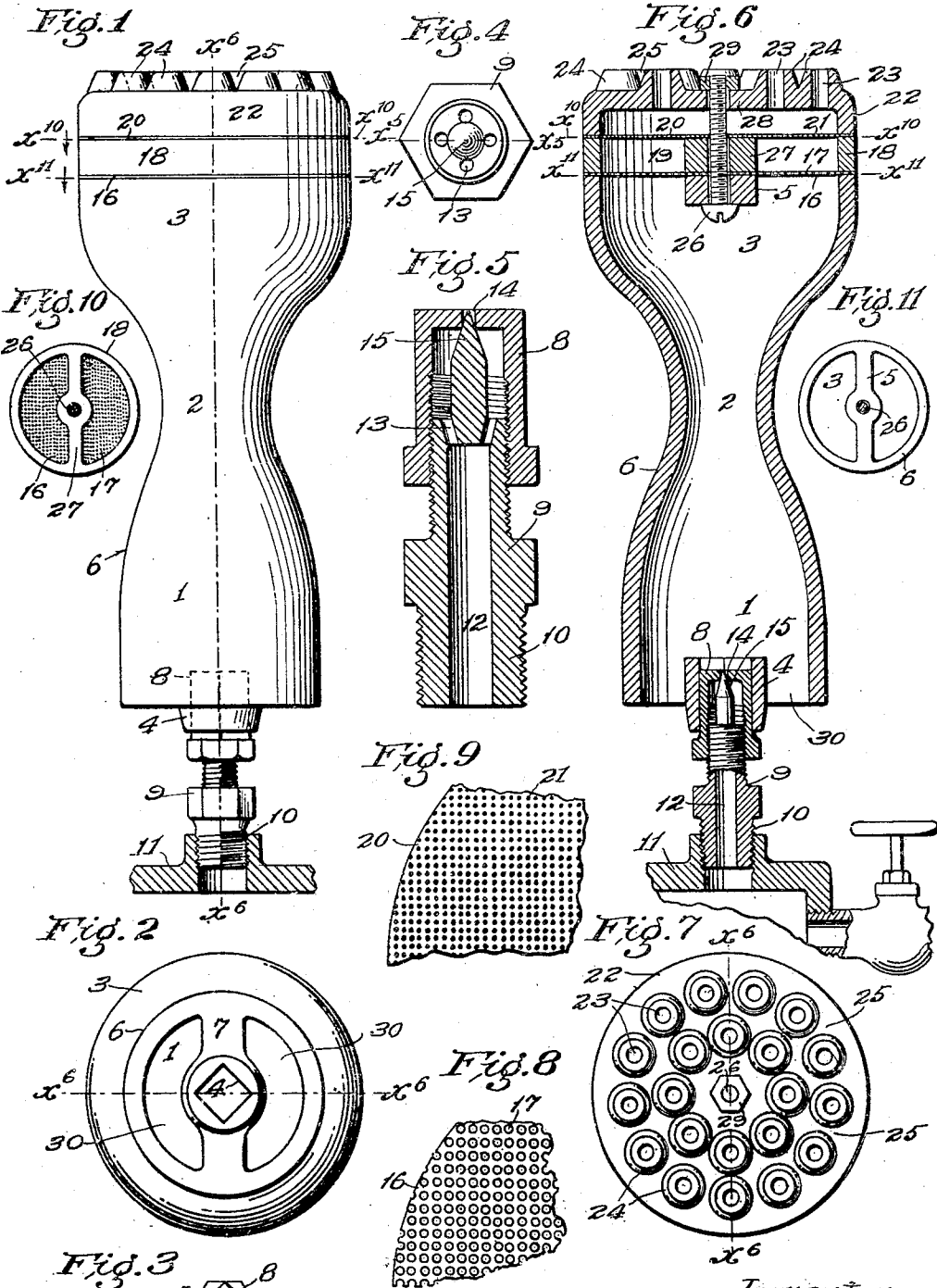


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ADJUSTABLE NON-FLASH GAS BURNER.
APPLICATION FILED JUNE 14, 1915.

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Patented Nov. 13, 1917.



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UNITED STATES PATENT OFFICE.

ALFRED H. THOMPSON, OF VENICE, CALIFORNIA.

ADJUSTABLE NON-FLASH GAS-BURNER.

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Specification of Letters Patent.

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Application filed June 14, 1915. Serial No. 34,106.

To all whom it may concern:

Be it known that I, ALFRED H. THOMPSON, a citizen of the United States, residing at Venice, in the county of Los Angeles and State of California, have invented a new and useful Adjustable Non-Flash Gas-Burner, of which the following is a specification.

This invention relates to burners of the Bunsen type adapted for use in stoves, water heaters, furnaces and other places for the purpose of burning gas mixed with atmospheric air; and belongs to that class of burners in which a fuel mixture of atmospheric air and gas in predetermined proportions is made within the burner and is thereafter supplied to the tip of the burner from which it issues, and there comes into contact with atmospheric air in such a manner that upon ignition it will burn with a blue flame.

It is understood that the proportions of gas and air should be exact in order that perfect combustion may take place.

An object of this invention is to provide a gas burner which may be conveniently and accurately adjusted to supply the proper mixture and to effect the combustion under the proper conditions.

This invention is adapted for application in many different situations, but is more particularly designed for burning gas under conditions where there is a constantly burning pilot light for the purpose of allowing the gas to be automatically turned off and on as occasion may require.

A difficulty arising with gas burners in which a mixture of gas and air is burned at a distance from the jet piece of the burner is that when the supply of gas is cut down low, or completely turned off, there is a liability that the flame will flash back to the jet piece and will there continue to burn, so that when the gas is again turned on while the gas is thus burning, the gas will continue to burn uselessly and as mere waste between the jet piece and the tip of the burner instead of burning beyond the tip of the burner, where it can be of use; and when thus burning there will be insufficient oxygen supplied to the flame, thus causing deposits of carbon or soot within the burner, clogging the passage thereof and causing trouble until the burner is taken out and cleaned.

Another objection to a flash-back of the

flame is that when the supply of gas is entirely cut off at the supply valve and the flame flashes back and burns at the jet piece, combustion will continue until all of the gas contained in the conduit between the jet piece and the supply valve is consumed and the conduit is filled with atmospheric air. This action is objectionable for several reasons, there being a considerable waste of gas from the combustion inside the conduit, and a measurable loss of time from the time the gas is again turned on at the valve until it issues from the jet piece.

This practically precludes the use of flash-back burners where the conduit that supplies the burners forms a large chamber between the supply valve and the jet piece, and I have discovered that it is very desirable for various reasons to supply the burners through a conduit capable of containing a considerable amount of gas between the supply valve and the jet piece of the burner.

An object of this invention is to avoid all of these objections and to construct a burner which can be satisfactorily installed and used with a supply conduit containing a large amount of gas between the supply valve and the jet piece of the burner, so that a considerable number of burners may be mounted on and receive gas from a drum or reservoir to which the gas is admitted from a single supply valve.

An object of this invention is to provide a burner that will furnish a supply of mixed air and gas to burn at a desired point, with perfect combustion and without the difficulty of having the gas light back in the gas orifice of the jet piece that supplies the burner. Also to so construct the burner that the supply of gas can be closed off or turned on with extreme slowness, as in the operation during decrease and increase of the fire when or where an automatic control is used, and to accommodate this slow operation without the difficulty of the fire flashing back to the valve orifice or the source of supply. Also to produce a burner so constructed that it is possible to accurately change the amount of gas supplied for burning purposes, so that perfect combustion can be secured without accumulation or formation of carbon or soot at the burning point, or on the surface of the heated parts.

I find that to have good combustion, the amount of gas supplied to the burner must be regulated by the amount of B. T. U's contained in the gas.

5 That is to say, gas burners are constructed with an air inlet and a jet piece or gas orifice at one end and with burner tip outlets at the other end, through which outlets the mixture of gas and air is delivered
10 for combustion; and in carrying out this invention I determine by experiment the size of outlet which is most effective for utilizing for perfect combustion the gas and air admitted at the inlet, and I find that
15 when the outlets at the tip of the burner have been properly determined for taking care of the air admitted at the air inlet for securing perfect combustion of the maximum amount that may be required of gas
20 containing a certain number of B. T. U's per cubic foot, a change in the richness of the gas will change the character of the combustion. For example, if the outlets at the tip of the burner are of appropriate size to
25 burn, per hour, 25 cubic feet of gas containing 600 B. T. U's per cubic foot, and the burner is then used to burn a richer gas containing for instance, 1000 B. T. U's per cubic foot, such burner is only capable of
30 affording good combustion to 15 cubic feet of such richer gas per hour; and an object of this invention is to provide means whereby the same burner can be accurately and conveniently adjusted to afford the proper
35 mixture of gas and air for burning any character of combustible gas, within certain limits.

This burner is designed to be used for burning gas having a lighter specific gravity
40 than air and is designed to be used in an upright position, the burner outlet being uppermost when the burner is installed and the gas and air admitted at the bottom.

A purpose of the invention is to produce
45 an adjustable non-flash gas burner especially adapted to be used in connection with an automatic gas steam boiler and an automatic gas hot water heater or hot water heating system with a pilot light in connection. It is necessary with a certain system
50 of this kind invented by me that the fire will not flash back to the jet piece for the reason that my automatic gas steam system and automatic gas water heater are so operated
55 by my automatic gas regulator that when there is a predetermined pressure accumulated or exceeded, either in the steam boiler, the water service, or in the thermostat, the gas is shut off gradually until it is completely shut off and as such pressure diminishes, the gas valve opens up gradually; and,
60 consequently, it is necessary that the burner be so constructed that it will retard the outward flow of the gas and allow an accumulation of gas and air to occur in the mixing

chambers to supply fuel mixture at the burning point; and to avoid trouble in the operation of shutting off the gas, it is necessary that the burner be so constructed that an accumulation of gas be stored in the mixing chambers to supply the necessary amount
70 of gas to maintain ignition at the burning point until the fuel contact or train is broken between the jet piece and the burner tip. In other words, it is absolutely necessary to provide means to prevent back fire.

That is to say, I provide a burner having above the gas supply jet piece an elongate ejector shaped conduit having enlarged ends and a contracted middle, thus forming an
80 entraining chamber, a mixing passage and a mixing and distributing chamber and provide beyond said mixing and distributing chamber a plurality of screen chambers through which the gas will successively
85 pass to orifices in the top of the burner beyond which ignition takes place. By this construction I provide for the delivery to the burner orifices, of a thoroughly mixed mixture of air and gas and prevent the
90 flashing back of flame into the entraining chamber.

An object of this invention is to construct a burner especially adapted for use in automatic systems wherein the gas supply is
95 pressure-regulated, either by the variable pressure of thermostatic means or steam or air, or by the pressure of water; whether the variation of pressure occurs through variations of pressure in the source of water supply or through the opening or closing of
100 cocks or faucets of the system.

An object of this invention is to provide a gas burner adapted for large production of heat from each burner unit, and in order to
105 do this it is necessary that there be a multiplicity of orifices for each unit in order that the application of oxygen to the fuel mixture shall be most effective, and I find by experiment that it is desirable to make the burners of standard sizes and that it is convenient and practicable to so construct the burner of one size that it can be regulated to burn to the best advantage gas of from 200
110 B. T. U's to 600 B. T. U's per cubic foot, and that the same size burner can also be constructed to burn gas containing from 600 B. T. U's to 1200 B. T. U's per cubic foot; the change in the burner being made by simply enlarging the gas orifice of the jet
120 piece for gas containing the decreased B. T. U's.

I find that there are quite a number of items to be observed in the construction of a scientific gas burner for burning gas that
125 has to first be mixed with atmospheric air, viz., the area of the air inlet; the distribution of the fuel mixture at the burner tip so as to supply the oxygen to the fuel mixture in the most effective manner to produce per-
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fect combustion; the area of the gas orifice that supplies gas to the burner; the pressure of the gas at the gas orifice; the construction of the body of the burner to effect a thorough intermixing of the air and gas; even distribution of the fuel mixture to the numerous orifices at the tip of the burner, and the provision of means to supply the fuel mixture to the orifices of the tip for a period after the gas has been shut off at the jet piece of the burner.

This invention relates to a burner in which the air inlet orifices remain constant and the gas inlet orifice is adjustable, and I have found by experiment that the most desirable proportion between the air inlet and the fuel mixture outlet at the tip of the burner is approximately four to one, and that by constructing the burner with air inlet openings and fuel mixture outlets in this proportion, the same sized burner can be adapted by a slight change for burning gas throughout a wide range; one adaptation being suitable for burning gas containing from 200 to 600 B. T. U's per cubic foot and the other adaptation being suitable for burning gas containing from 600 to 1200 B. T. U's per cubic foot; the only change required for these two adaptations of the burner being that the gas valve orifice at the jet piece, for the low grade gas burner of a given size, may be an orifice made by a 24 gage drill, while the orifice for the high grade gas may be a smaller orifice, say, that made by a 42 gage drill. The variations within the range from 200 to 600 B. T. U's per cubic foot can then be satisfactorily adjusted by adjusting a valve needle to more or less close the gas orifice of the jet piece; and the adjustment for the variations of the gas from 600 to 1200 B. T. U's can be made in a like manner. The above refers to gas at from six to nine inch water pressure.

It is desirable that the gas issue from a gas valve in a solid jet, so that the air which is entrained by such jet shall be entrained evenly on all sides of the jet and an object of this invention is to effect this action.

Another object of the invention is to make provision for easily regulating the maximum flow of gas from the jet piece of the burner.

Other objects are cheap and simple construction, ease of installation and dismantling, even distribution of flame, perfect mixing of the air and consequent perfect combustion of the fuel, and absolute prevention of any flashing back of fire from the tip of the burner to the tip of the gas valve or jet piece.

Other objects and advantages may appear from the subjoined detail description.

The accompanying drawings illustrate the invention in that form of its embodiment which I at present deem most desirable.

Figure 1 is an elevation of the gas burner

installed on a drum supplied through a cock, a fragment of which drum is shown in section.

Fig. 2 is a bottom view of the burner body detached.

Fig. 3 is a top view of the gas jet piece from which the body of the burner shown in Fig. 2 has been detached.

Fig. 4 is an enlarged plan of the body of the gas valve from which the jet piece has been detached.

Fig. 5 is an axial section on line x^5 , Figs. 3 and 4, on the scale of Fig. 4.

Fig. 6 is an axial section on line x^6 , Figs. 1, 2 and 7, of the jet piece installed as in Fig. 1.

Fig. 7 is a plan of the tip or top of the burner.

Fig. 8 is a fragmental plan of the initial distributor.

Fig. 9 is a fragmental plan of the secondary distributor.

Fig. 10 is a reduced plan on line x^{10} , Figs. 1 and 6.

Fig. 11 is a reduced plan on line x^{11} , Figs. 1 and 6.

The ejector body of the gas burner may be a casting of brass or other metal, or may be of any other suitable material, and is constructed as shown having an entraining mouth or chamber 1 reduced at its upper end, a contracted entraining and mixing passage 2 opening from the entraining chamber 1; and the enlarged mixing and distributing chamber 3; and is provided at its lower end with a socket 4 and at its upper end with a support 5, said socket and support are connected to the walls 6 of the burner body at the inlet and outlet ends thereof. The inlet socket 4 may be formed on a spider or on a bar 7, and is adapted to non-rotatably seat on an adjustable gas valve tip member which is shown in the form of a cap 8 that is in threaded relation with a valve body 9 that is also threaded at 10 for connection with the gas conduit 11; said valve body having a bore 12 and outlet 13 to deliver gas into said valve tip member. Said valve tip is provided with a jet orifice 14 and the valve body 9 is provided beyond the outlet 13 with a valve needle 15 adapted to regulate and to close the gas jet orifice 14.

By reason of the non-rotatable connection which may be formed by any suitable means, as by the square socket 4 and the square tip or cap 8, rotation of the burner body will cause rotation of the cap thus to adjust the valve opening at the orifice 14 to allow a less or greater amount of gas to pass there-through.

A primary distributor in the form of a non-backfiring screen, preferably a metal disk 16, is mounted on the upper end of the primary mixing chamber 3 and is provided with numerous symmetrically arranged pas-

sages formed by perforations 17 which are preferably of a determined uniform character.

On said primary distributor 16 is mounted
5 a secondary mixing chamber 18 into the cavity 19 of which the passages 17 open, forming a foraminous way for the gas to enter the cavity 19 from the chamber 3. On the mixing chamber 18 is fitted a distributor in the form of a second non-back-firing screen comprising a perforated plate
10 20 having a multitude of perforations 21 that are finer than the perforations of the primary distributing plate 16.

Above the secondary distributing plate is mounted a coarse heavy heat-resisting flame-supporting burner screen or tip 22 forming a final mixing chamber forming the top of the burner and provided with outlets 23
15 through which the combustible mixture produced in the burner is emitted for ignition.

The top of the burner is provided with tips 24 for the outlets 23, respectively, thus to provide air channels 25 to supply oxygen
20 to the various jets of fuel mixture that issue from the outlets 23.

The burner body 6, the secondary mixing chamber 18, and the final mixing chamber and burner top 22 are connected together by
25 suitable means as a stove bolt 26 having its head inside the primary mixing chamber 3, and its body extending through the bar 5 of the burner body, through the corresponding bar 27 of the secondary mixing chamber
30 18 and through the web 28 of the final mixing chamber and burner top 22, the nut 29 of said bolt being on the outer face of the burner top by preference and screwed firmly home on the bolt to hold the parts tight together, thus making the walls of the burner
35 air-tight from inlet 1 to the outlets 23.

In practical operation when gas is turned on to flow through the jet piece at 14, the jet of gas passing on upward through the
40 air inlet and mixing chamber 1 and through the reduced neck 2, entrains air, and flows into the large mixing and distributing chamber 3; and during the passage of air and gas to this point the initial mixing takes place. The result of which is that the mixture passes up through the perforations of the coarse distributing screen 16 into the
45 mixing and distributing chamber 18, and thence out through the distributing screen 20 into the upper mixing and distributing chamber 22, whence the mixture of gas and air flows through the burner tip outlet 23. The amount of B. T. U's consumed at this point depends upon the amount of air admitted at the air inlet 30 of the burner.
50 When the mixture at the outlet 23 is ignited it can be determined by turning the burner body 6 in first one and then in another direction, into what position the gas valve should
55 be adjusted in order to secure the best com-

bustion. This is determined by observation, the operator turning the body 6 until he can get the proper flame, that is to say, until the flame which shows complete combustion is of the greatest strength.

Any desired form of connection between
70 the body of the burner and the cap 8 of the jet piece may be employed. But in the drawings a simple connection is shown consisting of the square socket 4 fitting on a square cap 8 from which it may be lifted whenever desired. This is shown as a preferred construction. The cap 8 being screwed onto the screw-threaded valve body 9 enables the attendant to adjust the outlet at 14 by simply
75 rotating the burner body 6 while seated on the cap, thus screwing the cap up or down as may be desired, such operation simply adjusting the walls of the orifice 14 toward or from the needle 15, thus reducing or increasing the size of the jet piece and regulating the amount of gas to be supplied to the burner.

The air inlet 30 is made large to admit the necessary amount of air to get the best
80 results.

The smaller part or contracted neck 2 is for the purpose of utilizing the force of the jet to entrain and mix air with the gas and so that when the air is drawn into the mixing chamber it is directed to flow toward
85 the center so as to get into the course of the gas route, thereby mixing with the gas to some extent. Then the bore of the burner is increased as at 3, so as to have a space to accumulate enough gas to furnish a uniform supply to the burning point. The first deflecting screen 16 is preferably made coarse to allow the free passage of mixed gas and air to the second mixing chamber
90 19, and the second distributing screen 20 is preferably made finer for the purpose of getting a perfect mixture and distribution. The third mixing chamber 22 is for the purpose of keeping the gas from burning at the second screen, and to retard the mixture and prevent it from burning out too fast when the gas is shut off.

All three castings 6, 18 and 22, and the two screens 16 and 20 are bolted together
95 in the center for the purpose of making the joints tight, so that the mixed gas and air can only get out the orifices on the top of the burner.

The head of the bolt 26 is placed in the center of the casting for convenience and also for the purpose of breaking the direct flow of the fuel; for preventing the forming of a direct current which would cause an unequal distribution at the burner top and consequently causing uneven distribution to the different tips 24.

I claim:—

1. A gas burner having a gas inlet, an air inlet, a primary mixing chamber, a non-
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back-firing distributing screen, an intermediate mixing chamber, a second non-back-firing distributing screen, a final mixing chamber, and a heavy heat-resisting flame-supporting free burner tip for delivery of the fuel mixture to the air.

2. A gas burner having a regulable gas inlet, an air inlet, a mixing chamber, a non-backfiring distributing screen, a second mixing chamber, a second non-backfiring distributing screen, a third mixing chamber, and a coarse heavy, heat-resisting, flame-supporting delivery tip, arranged in the order named.

3. A gas burner comprising an upright hollow body having chambers at its ends and a contracted portion between its ends; means to admit gas to the chamber at its lower end, means to admit air to said chamber; a non-backfiring screen across the upper end of the upper chamber; a second non-backfiring screen; means between said screens to form therewith a distributing chamber; and a heavy heat-resisting, flame-supporting burner cap having a chamber open to said second screen to receive fuel mixture therefrom and being provided with fuel outlets.

4. A burner comprising an elongate hollow ejector burner body, a hollow intermediate section forming an extension of the burner body, a cap having a coarse heavy heat - resisting, flame - supporting burner screen and forming an extension of the intermediate section and provided with fuel outlets, a non-backfiring screen between the burner body and the intermediate section, a non-backfiring screen be-

tween the intermediate section and the walls of the cap, means to fasten the sections and burner body together, and means to supply gaseous fuel and air to the intake end of said body.

5. A gas burner comprising a burner body; an outlet cap provided with fuel outlets and an intermediate section, said body being provided with a cross bar having a hole therethrough; said intermediate section being also provided with a cross bar having a hole therethrough; a screen between the body and intermediate section; a screen between the intermediate section and the cap; and a bolt extending through said bars and the cap and secured by a nut.

6. A gas burner comprising a hollow body provided with a gas inlet and an air inlet and a primary mixing chamber, a primary non-backfiring screen on the end of said mixing chamber, a section forming a secondary mixing chamber on the primary non-backfiring screen, a second non-backfiring screen on said section and forming a final mixing chamber on the second non-backfiring screen and provided with a coarse heavy heat-resisting, flame-supporting burner screen having outlets for emission of fuel, all of the parts being bolted together in alinement so that the joints are sealed, thus allowing combustion only at the burner outlets.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 8th day of June, 1915.

ALFRED H. THOMPSON.

In presence of—

JAMES R. TOWNSEND.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."