June 7, 1966 J. T. GRIMM 3,254,696

SCARFING BURNER TIP

Filed Oct. 22, 1963

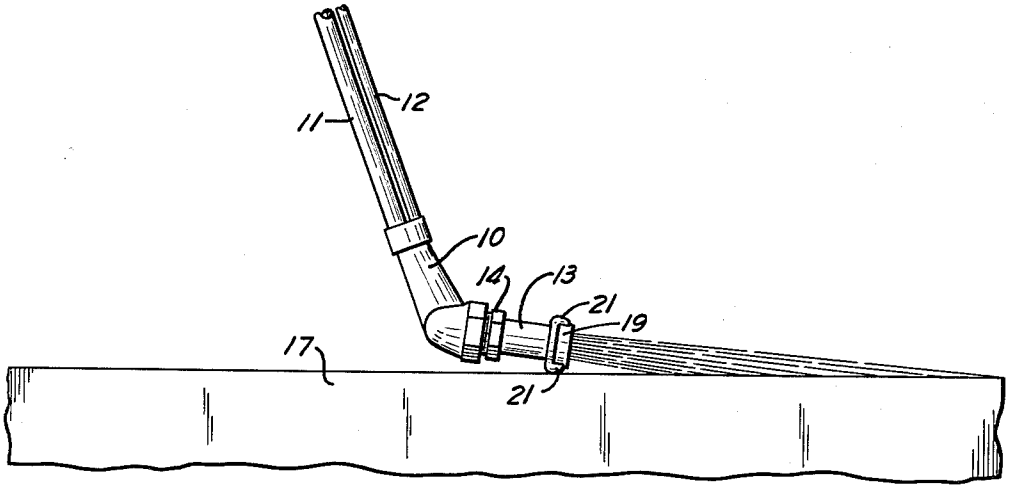



Fig. 1

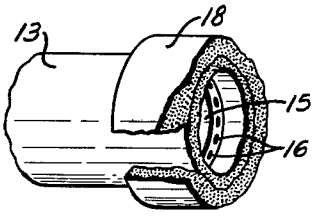



Fig. 2

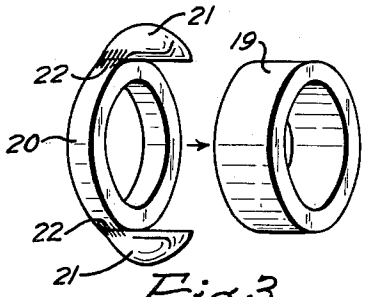



Fig. 3

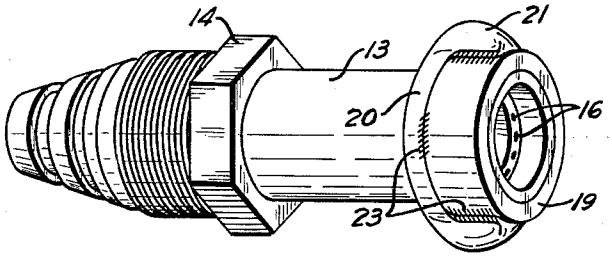



Fig. 4

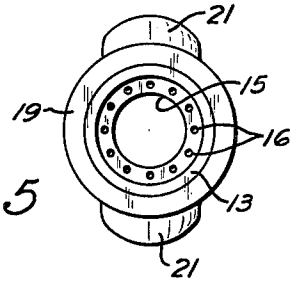



Fig. 5

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# SCARFING BURNER TIP

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This invention relates to an improved tip for use with oxygen burners commonly called scarfing burners.

In use these scarfing burners are moved manually along the billet being scarfed, and due to their heavy weight, the operator usually permits the tip to skid along on the hot surface. The combination of the high temperature and abrasion cause a very aggravated condition of wear on the lower side of the burner tip which comes in contact with the billet.

Numerous efforts have been made to solve this problem by the use of a metal that is highly wear-resistant at high temperatures, but none of these proposed solutions have been satisfactory, primarily due to the fact that such metals are very brittle. One of the most common of these expedients involves surrounding the extreme end of the burner tip with a band of such metal. However, this solution has not been very successful, as the band has a tendency to erode and crack away quite rapidly.

The present invention provides a different solution. Instead of surrounding the tip of the burner with a band of wear-resistant steel, a band of copper-bronze is used, and projecting lugs of wear-resistant steel are arranged on the periphery of this band. These wear-resistant lugs are carried by a ring of mild steel mounted on the burner tip. By this arrangement the copper-bronze band helps to dissipate the heat, and the wear-resistant lugs can be located at the points where localized abrasion takes place. With this arrangement the life of the burner tip is very much longer than when a solid band of wear-resistant steel is used.

The invention also includes the special construction of the ring of mild steel which carries the lugs of harder metal. This is the part of applicant's device subject to most wear, and could conveniently be manufactured and sold as a separate unit for the repair of the complete device.

These, and other objects and advantages of the invention will become apparent as the description proceeds.

In the drawings:

FIG. 1 is a side elevation of a burner tip of the invention being applied to a billet.

FIG. 2 is an oblique side view partly broken away to show a prior-art device.

FIG. 3 is an exploded perspective view of the parts of the protector band of the present invention.

FIG. 4 is an oblique side view of a scarfing burner tip incorporating the invention.

FIG. 5 is an end elevation of the burner tip of FIG. 4.

The scarfing burner includes the head **10** which is carried at the end of oxygen tube **11** and gas tube **12**. The tip **13** is attached to head **10** by the coupling nut **14** in a well-known manner. The tip **13** is provided with a relatively large center bore **15** which conducts oxygen for the scarfing operation and with a series of relatively small side bores **16** which conduct oxygen and fuel gas, such as acetylene, for the pre-heat operation.

It will be understood that the head **10** is provided in a well-known manner with suitable internal connecting passages to conduct the fuel gas from the tube **12**, and oxygen from the tube **11** to the bores **16**. The head **10** is also provided with suitable internal passages to conduct oxygen from the oxygen tube **11** to the central bore **15**.



A scarfing operation using a scarfing burner tip of the type involved in this invention is performed by first using the oxy-acetylene flame to heat a portion of the billet **17** to kindling temperature after which a jet scarfing oxygen is directed against the heated portion of the billet.

In carrying on the scarfing operation the scarfing burner is manually applied to the billet in approximately the position illustrated in FIGURE 1. Since hand scarfing torches may be as much as four feet long and weigh approximately twenty pounds, the operator usually permits the end of the tip to skid along the upper surface of the billet so that much of the weight of the torch is carried by the tip. The operator then slides the tip along the billet to scarf a certain area during a pass along the length of the billet. After reaching the end of the billet the operator must return to the starting part and in doing so he usually again permits the tip of the burner to skid along the surface of the billet.

It will be understood that the burner tip is subjected to the very high scarfing temperatures and this combination of high temperature, plus the abrasion resulting when the tip skids along the billet, provides a very severe condition of abrasion along the bottom side of the burner tip.

One prior solution to this problem is illustrated in FIGURE 2. In this instance a band **18** is attached to the end of the burner tip. The band **18** has been made of a cobalt-base or a nickel-base alloy which is highly resistant to wear. However, these alloys also contain large percentages of chromium or tungsten and while they are extremely hard, are also quite brittle.

It is not practical to form the burner tip **13** itself from such wear-resistant metals because of the difficulty of forming and machining these metals. It is, therefore, preferred to form the tip **13** of copper-bronze which can readily be formed with the necessary configurations such as the small passages **16**. The use of the bronze material is also advantageous for this part because of its ability to conduct away some of the heat of combustion.

The result is that in the construction of FIGURE 2 the wear-resistant band **18** is subject not only to abrasion, but to the expansion of the bronze tip **13** and to entrapment of heat, with the result that there is a tendency for this band to erode and crack away very rapidly, as shown by the roughened surfaces in FIGURE 2.

The method of forming the protective band of the present invention is illustrated in FIGURE 3. The improved construction includes a band **19** formed of copper-bronze similar to that of tip **13**. This band **19** is formed with an inner diameter that fits closely over the outer surface of tip **13**.

A washer-like ring **20** which may be formed of mild steel has the same internal and external diameter as band **19**. To this steel ring **20** are attached two lugs **21** which are formed of a highly wear-resistant material as will presently be explained. The lugs **21** are welded (as indicated at **22**) to the outer circumference of the ring **20** to form a ring assembly.

In assembling the improved burner tip, the ring assembly is first placed over the tip, and the band **19** is then put in position. The assembly is then subjected to a brazing operation which brazes these parts to each other and to the burner tip **13**, as indicated at **23**.

It will be clear that the lugs **21** are of such axial length that they extend over band **19**, but do not project beyond the end of that band. The lugs **21** may be of varied circumferential length, but it is preferred that the two lugs together should cover approximately 20 to 40 percent of the circumferential extent of the band **19**. This is to avoid any excessive expansion stress of the ring **19** on the lugs **21**.

In some cases it may be preferred to use only one of the lugs **21**, or more than two lugs, although a pair of lugs is the presently preferred construction.

The lugs **21** may be formed of any suitable high-temperature wear-resistant material indicated in a descending order of preference as follows:

I. *Cobalt-base alloys*

| | Alloy A | Alloy B | Alloy C | Alloy D |
|---|---|---|---|---|
| C | 1.0 | 1.2 | 2.40 | 1.0 |
| Si | 1.10 | 1.0 | .85 | |
| Cr | 27.5 | 28.0 | 29.5 | 28.0 |
| W | 4.5 | 5.0 | 12.0 | 5.0 |
| Fe | 1.5 | | | |
| Mo | | | .5 | |
| Co | Bal. | Bal. | Bal. | Bal. |

II. *Nickel-base alloys*

| | Alloy A | Alloy B | Alloy C | Alloy D | Alloy E |
|---|---|---|---|---|---|
| C | 1.75/2.25 | .10 | .05 max. | .08 max. | .05 max. |
| Si | .50 max. | .60 | | | |
| Cr | 25.0/27.0 | | 1.0 max. | 15.5 | 22.0 |
| W | 8.0/9.4 | .60 | | 4.0 | .6 |
| Fe | 1.0 max. | 18.50 | 5.0 | 5.0 | 17.0 |
| Co | .30 max. | 1.50 | 2.5 max. | 2.5 max. | 2.5 max. |
| Mn | .50 max. | .65 | | | |
| Cr | | 21.50 | | | |
| Mo | | | 28.0 | 16.0 | 6.5 |
| Others | | | 3.0 | 3.0 | 5.5 |
| Ni | Bal. | Bal. | 61.0 | 54.0 | 47.0 |

III. *Hot-work tool steels*

| | Alloy A | Alloy B |
|---|---|---|
| C | As desired | .82/.86 |
| Si | .20/.40 | .20/.40 |
| Cr | 3.75/4.25 | 3.90/4.40 |
| W | 12.50/18.50 | 6.00/6.75 |
| Mn | .20/.40 | .20/.40 |
| P | .030 max. | .030 max. |
| S | .030 max. | .030 max. |
| V | 1.00/1.25 | 1.80/2.05 |
| Mo | .50 max. | 4.75/5.25 |

It has been found that low carbon (mild) steel is totally unsuitable for the lugs **21**, because this material oxidizes and disintegrates rapidly under operating conditions.

With the construction of the present invention, the bronze band **19**, which is brazed to the tip **13**, provides a good heat conduction path to conduct heat away from the burner tip without applying excessive pressures of expansion to tthe lugs **21**. The lug **21** at the bottom side of the burner tip, as illustrated in FIGURE 1, provides a sled-runner type of support for the burner tip, and after this lower tip becomes unduly worn the coupling nut **14** may be loosened and the burner tip **13** rotated so as to bring the upper lug **21** into the lower operating position. These two spaced-apart lugs thus provide substantial wear-resistant surfaces, while at the same time avoiding the difficulties that cause rapid deterioration of the complete band as in FIGURE 2.

The advantages of the present invention that provides a scarfing burner tip with a greatly prolonged life, will be evident to those skilled in the art.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

**1.** In a scarfing burner of the type having a tubular tip formed from metal having relatively high heat conductivity, the improvement which comprises:

(A) a band formed of metal of relatively high heat conductivity surrounding and brazed to the outer end of the burner tip;



(B) a ring formed of mild steel,

(1) the ring fitting over the burner tip, and

(2) being located adjacent the inner end of the band; and

(C) at least one lug formed of a hard metal having high resistance to heat and wear,

(1) the lug being welded to the steel ring to form a ring assembly,

(2) the ring assembly being positioned over the burner tip with the lug extending axially over the outer periphery of the band,

(D) the ring assembly being brazed to the burner tip and to the band.

**2.** A device as specified in claim **1** in which a pair of lugs are provided, the lugs being located on opposite sides of the band.

**3.** A device as specified in claim **2** in which the lugs together cover approximately 20 to 40 percent of the periphery of the band.

**4.** A device as specified in claim **1** in which the burner tip and the band are formed from copper-bronze.

**5.** In a scarfing burner of the type having a rotatable tubular tip formed from material having relatively high heat conductivity, the improvement which comprises:

(A) A band of metal of heat conductivity comparable to that of the burner tip, the band surrounding and being brazed to the outer end of the burner tip, and

(B) a ring fitting over the burner tip and secured adjacent the inner end of the band, and

(C) a pair of lugs carried by the ring and adapted to contact the workpiece being scarfed,

(1) the lugs being formed of a metal that is harder and more wear-resistant that the material of the burner tip, but of lesser heat conductivity than the band,

(2) the lugs being located on the upper and lower ends of a diameter of the burner tip,

whereby, when the lower lug becomes worn, the burner tip may be rotated to bring the upper lug into the lower position where it may be brought into contact with the workpiece being scarfed.

**6.** A device as specified in claim **5** in which the lugs together cover approximately 20 to 40 percent of the periphery of the band.

**7.** A device as specified in claim **5** in which the burner tip and the band are formed from copper-bronze.

**8.** A protecting device for the tip of a scarfing burner, which comprises:

(A) a ring formed of mild steel and of a size to fit over the end of the burner tip; and

(B) a pair of lugs welded to the ring at opposite ends of a ring diameter, and extending axially of the ring, the lugs being of a metal harder and having a higher resistance to heat and wear than mild steel.


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