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E. J. W. EGGER ET AL

2,294,392

BLOWPIPE NOZZLE

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Fig. 1.

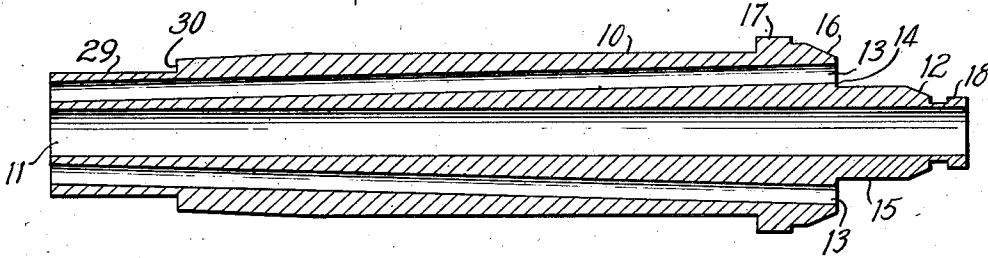


Fig. 2.

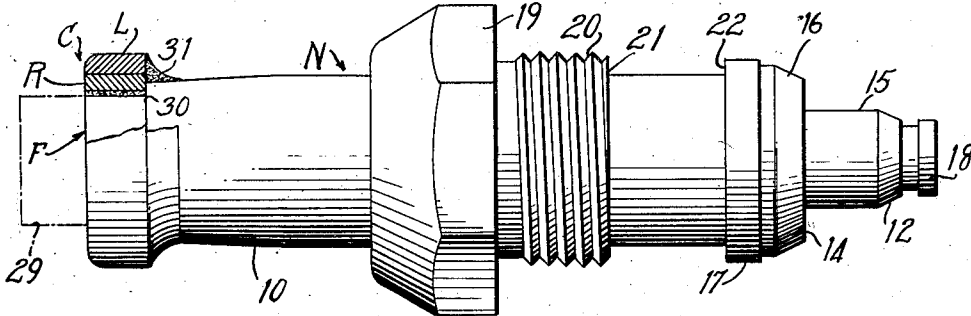
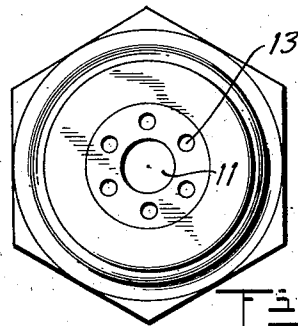


Fig. 4.

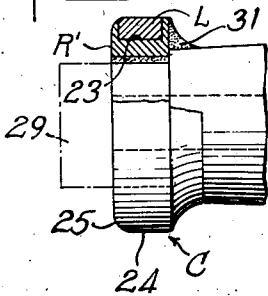
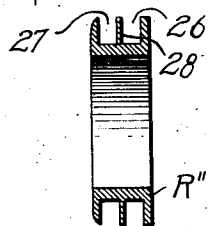


Fig. 5.



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BLOWPIPE NOZZLE

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18 Claims. (Cl. 158—27.4)

This invention relates to blowpipes; particularly to blowpipe nozzles, the forward ends of which normally engage and are guided by a metal surface being acted upon by the gas stream discharging from said nozzles.

In certain metal-working operations, e. g., when deseaming steel billets and the like, the work surface is preheated to the ignition temperature and a relatively low-velocity large-volume oxidizing gas jet is applied obliquely against successive portions of the metal surface so preheated, to remove metal from or deseam said surface. Nozzles employed for this purpose usually include a relatively large diameter oxygen passage extending along or parallel with the axial center line of the nozzle, and a series of relatively small diameter preheating gas passages parallel with the large oxygen passage or converging towards the forward end of the nozzle, and usually, but not necessarily, spaced circumferentially about the large oxygen passage. The nozzle is held so that its axis is oblique and makes a sharp angle with the surface of the workpiece and the nozzle is guided by and pushed along the workpiece in the direction of the issuing oxidizing gas stream, thus wearing away the front periphery and the peripheral portions behind the front face of the nozzle body and exerting a rearward thrust against the latter. Such guidance of the nozzle by contacting its end with the metal surface is especially desirable when hand-operated deseaming blowpipes are moved along the surface to be deseamed because the preheating and oxidizing jets may then be maintained in accurate positions with respect to the work surface during relative movement, irrespective of the surface contour of the work—thus uniform removal of metal along the surface can be accomplished.

Rapid wear and deterioration will occur at the periphery of the nozzle adjacent but behind its front face when such periphery continually engages the surface of a workpiece to guide the nozzle while held obliquely against the workpiece, especially during a deseaming or other thermochemical operation, because of the intense heat adjacent the nozzle and in contact with the work.

An object of this invention is to provide a blowpipe nozzle of economical construction having a peripheral portion surrounding and extending a substantial distance beyond the periphery of the nozzle body which serves to accurately space the discharge end of the nozzle from the work surface, and which peripheral portion will resist

abrasion, deformation and oxidation at extremely high temperatures.

Other objects of this invention include the provision of a blowpipe nozzle having a peripheral work-contacting portion adjacent but behind its front face which peripheral portion extends a substantial distance beyond the periphery of the nozzle body and comprises metal resistant to abrasion, deformation and oxidation at high temperatures; the provision of such a nozzle in which said work-contacting portion cooperates with a shoulder at the rear of the nozzle body for retaining a nut on said nozzle body between said work-contacting portion and shoulder for coupling said nozzle to a blowpipe; the provision of such a nozzle in which a layer of abrasive-resistant and oxidizing-resistant material is firmly secured to the periphery of the nozzle, which nozzle is formed from metal having a substantially lower melting point than said resistant material; the provision of such a nozzle in which a layer of metal resistant to oxidation and abrasion at high temperatures is deposited on a ring of relatively inexpensive metal which is also resistant to oxidation at high temperatures—thus forming a composite collar which latter is firmly but removably secured to the nozzle body by brazing; and the provision of such an improved nozzle the making of which includes steps in the manufacture of the nozzle for preventing the contamination, clogging, distortion, or in other wise objectionably affecting the gas passages in the nozzle during the brazing operation.

The above and other objects and novel features of the invention will become apparent from the following specification and the accompanying drawing, in which:

Fig. 1 is a longitudinal central sectional view of a nozzle blank to which the principles of this invention are applicable;

Fig. 2 is a plane view, partially in section, showing a blowpipe nozzle to which the principles of this invention have been applied;

Fig. 3 is a front end elevation of the blowpipe nozzle shown in Fig. 2;

Fig. 4 is a view of the forward portion of a nozzle showing a different form of the invention; and

Fig. 5 is a view of a modified element of the invention.

In accordance with the invention there is provided a deseaming blowpipe nozzle comprising an elongated body of metal, such as copper, having oxygen and combustible gas passages extend-

ing longitudinally therethrough, said passages having their outlets in the front face of the body which has a substantially cylindrical outer surface; and a protective metal collar permanently secured to the body and extending around the same behind but adjacent the front end face thereof. The collar comprises a metal ring which is relatively thick radially and has a substantially greater outside diameter than the cylindrical surface of the body adjoining the ring which consists throughout of metal having greater wear resistance than the metal of the body, an outer circumferential portion of the ring adjacent its periphery having greater wear resistance than the portion of the ring closer to the body. The ring is permanently secured to the body by means comprising a relatively thin layer of bonding metal united to and covering both the entire inner peripheral surface of the ring and the corresponding opposed outer surface portion of the body within the ring.

Referring to Fig. 2, the principles of the invention are shown as embodied in a deseaming nozzle N having a forward portion of reduced diameter adapted to receive a collar C adjacent to but behind the front face of the nozzle. The collar C preferably extends radially beyond the periphery of the nozzle N and includes a ring R made from metal which is resistant to oxidation, cracking or spalling at high temperatures, such as the nickel-copper alloys containing approximately 70 per cent nickel and 30 percent copper—commonly known as Monel metal; or such a metal as the high chromium or chromium-nickel steels, usually containing 10 per cent to 25 percent chromium. The collar C also may include a layer L of a metal alloy including 35 percent to 90 percent of metal from the group consisting of chromium, molybdenum and tungsten, the remainder principally comprising metal from the group consisting of iron, nickel and cobalt, which alloy, at high temperatures, is resistant to abrasion, deformation and oxidation. The alloy L is deposited on and permanently bonded to the outer periphery of the ring R.

Referring to Figs. 1 and 2, the blank from which nozzle N is formed comprises a substantially cylindrical and elongated body 10 of metal such as copper. It is provided with a relatively large central passage 11, which extends throughout the length of the nozzle for conveying oxygen therethrough. The rear end of the tubular body 10 is provided with a seat 12 surrounding the entrance end of the passage 11. The seat 12 is adapted to form a hermetical seal with a complementary seat in a socket in the blowpipe head to which the nozzle is adapted to be connected. Oxidizing gas is adapted to flow from the blowpipe head into the passage 11, from which it discharges onto the work being treated. A series of preheat or combustible gas passages 13 are arranged in parallel relation about the central passage 11. The rear ends or inlets of these passages terminate in an annular surface 14 which is spaced forwardly of the inlet end of passage 11. The surface 14 and the adjoining cylindrical surface 15 form a gas-distributing chamber with a portion of the blowpipe head. A seat 16 surrounds the surface 14 and the inlets of the preheat passages 13 and forms a hermetical seal with a complementary seat in the socket of the blowpipe head. A combustible gas, such as a mixture of oxygen and acetylene, is fed to said gas-distributing chamber, thence

through the preheat passages 13, and finally the gas mixture discharges from the outlets of said passages in the front end face F of the nozzle N, to provide an annular row of preheating flames.

An integral annular enlargement or shoulder 17 is provided close to and forwardly of the seat 16, and is of such outer diameter that it cooperates with an integral collar 18 located at the extreme rear end of the nozzle N to provide means for protecting the seats 12 and 16 when the nozzle N is dropped while it is separated from the blowpipe.

Referring to Fig. 2, the nozzle N is provided with a hollow coupling nut 19 having screw threads 20 adapted to cooperate with complementary threads in the socket of the blowpipe head to which the nozzle is to be secured. The nut is rotatable and slidable axially relatively to and upon the outside surface of the nozzle N when coupling the nozzle to the blowpipe head, thus permitting any circumferential portion of the collar C to be located in work-contacting position and thereby affording a longer life for the nozzle, since the wear-resistant collar may then be adjusted so that it wears off evenly throughout its circumference. While coupling the nozzle to a blowpipe head, an end 21 of the nut bears against the surface 22 of the shoulder 17. Furthermore, the abutments provided by the collar C and the shoulder 17, being of greater outside diameters than the inside diameter of the nut, prevent removal of the nut 19 from the nozzle but permit sliding and rotation of the nut relatively to the nozzle.

The layer of material L should preferably comprise metals such as alloys of cobalt, chromium, and tungsten, because metals in this class are resistant to both oxidation and abrasion at extremely high temperatures. These alloys are commonly known to the trade as "Stellite" alloys. The invention, however, is not limited to such specific alloys but covers all such materials capable of simultaneously withstanding abrasive wear and oxidation at a high temperature.

Alloys containing cobalt, chromium and tungsten are extremely difficult to work, and casting is the only commercial method of making rings therefrom. These cast rings are extremely brittle and will crack, spall and chip when subjected to substantial temperature variations, or impacts due to handling unless an excellent bond of sufficient extent is formed between the alloy and the metal to which it is to be joined. It is extremely difficult and commercially impractical to form a satisfactory bond between such a cast alloy ring and copper in a deseaming nozzle. Consequently, if a cast ring of such alloy is so connected by direct bonding to the forward end of the nozzle, it usually fails by cracking into segments which will separate from the forward end of the nozzle and leave the same unprotected.

It has been found that only a relatively thin layer of a metal such as a "Stellite" alloy need be employed to adequately protect the nozzle. However, the melting point of such an alloy is much higher than that of copper, or the metal from which the nozzle N is made, which metal is necessarily one of high heat conductivity in order to avoid local overheating or burning. It is undesirable and impractical to deposit a thin homogeneous coating of such an alloy on the forward end of the copper nozzle body. These metals will not mix during a fusion welding

process, and if they did mix properly to form a bond, the difference between their melting points would cause a dilution of the alloy thereby materially detracting from the resistant properties of the coating. Likewise, the melting temperature of such an alloy is so high that if it were applied directly to the copper nozzle N, distortion as well as oxidation of the walls of the gas passages would occur thereby detrimentally affecting the size, alignment, and disposition of these passages within the nozzle.

It has been found that a thin layer of such an alloy L can be deposited in substantially undiluted condition on, and homogeneously bonded to, a metal support such as steel, and the latter metal then can be more readily welded or brazed directly to the copper nozzle body. Thus, a relatively thin layer of undiluted and relatively more expensive alloy which is resistant to oxidation and abrasion at high temperatures may be secured, effectively and without difficulty, to the forward end of the nozzle N by an intermediate agency such as inexpensive steel.

Inasmuch as the temperature during the decanning or other metal-working operation is relatively high, any readily oxidizable metal used for the ring R will be subjected to scaling and burning by the oxidizing gas discharging from the end of the nozzle. Accordingly, ring R is preferably made from an inexpensive metal which is resistant to oxidation at high temperatures, such as Monel metal, or the chromium or chromium-nickel steels, usually containing 10 percent to 25 percent chromium. Furthermore, such metals have high strength; may be readily brazed or otherwise firmly united to the copper nozzle body; will not crack when subjected to substantial temperature variations; and the difficulties encountered by the cracking of thick collars of alloys containing cobalt, chromium and tungsten will be avoided. Additionally, a relatively thin layer of the alloy L is less apt to crack than a thick collar of such alloy, and even if cracks develop in the thin layer, they will be of no consequence since the entire layer is homogeneously bonded to the ring R.

The composite collar C may be formed by fusion depositing a layer of alloy L onto and covering the outer cylindrical surface of a relatively long stainless steel tube of the desired inside and outside diameters. This may be accomplished by using an oxy-acetylene flame to raise the temperature of the tube to the point where its external surface will "sweat" or become fluid superficially; and then fusion depositing, by the puddling process, the alloy L onto such "sweated" surface. The tube so coated may then be cut perpendicular to its axis into sections of appropriate length to form a number of finished pieces, each constituting a collar C.

Referring to Fig. 4, another embodiment of the invention is disclosed, wherein the collar C includes an independently formed ring R' of stainless steel having a channel 23 in its outer peripheral surface. The alloy L is then fusion deposited, as described above, within the channel 23 so that a crest 24 is formed which, upon the rounding of shoulder 25 of the collar C, will directly engage the work during a metal-working operation.

Referring to Fig. 5, another form of the invention is disclosed, wherein a ring R'' is made from a nickel-copper alloy. This collar is provided with two channels, 26, 27 separated by a relatively thin web 28. The cold ring R'' may be placed

within a suitable mould, and the alloy L in molten state may be fed to the channels 26, 27 where it unites or thermo-chemically reacts with at least a portion of the thin web 28 and forms an excellent bond with the metal of the ring R''. By virtue of the rapid transfer of heat from the molten alloy L to the cold extensive surface of the ring R'' with which it contacts, the alloy L quickly freezes without an appreciable dilution of the molten metal with the metal of ring R''. However, the interior of the mass of molten metal L dissolves or alloys with at least a portion of the thin web 28, which newly formed alloy provides a rigid bond between the alloy L and the metal of ring R''.

In both instances where the rings R' and R'' are independently formed, their external diameters are substantially larger than that which is ultimately required, since it is desirable to provide relatively deep channels within which to cast or deposit the alloy L. The composite collars C, formed from the rings R' and R'' are then dressed by grinding their outer peripheries to provide the desired form.

The composite collar C is bronze welded to the forward end of the nozzle N in a manner to protect the discharge ends of the gas passages within said nozzle. Thus, referring to Figs. 1 and 2, the forward end of the tubular copper body 10 may be turned to a reduced diameter, as at 29, to provide an annular outer surface adjacent but behind the face F and a shoulder 30 against which the annular metal collar C is adapted to abut—thus the shoulder 30 resists the rearward thrust of the collar C while the latter rubs along the surface of the workpiece. The integral extension 29 is of substantially greater length than the longitudinal dimension of the collar C and the ultimate internal diameter of the collar C is slightly greater than the external diameter of the extension 29 to provide a slight clearance therebetween. The collar C is set in place around the extension 29 so that one side of the collar abuts against the shoulder 30, the collar having a substantially greater outside diameter than the adjoining portion of the body 10. The extension 29 is covered with a flux prior to mounting the collar C thereon, and upon assembly of the collar, a bronze fillet weld 31 is formed between its rear side and outside of the copper body 10. It has been found that the formation of the weld 31 may be facilitated by employing a phosphorus bronze welding material to start the same and completing weld 31 with ordinary bronze welding rod. During the welding of the collar C to the body 10, a portion of the weld metal 31 flows by capillarity inwardly along and past the shoulder 30 and fills the space between the extension 29 and the internal surface of the collar C, thus forming a rigid connection between the collar and the nozzle N whereby the nozzle body internally supports the collar at substantially every part of the inner surface of the collar. The flux and weld metal may flow along and downwardly over the outer end of the extension 29, thus clogging the discharge outlets of the passages 11 and 13. After the collar has been welded in place, the projecting portion of the extension 29 is cut off flush with the front face of the collar C, thus providing the finished nozzle and consequently avoiding clogging of passages 11 and 13.

From the foregoing it is apparent that a nozzle has been provided which comprises a work-contacting peripheral portion adjacent but behind

the front face of the nozzle, which portion extends beyond the periphery of the nozzle body, includes a layer of material which is resistant to wear, deformation and oxidation at high temperatures permanently bonded thereto.

In descaling operations, the blowpipe is so held that the longitudinal axis of its nozzle is obliquely inclined at a sharp angle to the surface of the steel workpiece, and the nozzle is pushed along the workpiece in the direction of the issuing oxygen stream. It will be evident that the improved composite metal collar on each of the nozzles disclosed herein projects a substantial distance outwardly beyond the adjoining periphery of the softer copper nozzle body, which construction serves (1) to amply protect all peripheral portions of the nozzle body which otherwise would deteriorate while engaging against a metal surface, and (2) to maintain the oxygen and preheating gas outlets a greater but predetermined distance away from such surface during the movement of the nozzle and its collar along and in engagement with said surface, thus achieving a more uniform efficient operation and less clogging of the gas outlets.

Although the various features of the improved nozzle have been shown and described in detail to fully disclose several embodiments of the invention, it will be evident that numerous changes may be made in such details, and certain features may be used without others without departing from the principles of the invention.

The method of making blowpipe nozzles of the type disclosed herein is claimed in divisional application Serial No. 386,634, filed April 3, 1941.

What is claimed is:

1. A blowpipe nozzle adapted to be guided along and in contact with a work surface comprising, in combination, a nozzle body; a metal ring secured behind but adjacent to the front face of said nozzle; and a layer of metal, which is resistant at high temperatures to abrasion, deformation and oxidation, permanently united to the periphery of said ring forming therewith a composite collar the periphery of which extends outwardly beyond the periphery of said nozzle body; in which said ring is made from high chromium steel.

2. A blowpipe nozzle adapted to be guided along and in contact with a work surface comprising, in combination, a nozzle body; a metal ring secured behind but adjacent to the front face of said nozzle; and a layer of metal, which is resistant at high temperatures to abrasion, deformation and oxidation, permanently united to the periphery of said ring forming therewith a composite collar the periphery of which extends outwardly beyond the periphery of said nozzle body; in which said ring is made from high chromium steel, and said layer of wear-resistant metal is a metal alloy including 35 percent to 90 percent of metal from the group consisting of chromium, molybdenum and tungsten, and the remainder principally comprising metal from the group consisting of iron, nickel and cobalt.

3. A blowpipe nozzle adapted to be guided along and in contact with a work surface comprising in combination, a nozzle body; a metal ring secured behind but adjacent to the front face of said nozzle; and a layer of metal, which is resistant at high temperatures to abrasion, deformation and oxidation, permanently united to the periphery of said ring forming therewith a composite collar the periphery of which extends out-

wardly beyond the periphery of said nozzle body; in which said ring is made from high chromium steel and provided with a peripheral channel, said layer of wear-resistant metal being located within said channel, forming a bond with its walls, and comprising an alloy of cobalt, chromium and tungsten.

4. A blowpipe nozzle adapted to be guided along and in contact with a work surface comprising, in combination, a nozzle body; a metal ring secured behind but adjacent to the front face of said nozzle; and a layer of metal, which is resistant at high temperatures to abrasion, deformation and oxidation, permanently united to the periphery of said ring forming therewith a composite collar the periphery of which extends outwardly beyond the periphery of said nozzle body; in which said ring is an alloy containing approximately 70 percent nickel and 30 percent copper.

5. A blowpipe nozzle adapted to be guided along and in contact with a work surface comprising in combination, a nozzle body; a metal ring secured behind but adjacent to the front face of said nozzle; and a layer of metal, which is resistant at high temperatures to abrasion, deformation and oxidation, permanently united to the periphery of said ring forming therewith a composite collar the periphery of which extends outwardly beyond the periphery of said nozzle body; in which said ring is provided with a channel having a relatively thin web therein and comprises an alloy containing approximately 70 percent nickel and 30 percent copper.

6. A blowpipe nozzle collar comprising a ring of metal adapted to be readily united with a copper nozzle body to lie behind but substantially adjacent to the front face of said nozzle body, said ring having a peripheral surface, and a layer of metal on said peripheral surface which is resistant at high temperatures to abrasion, deformation and oxidation, said ring being provided with web-like integral means rigidly bonded with said layer of metal on said peripheral surface.

7. A descaling blowpipe nozzle comprising an elongated body of metal, such as copper, having oxygen and combustible gas passage means extending longitudinally therethrough, such passage means having outlet means in the front end face of said body, said body having a substantially cylindrical outer surface; and a protective metal collar permanently secured to said body and extending around the same behind but adjacent said front end face, said collar comprising a metal ring which is relatively thick radially and has a substantially greater outside diameter than the cylindrical surface of said body adjoining said ring, said ring consisting throughout of metal having greater wear resistance than the metal of said body, an outer circumferential portion of said ring adjacent its periphery having greater wear resistance than the portion of said ring closer to said body, said ring being permanently secured to said body by means comprising a relatively thin layer of bonding metal united to and substantially covering both the inner peripheral surface of said ring and the corresponding opposed outer surface portion of said body within said ring.

8. A descaling blowpipe nozzle comprising a substantially cylindrical body of metal, such as copper, provided with a relatively large central oxygen passage extending throughout the length of the nozzle for conveying oxidizing gas there-

through, and a series of preheat gas passages arranged about said central oxygen passage for discharging a combustible gas, such as a mixture of oxygen and acetylene, to provide an annular row of preheating flames; and a relatively thick solid ring of metal, such as steel, mounted on said body behind but adjacent the front face of the nozzle, said ring and said body having annular cooperating surfaces adapted to prevent inward movement of said ring on said body, the entire inner annular surface of said ring being contiguous with said body, and bonding means firmly uniting said ring and said copper body substantially throughout their contiguous surfaces, whereby said ring remains united with said body even when subjected to the temperature variations met with in deseaming.

9. A deseaming blowpipe nozzle as claimed by claim 8, in which said ring has its entire outer annular surface substantially harder than that united to said copper body.

10. A deseaming blowpipe nozzle comprising an elongated body of metal, such as copper, having oxygen and combustible gas passage means extending longitudinally therethrough, said passage means having outlet means in the front end face of said body and said body having an annular outer surface adjacent but behind said face; and an annular metal collar extending around said annular outer surface and permanently secured to said body, the construction of said body and said collar being such that said annular outer surface internally supports said collar at substantially every part of the inner surface of said collar, said collar having a considerably greater outside diameter than that of the adjoining portion of said body and consisting of metal having greater wear resistance than the metal of said body.

11. A deseaming blowpipe nozzle as claimed in claim 10, in which an outer peripheral portion of said collar consists of metal having a greater wear resistance than the portion of said collar directly adjacent to said annular outer surface.

12. A deseaming blowpipe nozzle as claimed in claim 10, in which said collar is permanently secured to said body by means comprising a relatively thin layer of bonding metal united to and disposed between said annular outer surface of said body and said inner surface of said collar.

13. A deseaming blowpipe nozzle as claimed in claim 10, in which said body has an annular

shoulder coextensive with that part of said annular outer surface which is most remote from the front end face of said body, and said collar bears against said shoulder and has a greater outside diameter than the outside diameter of said shoulder.

14. A blowpipe nozzle protective collar comprising, in combination, a ring having an annular channel in its outer peripheral surface, and an annular member filling said channel and integrally united with said ring, said member having an annular crest adapted to engage the work directly during a metal working operation of the nozzle.

15. A blowpipe nozzle protective collar as claimed by claim 14, wherein said ring is provided with an integral annular web in the bottom of said channel which is integrally united throughout with said member.

16. A blowpipe nozzle protective collar comprising, in combination, a ring of a material weldable to copper, and an annular member integrally united with said ring, said member being of harder material than said ring and adapted to engage the work directly during a metal working operation of the nozzle, the width of said member approaching the width of said ring.

17. An article of manufacture comprising, in combination, a substantially cylindrical nozzle body of relatively soft metal having gas passage means extending longitudinally therethrough, a collar of relatively hard metal permanently secured to and extending in its entirety annularly around said body behind but adjacent the gas discharge end of said body, a nut carried by said body, said nut being rotatably and axially movable relatively to said body, said body having an external annular shoulder spaced from said collar, both the outside diameter of said collar and the outside diameter of said shoulder being greater than the inside diameter of said nut, and said nut being disposed between and limited in its longitudinal movement by said collar and said shoulder.

18. An article of manufacture as claimed by claim 17, in which said nozzle body consists of copper and said metal collar consists of a metal ring surrounded by an annular integral layer of "Stellite" alloy.

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