearound.

7. In combination with a gas supply pipe, an air tube located in said pipe, a nozzle located in said tube and spaced therefrom, said nozzle being provided with ducts communicating with the interior thereof, ducts providing communication with the space between the exterior thereof and the interior of said tube, a valve operable to cut off flow of air through said nozzle ducts, said valve and ducts being so arranged that when flow through said nozzle is cut off air will flow therearound, and means to prevent complete closure of said ducts leading to the space around said nozzle whereby a comparatively small amount of air will flow through said tube around said nozzle when said valve is in position approximately closing communication with the exterior of said nozzle.

8. In combination with a gas supply pipe, an air tube located in said pipe, a nozzle located in said tube and spaced therefrom, said nozzle being provided with ducts communicating with the interior thereof, ducts providing communication with the space between the exterior thereof and the interior of said tube, a valve operable to cut off flow of air through said nozzle ducts, said valve and ducts being so arranged that when flow through said nozzle is cut off air will flow therearound, means to prevent complete closure of said ducts leading to the space around said nozzle whereby a comparatively small amount of air will flow through said tube around said nozzle when said valve is in position approximately closing communication with the exterior of said nozzle, and means to diffuse air flowing through said ducts around said nozzle when the latter are substantially closed.

9. In combination with a gas supply pipe, an air tube located in said pipe, a nozzle located in said tube and spaced therefrom, said nozzle being provided with ducts communicating with the interior thereof, ducts

providing communication with the space between the exterior thereof and the interior of said tube, a valve operable to cut off flow of air through said nozzle ducts, said valve and ducts being so arranged that when flow through said nozzle is cut off air will flow therearound, means to prevent complete closure of said ducts leading to the space around said nozzle whereby a comparatively small amount of air will flow through said tube around said nozzle when said valve is in position approximately closing communication with the exterior of said nozzle, and means to diffuse air flowing through said ducts around said nozzle when the latter are substantially closed, said means comprising blocks or the like located around said nozzle.

10. In combination with a gas supply tube, an air tube located therein, a nozzle in said air tube and spaced therefrom, said nozzle being provided with a peripheral flange arranged to deflect and diffuse air flowing through said air tube around said nozzle.

11. In combination with a gas pipe or the like, an air pipe located therein, a nozzle mounted in said air pipe, a collar located around said nozzle in said air pipe, said collar being provided with apertures therethrough, said nozzle also being provided with apertures therethrough, said collar and nozzle apertures being alternately arranged and of equal area, and a valve operable to close either said apertures.

12. In combination with a gas pipe or the like, an air pipe located therein, a nozzle mounted in said air pipe, a collar located around said nozzle in said air pipe, said collar being provided with apertures therethrough, said nozzle also being provided with apertures therethrough, said collar and nozzle apertures being alternately arranged and of equal area, and a valve operable to close either said apertures, or partially close both said apertures.

13. In combination with a gas pipe or the like, an air pipe located therein, a nozzle mounted in said air pipe, a collar located around said nozzle in said air pipe, said collar being provided with apertures therethrough, said nozzle also being provided with apertures therethrough, said collar and nozzle apertures being alternately arranged and of equal area, a valve operable to close either said apertures or partially close both said apertures, and means to prevent absolute closure of said collar apertures, said means comprising a pin carried by said collar and so arranged that when said valve is in contact therewith in position fully opening said nozzle apertures, comparatively small openings will be provided through said collar apertures permitting a relatively small current of air to flow through said space around said nozzle.

14. In combination with a gas pipe or the like, an air pipe located therein, a nozzle mounted in said air pipe, a collar located around said nozzle in said air pipe, said collar being provided with apertures therethrough, said nozzle also being provided with apertures therethrough, said collar and nozzle apertures being alternately arranged and of equal area, a valve operable to close either said apertures or partially close both said apertures, means to prevent absolute closure of said collar apertures, said means comprising a pin carried by said collar and so arranged that when said valve is in contact therewith in position fully opening said nozzle apertures comparatively small openings will be provided through said collar apertures permitting relatively small currents of air to flow through said space around said nozzle, and means to diffuse such small currents of air.

15. In combination with a gas pipe or the like, an air pipe located therein, a nozzle mounted in said air pipe, a collar located around said nozzle in said air pipe, said collar being provided with apertures therethrough, said nozzle also being provided with apertures therethrough, said collar and nozzle apertures being alternately arranged and of equal area, a valve operable to close either said apertures or partially close both said apertures, means to prevent absolute closure of said collar apertures, said means comprising a pin carried by said collar and so arranged that when said valve is in contact therewith in position fully opening said nozzle apertures, comparatively small openings will be provided through said collar apertures permitting relatively small currents of air to flow through said space around said nozzle, and means to diffuse such small currents of air, said means comprising lugs or blocks in alinement with such relatively small apertures.

16. In combination with a gas supply pipe, an air supply pipe located therein, means to supply air under pressure to said air pipe, a nozzle located in said air pipe, said nozzle being provided with air ducts between itself and the interior of said air pipe whereby a deposit of foreign substances will be prevented at the end of said air pipe.

In testimony whereof I have subscribed my name.

HENRY A. DREFFEIN.

Witnesses:
HENRY A. PARKS,
HELEN D. FREUND.