April 23, 1957 J. H. FLYNN 2,789,633

GAS BURNER

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Fig. 1

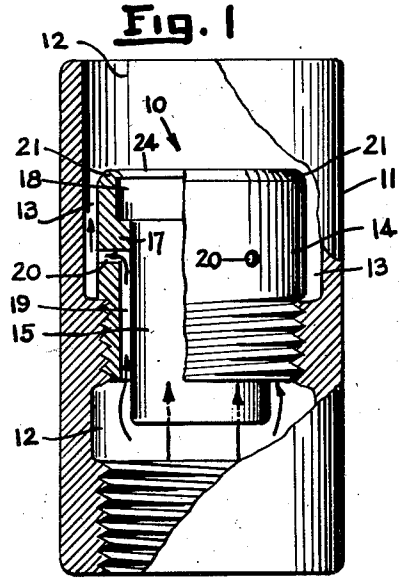
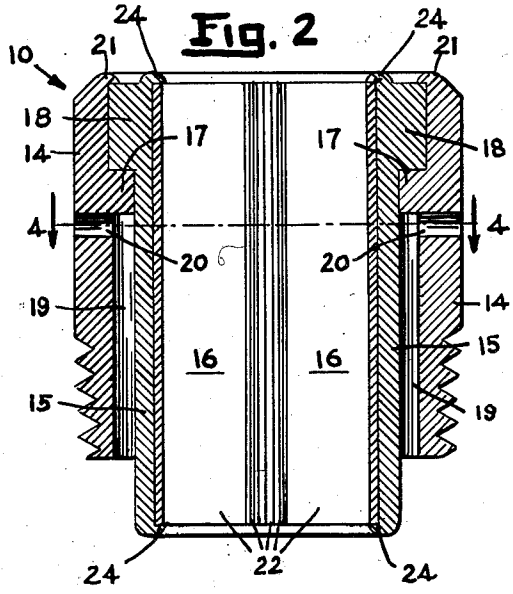


Fig. 2



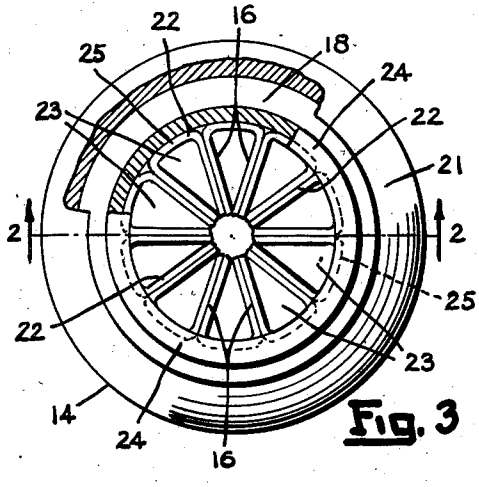
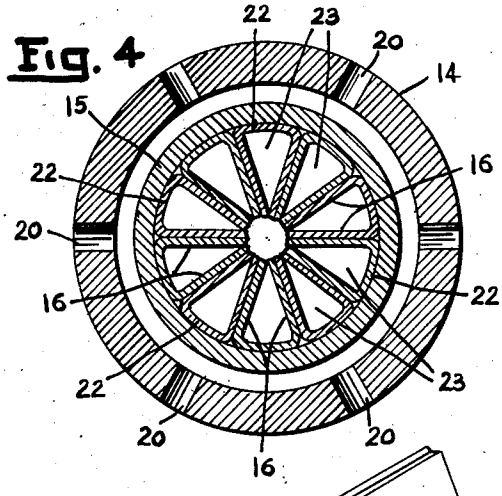


Fig. 3

Fig. 4



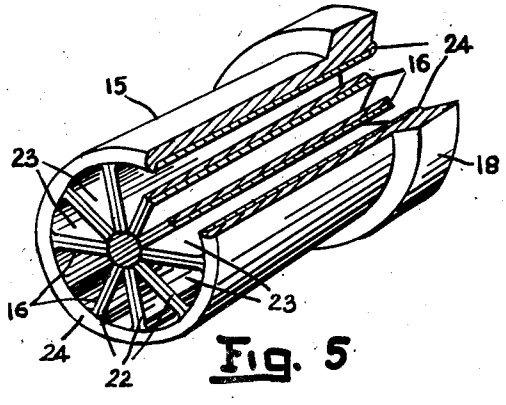
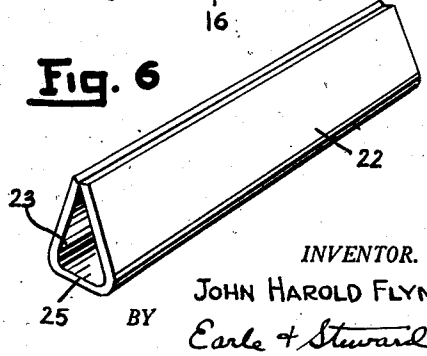


Fig. 5

Fig. 6



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Fig. 7

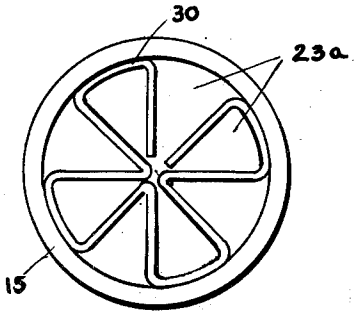


Fig. 8

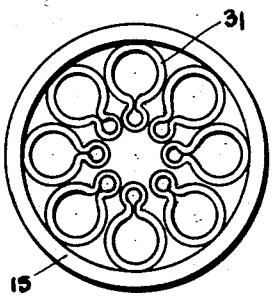


Fig. 9

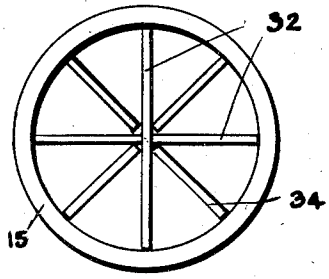


Fig. 10

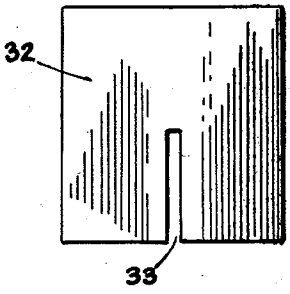
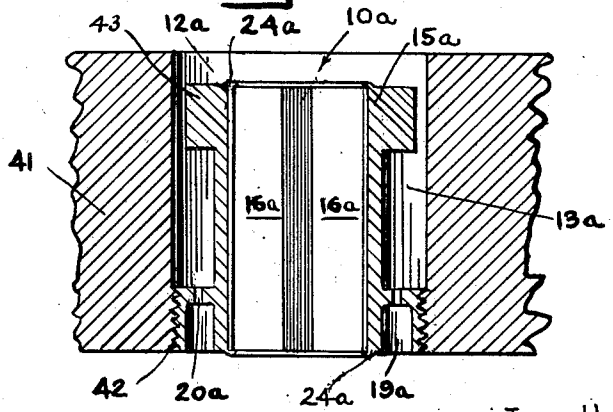


Fig. 11



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GAS BURNER

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5 Claims. (Cl. 158—116)

This invention relates generally to gas burners and more particularly to an improved gas burner nozzle and tip therefor.

A common type of gas burner nozzle which has had wide use is what is known as an open-port burner. These burners usually have a piloting port to provide a low velocity pilot flame surrounding the high velocity main gas jet and preventing the gas from blowing itself out due to the high velocity required to burn large quantities of gas without drastically increasing the size of the burners. Due to the fact that the burner port area of this open-port type of burner is so large, the flame will burn back toward the source of the air-gas mixture at low turn-down pressures. This burn back and back flash frequently causes explosions within the burner.

In order to overcome back flashing, the burner tip was provided with a screen at its outer end to divide the main port into a large number of small apertures, known as individual burner ports, through which the gas passes before it becomes ignited. Such screen-type burners are commonly made by rolling up a narrow strip of metal ribbon, having diagonal corrugations therein, and placing it in the open end of the burner tip. The spaces formed by the corrugations, as the ribbon overlaps itself in a spiral, provide the individual burner ports or main ports as distinguished from pilot ports. Flash back is prevented because the individual burner port areas are so small that the gas, as it passes through the screen, will not support combustion. This screen-type of burner has, however, been incapable of satisfactorily burning a large quantity of gas due to the fact that the small individual burner port areas cause turbulence in the flame, the turbulence being further emphasized by the angle at which the corrugations are placed in the metal ribbon, thereby imparting a twist to the gas and flame as it passes out of the nozzle.

As is well understood in the art, providing a deep gas port enables the burner port area thereof to be increased while at the same time preventing back flash or burn back of the combustible mixture at extreme low turn-down range; in fact, the deeper the port, the greater can the burner port area be increased. In conventional burner tips of the type contemplated by this invention, this principle has not, however, been taken advantage of and the main ports of such conventional tips are of extremely shallow construction and consequently of restricted burner port area, resulting in a turbulent flame which in turn interrupts the smooth flow of the air-gas mixture, thereby cutting down the capacity of the burner tip and limiting the size of the flame.

An object of the invention is to provide a burner tip for a gas burner that will have a plurality of deep main ports so that the cross-sectional areas thereof may be greatly increased to permit combustion of a larger volume of gas while preventing back flash or burn back of the gas at extreme low turn-down range.

Another object is to provide a burner tip wherein the

combustible mixture fed to the burner body passes through the main ports in a straight line eventually forming an even, non-turbulent, fairly sharp needle or cone-shaped flame having reduced combustion noise.

It has been a disadvantage, moreover, of the aforementioned screen-type burner tips that dirt entrained in the combustible mixture clogs the relatively small burner ports of the screen, necessitating frequent cleaning. Consequently, it is an object of this invention to provide a substantially self-cleaning tip which only rarely requires removal for cleaning purposes.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is an elevational view of my assembled burner tip shown mounted within a conventional burner body, portions of the tip and body being broken away to show the relation of parts;

Fig. 2 is an enlarged vertical section of the assembled burner tip taken approximately along line 2—2 of Fig. 3 in the direction of the arrows;

Fig. 3 is a plan view of Fig. 2, a part of the circular chamfers being broken away to show the end formation of the individual segments and how they fit together within the inner shell to form from the radial partitions;

Fig. 4 is a horizontal sectional view taken along line 4—4 of Fig. 2 in the direction of the arrows, showing the piloting gas ports and the annular by-pass between the shells;

Fig. 5 is a perspective of the inner shell shown turned on its side to view the lower end thereof, a lengthwise portion of the shell being broken away to show the depth of the radial partitions within the shell;

Fig. 6 is a perspective of one of the individual segments employed to form the radial partitions;

Figs. 7, 8 and 9 are plan views of the inner shell of the burner tip shown in Figs. 1 and 2 and illustrate three different modifications of the partitions forming the main gas ports;

Fig. 10 is an elevational view of an interlocking partition used in the modification shown in Fig. 9; and

Fig. 11 is a vertical section of a modified construction of a burner tip mounted within a casting which forms the burner body.

In the particular embodiment of the invention which is disclosed in Figs. 1–6, I have shown in Fig. 1 my assembled burner tip, generally indicated at **10**, located within a conventional tubular burner body or nozzle **11** in the gas passage or bore **12** thereof. The lower end of the burner tip **10** is threaded to the inner wall of the burner body **11** at a reduced mounting section about midway between the ends thereof, the outside diameter of the burner tip and the inside diameter of the burner body being of such dimensions as to provide an annular space **13** between the tip and the body above the screw threads. The lower end of burner body **11** is internally threaded so that it can be connected to a suitable source of air-gas mixture, in conventional manner. Although the burner tip **10** is shown and described herein as being threaded into the burner body **11**, it can be secured therein in any other well known manner, such as by providing a taper fit between these two members. Moreover, while shown and described herein as positioned vertically, the tip, of course, may be at any angle depending on the particular installation in which it is to be used.

Burner tip **10** consists of a tubular outer shell **14**, Figs. 1 to 4, threaded at its lower end to engage burner body **11** and arranged to extend downstream from the point of its threaded connection therewith, a tubular inner shell **15** disposed within the outer shell in axial alignment therewith and having a main burner gas passage there-

through, and a plurality of partitions 16 longitudinally positioned within the gas passage in the inner shell. Outer shell 14 is provided with an internal ledge or shoulder 17 near the upper or downstream end thereof. The upper or downstream end of inner shell 15 is provided with a head 18 of such diameter that when the inner shell is placed within the outer shell, the headed end fits snugly into the upper or downstream end of the outer shell and rests against internal ledge 17, the upper ends of the two shells being then substantially flush and the inner shell 15 extending upstream from its mounting in the outer shell, as shown in Figs. 1 and 2. This construction leaves between the outer and inner shells below the internal ledge an annular pilot gas lead-in passage or by-pass 19 which is in direct communication with the source of air-gas mixture. Circumferentially arranged low pressure piloting gas ports 20 between the ledge 17 and the threaded connection connect annular by-pass 19 with annular space 13, Fig. 1, which forms an annular pilot gas outlet passage. For securing the inner shell within the outer shell, a circular chamfer 21 integrally formed with the upper inner edge of outer shell 14 is provided to be turned inwardly against headed end 18.

To obtain depth to the main ports so that the burner port areas thereof may be opened up to permit combustion of a larger volume of gas at high pressures but without fear of back flash or burn back of the gas at extreme low turn-down range, I extend inner shell 15 and partitions 16, therein disposed, downwardly through and beyond outer shell 14 to a point near the inlet of burner body 11 where it connects with a gas supply. Within inner shell 15, longitudinal partitions 16 extend substantially the entire length of the inner shell and are preferably, though not necessarily, radially disposed. In the particular construction shown in the drawings, shell 15 is substantially twice as long as its inside diameter. While these radial partitions may be shaped in several ways, I prefer to bend rectangular sheet metal pieces or partition elements lengthwise into individual tubes 22 of sector-shaped cross section so that each tube has a substantially pie-shaped cross section with an apex edge and an opposite peripheral wall or arc portion 25, as shown in Figs. 3 to 6, and to arrange said tubes radially within the inner shell in side-by-side relation with their converging sides abutting, the abutting sides of any two individual tubes forming a radial partition 16. The cross sectional area of inner shell 15 is thus divided by the partitions into a plurality of approximately equal individual main ports 23, each port being pie-shaped in cross section and of a depth substantially equal to the length of the inner shell. Integrally formed circular chamfers 24 at both ends of inner shell 15 are turned inwardly against the ends of the peripheral wall or arc portions 25, Figs. 3 and 6, of individual tubes 22 to secure radial partitions 16 within the inner shell. Although the drawings show an arrangement of ten partitions 16 providing ten main ports 23, it is to be understood that this is merely by way of illustration and that the number of main ports may be increased or decreased by varying the length of arc 25 of each individual tube 22 to provide a greater or less number of such tubes to be included within the 360° of the cross sectional area of inner shell 15.

In operation, a combustible air-gas mixture supplied to the burner body 11 is fed under pressure both to main ports 23 and to annular by-pass 19, as indicated by the arrows in Fig. 1. As the inner sides of the individual sector-shaped tubes 22, forming main ports 23, are straight they also serve as straightening vanes and the combustible mixture in consequence passes through each of the main ports in a straight line to form eventually into a fairly sharp needle or cone-shaped flame without turbulence. The lack of turbulence, moreover, tends to reduce the noise of combustion. The combustible mixture entering annular by-pass 19 is under the full gas-

pressure since this passage is in direct communication with the source of gas. From by-pass 19 the gas is diverted laterally out through gas ports 20 into annular space 13 where it immediately expands and slows down to form a slow velocity piloting gas flame surrounding the main gas flame issuing from main ports 23.

In gas burners provided with conventional screen-type burner tips of usual size, the maximum mixture pressure, which can be applied before the flame blows itself out, is about 1½ inches water column. In marked contrast to this, burners, having the same size tips with large port areas and with long deep ports in accordance with my invention, are capable of handling 28 inches water column mixture pressure without blowing itself out. At the same time, the pressure can be turned down to .01 inch water column without back flash.

Furthermore, I have found that my burner tips will remain cleaner than the screen-type burner tips for longer periods of time. From an operational standpoint, this is, of course, a great advantage.

Figs. 9–10 illustrate three modified forms which the partitions, shown in Figs. 1–6 as pie-shaped segments, may take. In Fig. 7 a continuous metal ribbon 30 is crimped to form four substantially pie-shaped segments which are radially disposed. This crimped ribbon 30 is then placed within the inner shell 15 to form eight main ports 23*a*.

Fig. 8 shows individual segments 31 which are round-shaped instead of pie-shaped in cross section and which are arranged radially within the shell 15. Fig. 9 illustrates still another form of partitioning wherein two interlocking metal plates 32, having slots 33, cut centrally therein to about half the depth of the port, are inserted within the inner shell 15 at substantially right angles to each other. Rectangular plates 34 are then placed diagonally within each of the four sectors formed by the plates 32 to divide the shell 15 into eight sectors.

In each of the modifications shown in Figs. 7, 8 and 9, the partitions are secured within the inner shell 15 by rolling in the chamfer provided at each end of the shell in the same manner as is described with respect to the embodiment shown in Figs. 1–6.

While in the foregoing specific description of certain embodiments of my invention illustrated in Figs. 1–10, the tip construction consists of two cylindrical shells, one within the other, it is obvious that the invention is not limited to this particular arrangement. For instance, the tip may consist of only one shell which is adapted to be directly secured in the burner body as shown in Fig. 11. In this modified construction the burner body comprises a casting 41 in which are usually arranged a plurality of gas passages 12*a*, only one of which is shown in Fig. 11. The burner tip, indicated generally at 10*a*, consists of a single tubular shell 15*a*, having a flange 42 at its lower end as shown in the drawing. Flange 42 threadedly engages the burner body 41 adjacent the inside end of passage 12*a* to provide an annular space 13*a* between the shell 15*a* and the burner body 41. An annular gas by-pass 19*a* is provided in the under face of flange 42 and a plurality of piloting gas ports 20*a* connect said by-pass with the annular space 13*a*. In order that the piloting gas will completely fill the zone surrounding the main gas flame, shell 15*a* is also provided at its upper end with a deflecting flange 43, against which the gas issuing from the ports 20*a* hits and is thrown outwardly.

Shell 15*a* is provided with partitions 16*a* secured therein as by rolling over the chamfer 24*a* at both ends of the shell after the partitions are placed therein. Partitions 16*a* may take any form including those shown in Figs. 3, 7, 8 and 9 so long as they provide relatively large individual burner port areas and long deep ports extending the full length of the shell 15*a*.

Burner tips according to my invention are also readily adapted for use in gas burners of the type known as pipe

burners. In this case two shells, an inner and an outer, similar to the construction shown in Figs. 1–6, are preferably used and arranged to provide the necessary piloting gas. The outer shell is mounted in the wall of the pipe which corresponds to the burner body referred to hereinabove.

It is seen from the above description that I have provided a novel gas burner tip having a plurality of straight individual main ports of relatively great depth that enable the burner port areas thereof to be opened up, thereby permitting an increase in the volume of gas capable of being burned without back flash or burn back of the gas at extreme low turn-down range, that produce an even, nonturbulent flame of increased volume and substantially of needle or cone formation, and that tends to reduce the noise of combustion.

It will, of course, be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A gas burner comprising a burner body having a bore for emission of gas and a reduced mounting section on the interior of said bore spaced from the downstream end; a tubular outer burner tip shell whose exterior diameter is substantially smaller than said bore affixed at one end to said mounting section on said body and supported thereby, said outer shell extending downstream from said mounting section with its outer surface spaced from the surface of said bore to provide an annular pilot gas discharge passage and having an internal shoulder near its downstream end; a tubular inner burner tip shell providing a passage through which burner gas flows and at one end of which it becomes ignited and is burned, said inner burner tip shell having a diameter over most of its length substantially less than the interior of said outer tubular shell and having a head at its downstream end substantially fitting the downstream end of the outer shell interior, said inner shell extending primarily upstream from said head with its outer surface spaced from the interior of said outer shell to provide an annular pilot gas lead-in passage; and means for retaining said head in the downstream end of said outer shell against said shoulder to support said inner shell on said outer shell with its upstream end free, said outer shell having at least one opening through its wall at a location between said shoulder and its mounting connection with said body to permit the flow of pilot gas from said annular pilot gas lead-in passage to said annular pilot gas discharge passage.

2. A gas burner comprising a burner body having a bore for emission of gas and a reduced female threaded mounting section on the interior of said bore spaced from the downstream end; a tubular outer burner tip shell whose exterior diameter is substantially smaller than said bore threadedly engaged at one end with said mounting section on said body and supported thereby, said outer shell extending downstream from said mounting connection with its outer surface spaced from the surface of said bore to provide an annular pilot gas discharge passage and having an internal shoulder near its downstream end; a tubular inner burner tip shell providing a passage through which burner gas flows and at one end of which it becomes ignited and is burned, said inner burner tip shell having a diameter over most of its length substantially less than the interior of said outer tubular shell and having a head at its downstream end substantially fitting the downstream end of the outer shell interior, said inner shell extending primarily upstream from said head with its outer surface spaced from the interior of said outer shell to provide an annular pilot gas lead-in passage; the end of said outer shell being deformed against said head to retain the same against said shoulder to support said inner shell on said outer shell with its upstream end free, said outer shell having at least one opening through its wall at a location between said shoulder and said threaded mounting to permit the flow of pilot gas from said annular pilot gas lead-in passage to said annular pilot gas discharge passage.

3. A gas burner comprising a burner body having a bore for emission of gas and a reduced female threaded section on the interior of said bore spaced from the downstream end; a tubular outer burner tip shell whose exterior diameter is substantially smaller than said bore threadedly engaged at one end with said reduced threaded section on said body and supported thereby, said outer shell extending downstream from said threaded connection with its outer surface spaced from the surface of said bore to provide an annular pilot gas discharge passage and having an internal shoulder near its downstream end; a tubular inner burner tip shell providing a passage through which the burner gas flows and at one end of which it becomes ignited and is burned, said inner burner tip shell having a diameter over most of its length substantially less than the interior of said outer tubular shell and having a head at its downstream end substantially fitting the downstream end of the outer shell interior, said inner shell extending primarily upstream from said head with its outer surface spaced from the interior of said outer shell to provide an annular pilot gas lead-in passage; means for retaining said head in the downstream end of said outer shell against said shoulder to support said inner shell on said outer shell with its upstream end free; and means for subdividing the cross-sectional area of the burner gas passage of said inner shell throughout its length into segments, comprising sheet metal partition elements bent to form substantially identical individual sector-shaped tubes having an apex edge and an opposite peripheral wall portion, the distance between which is slightly less than the radius of the internal surface of said inner shell, said tubes being packed in snug side-by-side relation in said inner shell with their apex edges towards the center of the inner shell, and means engaging the ends of said peripheral wall portion to prevent endwise displacement of said tubes relative to said inner shell, said outer shell having at least one opening through its wall at a location between said shoulder and said threaded mounting to permit the flow of pilot gas from said annular pilot gas lead-in passage to said annular pilot gas discharge passage.

4. A gas burner having main and piloting gas ports, comprising a burner body having a tubular bore providing a gas passage through which burner gas flows, a separable burner tip, and means for mounting said tip concentrically and in gas-tight relation in the bore of said burner body, said tip comprising a tubular shell providing a main port through which burner gas flows and at the downstream end of which it becomes ignited and is burned, said tip being spaced peripherally at said downstream end from the bore in said burner body to form said piloting gas port which surrounds said main port downstream from said means mounting said tip in said body, said tip having wall means at its upstream end forming an inlet passage providing restricted communication with said piloting gas port and by-passing said main port, and means for subdividing the cross-sectional area of said main port throughout the length of said tip into segments comprising thin-walled partition means disposed generally radially in said burner tip and defining substantially identical smooth walled sector-shaped passages, and means engaging the ends of said partition means to prevent endwise displacement thereof in said tip; said partition means comprising substantially identical individual sector-shaped sheet metal tubes each having a peripheral wall portion and radially disposed wall portions converging to an apex edge, the distance between the latter and said peripheral wall portion being slightly less than the radius of the internal surface of said main port, said tubes being packed in snug side-by-side relation in said tip with their apex edges towards the center thereof.

5. A gas burner as defined in claim 4, wherein the ends of said burner tip are deformed inwardly to overlie the ends of said peripheral wall portions to retain said tubes in place in said tip against endwise displacement relative thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

740,857	Hooker	Oct. 6, 1903
882,545	Von Wouwermans	Mar. 17, 1908
1,125,559	Kofod	Jan. 19, 1915
1,462,756	Ginger	July 24, 1923
1,641,350	Nieberding	Sept. 6, 1927
1,835,215	Hammon	Dec. 8, 1931
1,973,371	Charles et al.	Sept. 11, 1934
2,009,271	Moecker	July 23, 1935
2,134,169	Wright	Oct. 25, 1938
2,237,889	Rickert	Apr. 8, 1941
2,572,445	Cannon	Oct. 23, 1951
2,610,675	Downe	Sept. 16, 1952

FOREIGN PATENTS

577,854	Germany	June 6, 1933
16,911	Great Britain	1905