Oct. 1, 1957 C. J. O'BRIEN 2,808,254

HOT GAS GUN

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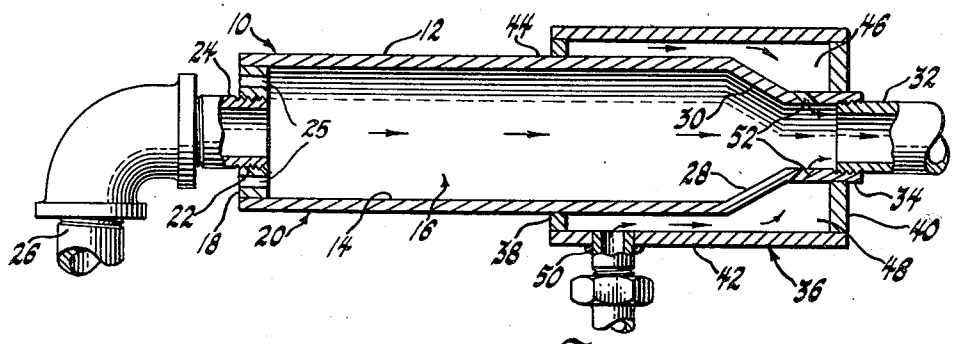



Fig. 1

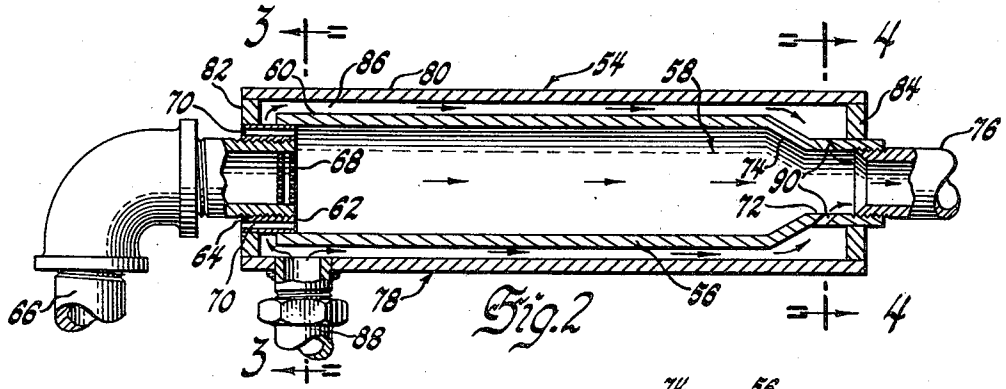



Fig. 2

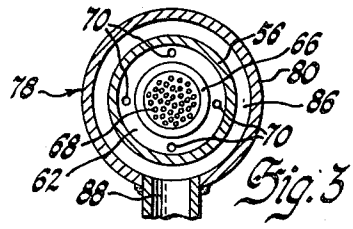



Fig. 3

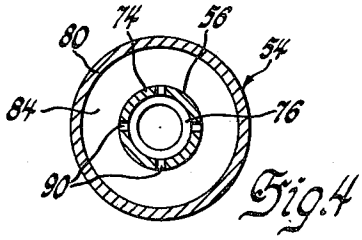



Fig. 4

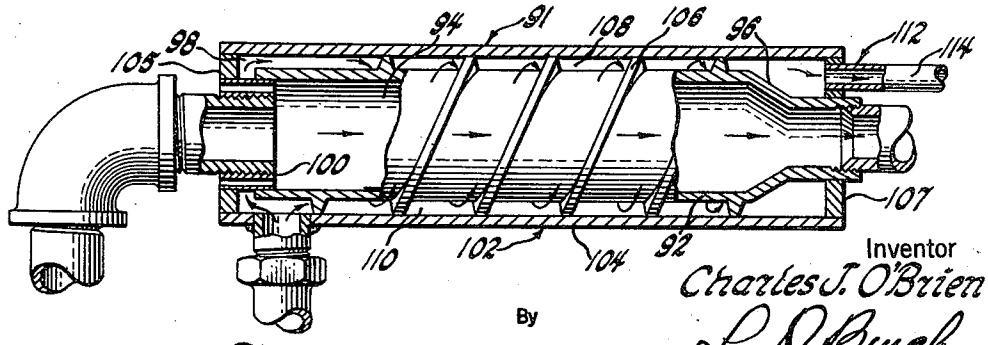



Fig. 5

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# HOT GAS GUN

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2 Claims. (Cl. 263—19)

The present invention relates to means for generating hot gases and more particularly to a hot gas gun for generating a large volume of gas having a moderate temperature.

Certain materials such as thermoplastic substances may be softened by the application of heat so that they may be easily worked into any desired shape. Also thermal-setting plastics such as are frequently employed in bonding several objects together require the application of heat to cause the plastic to set or cure. Heretofore, it has been necessary to place the plastic in an oven or to utilize a torch for heating the plastic. If an oven is used to heat the plastic, any structure attached thereto is heated. This heat may soften and deform other plastic members or otherwise impair the usefulness of the structure. If a gas torch is employed it is possible to heat localized areas of the structure so as to treat only the portion of the structure desired. However, the gas torches presently employed generally produce a flame having such a high temperature that a great deal of care must be exercised to prevent injury by burning or otherwise overheating the plastics.

It is proposed to provide a hot gas gun for treating plastics which has a combustion chamber for burning gaseous fuels having relatively high combustion temperatures. In order to prevent overheating of the object to be treated, a cooling jacket is placed in heat exchanging relation with the combustion chamber so that cooling fluids may pass through the jacket and cool the products of combustion produced by the burning of the fuels. This will not only cool the products of combustion but will also heat the cooling fluid. Thus the cooled products of combustion may be used as a reducing atmosphere to heat plastics or other material or if desired the cooling fluids may be used as an oxidizing atmosphere for heating. Also the gun may be used to produce a large volume of moderately hot gas by combining the cooling fluids with the burning gases.

Heretofore, the temperature generated by a gas torch can only be varied by varying the amount of gas that is burned. When the volume of gas varies the flame characteristics are very apt to be injuriously affected unless the tip of the torch is changed. Also when the volume of gas is reduced, the amount of heat available will be decreased as the temperature drops.

It is therefore proposed to provide a torch in which the temperature of the exhaust gases may be varied while at the same time producing substantially the same amount of available heat. This is accomplished by placing a cooling jacket about the combustion chamber so that the temperature of the combustion can be varied by merely controlling the flow of cooling fluid. By mixing the cooling fluids with the products of combustion, the fuels may be burned at an efficient temperature. Also the temperature of the exhaust gases may be lowered without reducing the amount of available heat.

In the drawings:

Figure 1 is a side elevational view, having a portion thereof broken away, showing a hot gas gun embodying the present invention.



Figure 2 is a side elevational view similar to that of Figure 1 but showing a modification of the present invention.

Figure 3 is a cross-sectional view taken substantially along the plane of line 3—3 of Figure 2 and showing the inlet end of the modified hot gas gun.

Figure 4 is a cross-sectional view taken substantially along the plane of line 4—4 of Figure 2 and showing the outlet end of the modified hot gas gun.

Figure 5 is a side elevational view, having a portion thereof broken away, of a further modification of the present invention.

Referring to the drawings in more detail, the hot gas gun 10 has an elongated tubular member 12. An opening 14 extends longitudinally through the tubular member 12 to form a combustion chamber 16 which is of substantially cylindrical shape. A plug 18 is secured in position across the inlet end 20 of the tubular member 12 by any suitable means. An aperture 22 is provided through the plug 18 and threadably receives the outlet end 24 of a fuel line 26. Passages 25 are provided in plug 18 to admit the air needed for combustion of the fuel. The fuel line 26 may be connected to any convenient source of fuel such as compressed illuminating or acetylene gas. The outlet end 24 of the fuel line 26 is disposed in the combustion chamber 16 and may be of any form suitable to deliver the fuels to the chamber 16 for combustion therein.

The outlet end 28 of the combustion chamber 16 may comprise a neck 30 on the end of the tubular member 12 and a nozzle 32 secured in the small end 34 of the neck 30. The nozzle 32 is adapted to discharge the hot exhaust gases from the combustion chamber 16 onto the plastic or any other material that it is desired to heat. The nozzle 32 may be given a cross-sectional size and shape which will cause the hot exhaust gases to flow at the optimum velocity and in the best pattern. If desired the nozzle 32 may be threaded into the end 34 of the tubular member 12 to permit changing the nozzle 32 for varying work conditions.

To reduce the temperature of the hot exhaust gases created by the burning fuel to a point where the plastic or other material can not be damaged by overheating, means may be provided for placing cooling fluids in heat exchanging relation with the combustion chamber 16. In the present instance a jacket 36 is disposed about the exterior of the tubular member 12 in spaced relation thereto. The jacket 36 comprises a pair of rings 38 and 40 and a sleeve 42 having a shape similar to that of the tubular member 12. The rings 38 and 40 are disposed at opposite ends of the sleeve 42 and are secured to the shank 44 and the end 34 of the tubular member 12. It is thus apparent that the space 46 between the sleeve 42 and the tubular member 12 forms an envelope 48 that is sealed from the atmosphere and completely encompasses the tubular member 12. Due to the heat conductivity of the tubular member 12, any gases in the envelope 48 will be in heat exchanging relation with the hot gases in the combustion chamber 16.

Inlet means 50 may be positioned in one end of the sleeve 42 to deliver a cooling fluid into the envelope 48 formed by the jacket 36. The cooling fluid may be either liquid or gaseous such as compressed air or an inert gas. During operation of the gun 10, as the gases are burned, heat will be transferred from the combustion chamber 16 to the cooling fluids in the jacket 36. This will result in heating the cooling fluid and materially reducing the temperatures of the exhaust gases formed by the burning fuel. If a reducing atmosphere is desired for heating the object to be treated, the cooled products of combustion

may be used. If an oxidizing or inert atmosphere is desired, a gas of that nature may be used as a cooling fluid. After the cooling fluid has been heated by passing through the jacket **36**, it can be applied to the object to be heated. In the present instance it is desired to obtain a maximum volume of hot gases. Accordingly, a plurality of outlet passages **52** are circumferentially spaced about the neck **30** so as to interconnect the fluid envelope **48** with the combustion chamber **16**, preferably adjacent the discharge nozzle **32**. The passages **52** are diagonally disposed so that the heated cooling fluids will be injected into the exhaust gases and thoroughly mixed therewith. This will produce a homogeneous mixture containing the cooling fluids and products of combustion. Thus a large volume of gas having a moderate temperature is available for heating the plastics. It is quite apparent that by merely varying the volume of the combustible gases and the cooling fluids flowing through the jacket **36** any desired volume of gases at any desired temperature may be obtained.

The hot gas gun may be embodied in a modified form to provide a more complete transfer from the combustion chamber to the jacket. The embodiment of the gun **54** shown in Figure 2 may have a tubular member **56** that forms a substantially cylindrical combustion chamber **58** similar to that in the first embodiment. The inlet end **60** of the combustion chamber **58** may be sealed by a plug **62** that is secured to the tubular member **56** by any suitable means so that the plug **62** projects from the end **60** of the tubular member **56**. The plug **62** may be provided with an aperture **64** for threadably receiving the end of the fuel line **66**. Although the fuel line **66** may be identical with that in the preferred form, a perforated grate **68** or other means may be provided adjacent the outlet end of the fuel line **66** so as to disperse the combustible fuel throughout the combustion chamber **58** to thereby provide any desired flame shape. In order to provide a more complete and efficient burning of the fuel a plurality of secondary passages **70** may be provided through the plug **62**. These passages **70** communicate between the atmosphere and the inlet end **60** of the combustion chamber **58**. It is desirable that the passages **70** be positioned so that the draft from the fire will draw air into the combustion chamber **58** similar to a Bunsen burner. The outlet end **72** of the chamber **58** may have a neck **74** and a detachable discharge nozzle **76** similar to that in the first embodiment **10**.

A jacket **78** comprising a sleeve **80** which is substantially the same length as the combustion chamber **58** is spaced concentrically about the tubular member **56**. A pair of attaching rings **82** and **84** are secured to the opposite ends of the sleeve **80** and are mounted on the outer end of the plug **62** and the neck **74** adjacent the discharge nozzle **76**. Thus it is apparent that this will form an envelope **86** that completely encases the tubular member **56** and is sealed from the atmosphere. Inlet means **88**, which may also be identical to that of the first embodiment **10** are provided in the sleeve **80** so as to discharge cooling fluids into the envelope **86**. This will cause the cooling fluids to flow along the surface of the tubular member **56** in heat exchanging relation with the combustion chamber **58**. This will heat the cooling fluids and cool the hot exhaust gases the same as in the first embodiment **10**; however, due to the increased areas exposed to the cooling fluid, the transfer of heat will be more complete. Although either the cooling fluids or the hot exhaust products may be used to heat the object to be treated, in the present embodiment the outlet means from the jacket **78** comprise a plurality of diagonal passages **90** in the tubular member **56** which discharge the cooling gases into the combustion chamber **58** adjacent the discharge nozzle **76**.

The hot gas gun may be embodied in a further modified form similar to that shown in Figure 5. This embodiment **91** employs a tubular member **92** having a combustion chamber **94** with a necked down outlet end **96** substantially the same as previously described. The inlet end **98** of the combustion chamber **94** may be similar to either the first or second embodiment. An inlet plug **100** similar to that of the second embodiment is employed, however no grate is used. The cooling jacket **102** comprises a sleeve **104** mounted on ring members **105** and **107** similar to that of the second embodiment **54**, although it may be identical with that of the first embodiment **10**. Since it is desirable to obtain a more complete transfer of heat in this embodiment, a baffle **106** is placed in the fluid envelope **108** formed by the space between tubular member **92** and the sleeve **104** so as to form a tortuous path **110**. This baffle **106** may comprise a helix integral with the tubular member **92** so as to make the envelope **108** in the form of a spiral path **110**. This not only effectively increases the area of contact for heat transfer, but it also requires the cooling fluid to follow a longer path and thereby remain in contact with the tubular member **92** for a longer period.

The heated cooling fluids may be mixed with the products of combustion as previously described or else used directly for heating the object to be treated. In this embodiment a separate outlet **112** in the form of a duct **114** is employed for allowing the cooling fluids to be released from the jacket **102**. Thus the hot exhaust products formed by the burning fuels may be cooled without mixing them with the cooling fluids. This allows a liquid coolant to be used if desired and also permits the reducing atmosphere of the cooled exhaust gases to be used for heating the object to be treated. Also if it is desired to heat the object in an atmosphere that is not contaminated by the products of combustion the duct **114** may be used. Thus an atmosphere of inert or oxidizing gases may be employed for heating the object by the choice of a proper cooling fluid.

While three embodiments have been shown and described, it will be apparent to those skilled in the art that the invention may be embodied in other forms without departing from the spirit thereof. It is also apparent that while each embodiment has distinctive features such as the baffle, the inlet means, the outlet means, etc., these features are interchangeable, and therefore the features of one embodiment may be added to or removed whenever it is desired. It is therefore to be understood that the present embodiments are merely illustrative and in no way restrictive, and that it is intended to limit the invention only by the scope of the claims which follow.

What is claimed is:

1. A hot gas gun comprising a tubular member having walls disposed to form an elongated combustion chamber, said combustion chamber having an inlet passage associated with one end thereof for admitting fuel to said combustion chamber and an outlet passage at the other end thereof including a neck for discharging the products of combustion from said chamber through a nozzle and into the atmosphere, and a cooling jacket completely surrounding and spaced from said elongated combustion chamber to provide a continuous cooling chamber around said tubular member, said cooling chamber being closed at both ends thereof and said cooling chamber having an inlet passage therein at the same end of said gun as said fuel inlet passage for admitting coolant fluid under pressure between said cooling jacket and said tubular member and coolant fluid outlet passages for introducing said cooling fluid into the stream of combustion products, said coolant outlet passages comprising circumferentially spaced openings in the smaller end of said combustion chamber neck and being disposed radially about and obliquely to the axis of said combustion chamber.

2. A hot gas gun comprising a tubular member having walls disposed to form an elongated combustion chamber, said combustion chamber having an inlet passage associated with one end thereof for admitting fuel to said combustion chamber and an outlet passage at the other end thereof for discharging the products of combustion from said chamber into the atmosphere, and a

cooling jacket completely surrounding and spaced from said elongated combustion chamber to provide a continuous cooling chamber around said tubular member, said cooling chamber being closed at both ends thereof and said cooling chamber having an inlet passage therein at the same end of said gun as said fuel inlet passage for admitting coolant fluid under pressure between said cooling jacket and said tubular member and coolant fluid outlet passages for introducing said cooling fluid into the stream of combustion products, said coolant outlet passages comprising circumferentially spaced openings in the wall of said combustion chamber at the exhaust outlet end thereof and being disposed radially about and obliquely to the axis of said combustion chamber and



sloping inwardly in the direction of said combustion chamber outlet passage.

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