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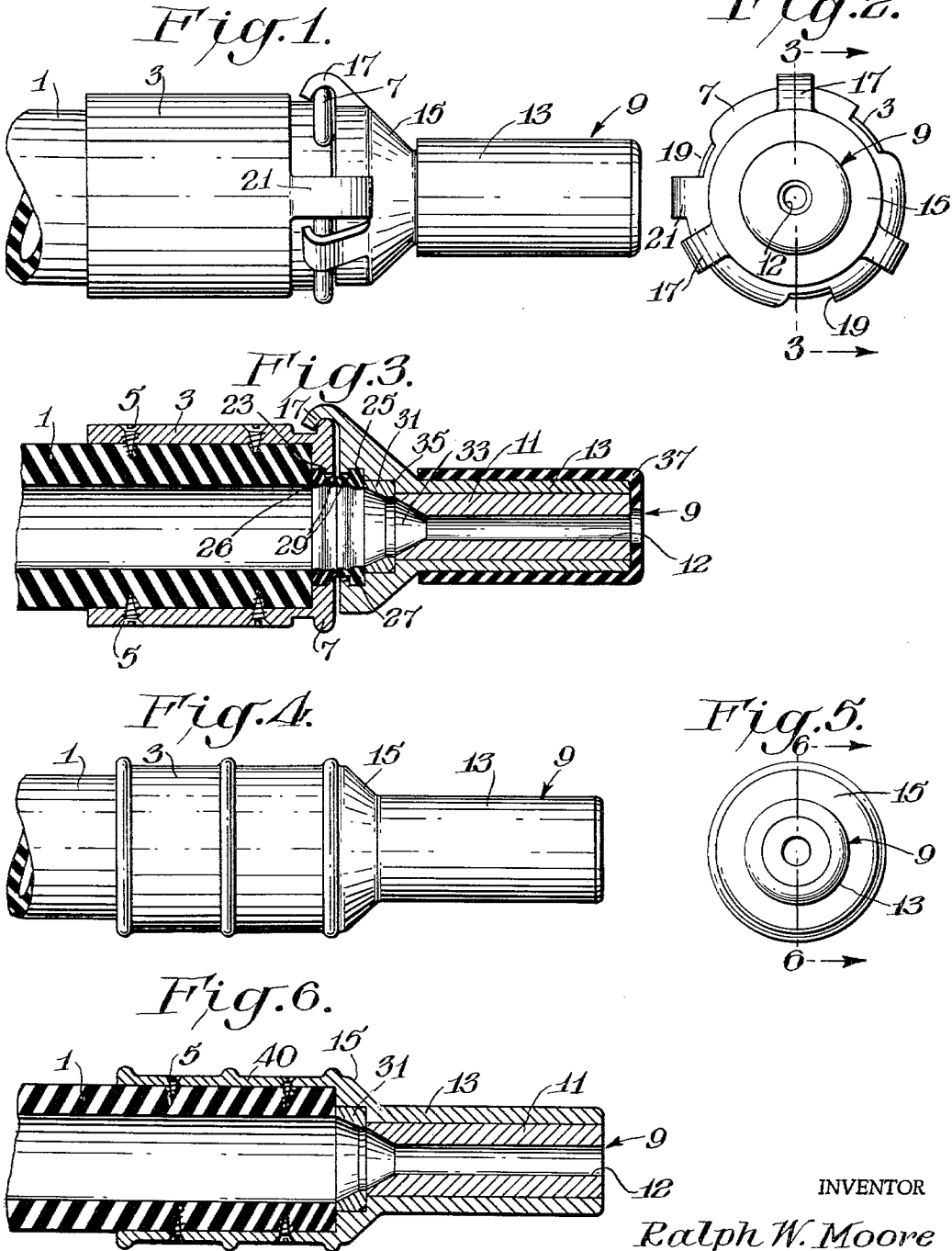
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NOZZLE ASSEMBLY FOR ABRASIVE BLASTING APPARATUS

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2 Sheets-Sheet 1



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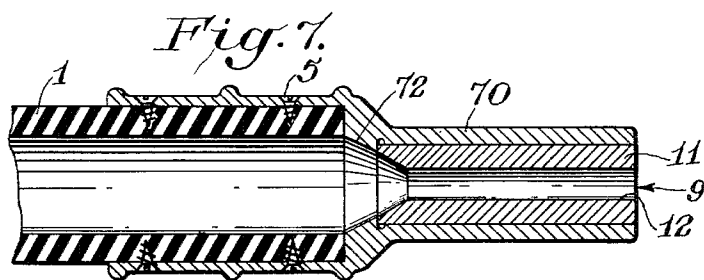
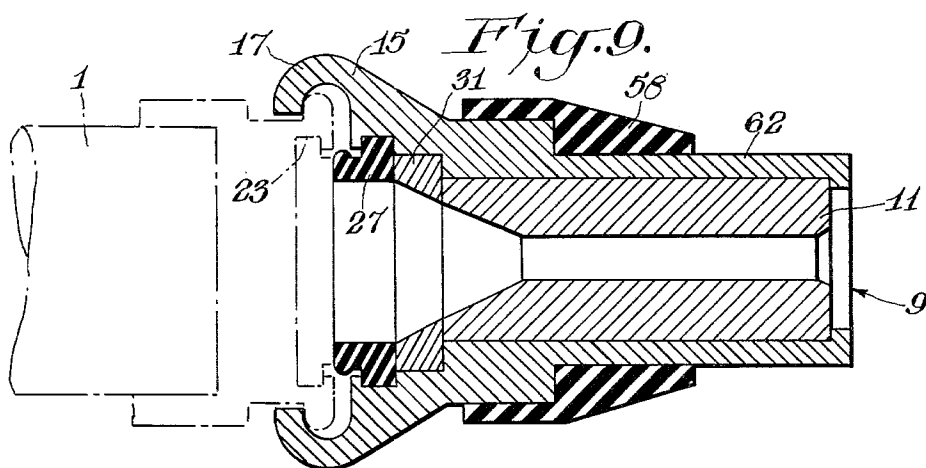
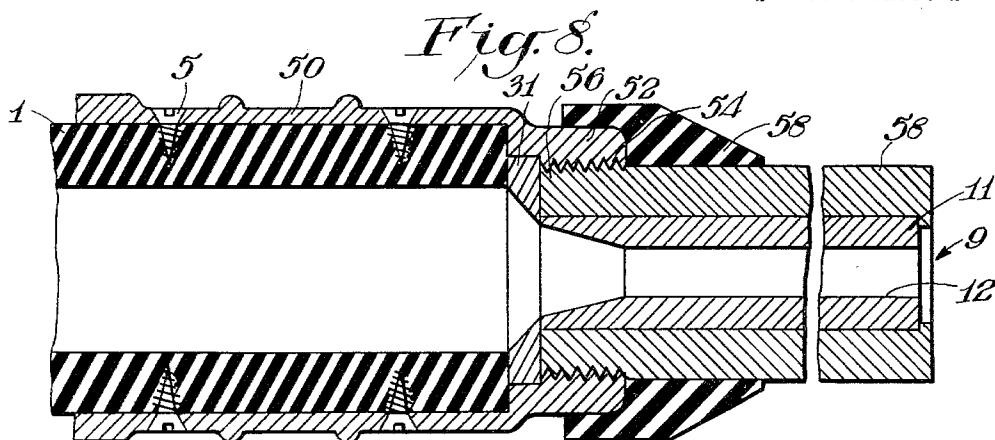
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NOZZLE ASSEMBLY FOR ABRASIVE BLASTING APPARATUS

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2 Sheets-Sheet 2



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NOZZLE ASSEMBLY FOR ABRASIVE
BLASTING APPARATUS

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8 Claims. (Cl. 51—11)

The present invention relates to a nozzle assembly for
ues in abrasive blasting apparatus. More particularly,
it relates to a direct pressure blast nozzle assembly for
use in hose-type blasting equipment.

Direct pressure blast nozzles for propelling abrasive
against a work surface have been known for some time.
Such apparatus includes a blast nozzle having a nozzle
liner, a hose attached thereto through which the abrasive
media is passed to the nozzle from a supply source, and
means for feeding the abrasive media from the supply
source to the hose and therethrough with sufficient accel-
eration so that the emitted abrasive passing from the
nozzle will impinge upon the work surface with great
force to blast-clean or otherwise treat the work surface.

One problem which has never been satisfactorily solved
relates to the feature that the nozzle and its elements,
which usually include rubber gaskets and soft metal por-
tions, cannot withstand the terrific erosive or wearing
force applied thereagainst by the abrasive passing through
the nozzle. The rubber gasket is used to protect the feed
end of the nozzle liner which is of smaller inside diameter
than the hose. In view of this abrasive force, the nozzle
elements soon deteriorate because of the wearing or
abrading action of the abrasive against the internal makeup
of the nozzle.

Long wearing blast nozzle liners have been developed
which are formed of tungsten carbide, alumina, ceramics
and other like material which satisfactorily resist the
abrading action of the accelerated abrasive media passing
through the nozzle. Particularly satisfactory in this
respect are liners which are formed of boron carbide
material. However, the basic problem mentioned above
is still not solved by the use of these long wearing blast
nozzles, because there still exists the problem of connect-
ing the liner to the hose in such a manner so that the
abrading action of the abrasive will not damage the
connection means.

One rather obvious solution to this problem would be
to make the outside diameter of the nozzle liner equal
to the inside diameter of the hose. The nozzle liner could
then be inserted into the hose and attached with hose
clamps. The disadvantages with such an arrangement
relate to the frequent breakage of the fragile liner before
installation and during use, and, plus the fact, that extreme
difficulty is encountered in attaching the liner securely
enough to keep it from blowing off the end of the hose
in view of the tremendous force and pressure developed
by the propelled abrasive within the hose and nozzle.

Another solution to this problem would be to make the
outside diameter of the nozzle liner sufficiently large to
make the normal conical shape inlet end of the bore of
the nozzle extend to a diameter equal to the inside
diameter of the hose. However, blast nozzles can be
efficiently used only to a point where their bore size
increases not more than 50%. In addition, unduly thick
walls would be required for the nozzle and this would
render the whole scheme impractical from a commercial
standpoint because of the additional expensive material
involved in building up the walls of the nozzle.

Other types of direct pressure blast nozzles have been
developed and are used. These nozzles include a threaded
engagement between the nozzle and a hose connection
piece which supports the hose. Still other types include

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certain bayonet type connections between the nozzle
and hose. However, in these nozzles and in other type
blast nozzles, a major disadvantage exists in that rubber
gaskets must be used between the nozzle liners and the
wider inside diameter hose. These gaskets are, of course,
subject to wear by the accelerated abrasive passing
through the hose and nozzle, and operating instructions
for some of these nozzles require that these gaskets
be replaced after every 10 to 20 hours of use.

It is, therefore, one object of the present invention
to provide a new and novel direct pressure blast nozzle
wherein all surfaces and areas of the nozzle and hose
connection generally subjected to the abrading and erosive
action of the accelerated abrasive media are formed of
long-wearing and erosive-resistant material which long-
wearing elements cooperate in a novel manner to provide
a complete and direct pressure blast nozzle which has a
long life in use and need not have certain elements
thereof replaced frequently during use.

Still another object of the invention is to provide a new
and novel direct pressure blast nozzle wherein a long-
wearing and erosive-resistant transition piece replaces the
heretofore widely used rubber gasket required for the
joining of the nozzle liner with the hose or hose connec-
tion.

Other objects and advantages of the invention will
become more apparent from a study of the following
description and drawing wherein:

FIGURE 1 is a side view partially in section of one
form of nozzle of the present invention;

FIGURE 2 is an end view of the nozzle in FIGURE 1;

FIGURE 3 is a longitudinal section taken along line
3—3 of FIGURE 2;

FIGURE 4 is a side view partially in section of another
form of nozzle according to the present invention;

FIGURE 5 is an end view of the nozzle of FIGURE 4;

FIGURE 6 is a longitudinal section taken along line
6—6 of FIGURE 5;

FIGURE 7 is a longitudinal section of still another
form of nozzle;

FIGURE 8 is a longitudinal section of another form
of nozzle of the present invention; and

FIGURE 9 is a longitudinal section of still another
form of nozzle which can be used in accordance with the
present invention.

Referring now to FIGURES 1—3 of the drawing which
show one form of blast nozzle which can be satisfactorily
used in accordance with the present invention, there is
shown a hose piece 1 inserted into a hose connection piece
3 which is secured to the hose by wood screws 5 in the
manner shown in FIGURE 3. At the free end of the
hose, the hose connection piece 3 has a peripheral flange
7 which is used to secure the hose 1 and the hose con-
nection piece 3 to the actual nozzle 9 as will be explained.
The nozzle 9 includes a liner 11 which contains an axial
opening or channel 12 through which the abrasive passes.
This liner is made of a long-wearing material, such as
tungsten carbide, alumina, ceramics and especially boron
carbide. Such liners are extremely resistant to any ero-
sive or wearing action produced by the abrasive being
propelled therethrough.

Surrounding the long-wearing liner 11 is an outer liner
13 which can be formed of ductile iron, for instance.
The hose connection end of this outer liner or cover 13
expands outwardly to correspond to the diameter of the
flange 7 on the hose connection piece. This expanded
outer portion is shown at 15 in FIGURE 1 of the drawing.

At spaced locations around the periphery of the
expanded portion 15 of the liner 13, there are provided
a plurality of ears 17 which fit over the flange 7 of the
hose connection piece 3 to provide a tight bayonet-type
locking fit between the hose connection piece 3 and the

nozzle 9. As shown better in FIGURE 2, the ears 17 are passed through indents 19 in the flange 7 and then rotated to the right looking at FIGURE 2. The sections of the flange 7 taper or expand as they extend to the right and the ears are jammed up tight thereagainst during the rotation. A stop member 21 is provided to assure that rotation of the ears will only occur in clockwise direction when looking at FIGURE 2.

As shown in FIGURE 3, inner grooves or seats 23 and 25 are provided in each of the expanded portions 15 of the outer liner 13 and in the flanged portion 7. Supported in these grooves are rubber gaskets or sealing rings 26 and 27. The gaskets have flanges which mate when compressed together as shown at 29. As shown in FIGURE 3, these rings are not subject to any direct abrading action by the abrasives since the inner diameters thereof are flush with the inner diameter or inner surface of the hose 1.

A transition piece 31 is shown which bridges the inside diameters of the hose and rubber gaskets 26 and 27 with the inside diameter of the conical shaped entrance 33 of the axial channel 12 in liner 11. A shoulder or seat 35 formed in the expanded portion 15 of the outer liner 13 supports the transition piece 31 in place. As seen in FIGURE 3, the inner surface of the transition piece tapers as it extends towards the gaskets 26 and 27 and the exit end of the hose. With this arrangement, the transition piece 31 protects the outer liner 13 from abrasion and wear and also provides a smooth flow of the abrasive from the hose to the nozzle along this troublesome area.

The transition piece 31 is of extremely hard metal and has extremely long-wearing properties. Its composition is as follows:

Carbon	3.15 to 3.35
Manganese	.60 to .90
Silicon	.40 to .60
Chrome	16.00 to 18.00
Molybdenum	3.00 to 3.50
Phosphorus	.05 max.

Of course, other metals having the same degree of hardness and resistance to abrasive media as that just described may also or can also be used. If desired, a rubber sheath 37 can be slipped over the outer liner 13 to protect the liner and nozzle from damage by contact with other objects.

FIGURES 4-6 show still another embodiment of a nozzle assembly for the present invention. The nozzle 9 is somewhat similar to that described in connection with FIGURES 1-3 except that the expanded portion 15 does not terminate in ears 17 but continues on to form an extension portion 40; also, no rubber gaskets are required. Here, the end of the hose 1 is inserted in the extension 40 and secured thereto by wood screws 5 in the manner described with respect to FIGURES 1-3.

The transition piece 31 is formed of the same material as has been defined with respect to FIGURES 1-3 and serves the same purpose.

As seen in the drawing, the end of the hose 1 abuts the end of the transition piece 31 in such a manner that the inner surfaces of both members are substantially flush with each other. With such an arrangement, it is again seen that there are no soft rubber or metal surfaces which would be subject to abrading action of abrasive passing through.

The embodiment shown in FIGURE 7 is similar to that shown in FIGURES 4-6, except that here the separate transition piece 31 is omitted and the whole outer shell 70 is formed of this special hard metal as defined in detail above. The gap between the inside diameter of the hose and that of the conical opening in the inner liner 11 is bridged by an inwardly projecting and tapering wall portion 72 of the shell 70 lying between the hose end and the conical shaped entrance in the inner

liner 11. Again, this is the only area which is more or less directly subjected to the abrading action of the abrasive being accelerated through the hose and nozzle assembly. Here it should be pointed out that the shell 70 formed of an extremely hard material, as previously defined in detail, is heat treated and air quenched to achieve maximum hardness.

Still another nozzle is shown in FIGURE 8. Here, a threaded type engagement is effected between the nozzle 9 and the hose 1. In this embodiment, a steel jacket section 50 is placed around the end of the hose and again is secured thereto by wood screws 5 in the manner indicated above. At the hose end, the jacket extends therebeyond to form extension 52. The inner surface of this extension 52 is threaded as at 54 to receive a complementary threaded section 56 formed on the outer surface or periphery of this outer liner 58 which surrounds the inner liner 11 which has an axial opening or channel 12 running therethrough to form the nozzle 9. The threaded section 56 of the nozzle is rotated into threaded engagement with the threaded section 54 of the extension 52 of the steel jacket 50. After this engagement has been effected a rubber protector 58 is slipped over the end of the nozzle to cover the extension 52 of the jacket 50 as well as a good portion of the outer liner 58 of the nozzle 9.

Here, again the transition piece 31 is formed of the extremely hard material defined heretofore and bridges the gap between the hose inner diameter and the inner diameter of the conical entrance of axial channel 12 in the nozzle 9. Here, the only surface which will be subjected to the abrading action of the accelerated abrasive media passing through the hose and the nozzle will be inner tapering surface of the transition piece 31. However, this will have no or little effect upon the transition piece whereby a long life is given to the entire nozzle-hose assembly.

Again, the inner liner 11 can be formed of the same material as that defined for the inner liners of the embodiments described above. The outer liner 58 can also be formed of ductile iron as already shown with the above-described embodiments.

The nozzle arrangement shown in FIGURE 9 is substantially similar to that shown in FIGURES 1-3 except for the rubber protector 37 which in the case of the FIGURE 9 arrangement is similar to that shown in FIGURE 8.

Also in the FIGURE 9 embodiment, the outer liner 62 has an inwardly extending end lip similar to the lip of liner 58 shown in FIGURE 8 which fits over the outer end of the inner liner. Here, the nozzle liner 11 and the transition piece 31 are inserted in the cast outer liner 62. Again, none of these surfaces, including the gasket, are subjected to unusual abrasive action by the abrasive passing therethrough since they are all substantially flush with the surface of the hose. Only the tapering inner surface of the transition piece formed of extremely hard material as defined above is subjected to any abrasive action and since this surface is extremely resistant to abrasive action, it has little or no wearing influence thereupon.

Other materials which will resist the abrading action of the fast moving abrasive are polyurethane, hardened tool steel and hardened alloy cast iron. Also, as mentioned before, other metals having the degree of hardness of these described can also be used for the transition piece.

Actually the transition piece of the present invention can be used with any combination of nozzle shape or configuration including a converging-diverging (Venturi) bore. Also different types of jacketing with or without screw threads and with or without bayonet attachments can be used.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that with-

in the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A direct pressure blast nozzle assembly comprising a nozzle, a flexible conduit for supplying abrasive media to said nozzle, said flexible conduit having a larger inside diameter than the inside diameter of the nozzle, means for connecting the flexible conduit with the nozzle, a wear resistant transition section in said blast nozzle assembly, the inner surface of which tapers to bridge the inside diameters of the flexible conduit and the nozzle, and the transition section being an inwardly projecting and tapering wall of an outer liner for the nozzle which extends between and which lies flush with the inside diameters of the flexible conduit and the nozzle.

2. A direct pressure pressure nozzle assembly comprising a nozzle, a flexible conduit having a larger inside diameter than that of the nozzle, a nozzle connection piece, said flexible conduit being inserted in said nozzle connection piece, means for securing the connection piece to said flexible conduit, said nozzle being connected to said connection piece, and a separate transition piece supported in said nozzle adjacent the opening thereof which bridges the large inside diameter of the flexible conduit with the smaller inside diameter of the nozzle, said transition piece being formed of a wear resistant metal which resists abrading action of the abrasive passing through the conduit and nozzle.

3. The nozzle assembly according to claim 2 wherein rubber sealing gaskets are supported at the mating ends of the conduit connection means and the nozzle, said gaskets being compressed together when the nozzle is affixed to the conduit connection means, the inner diameter of said gaskets being flush with the inside diameter of the flexible conduit.

4. The nozzle assembly according to claim 2 wherein the nozzle consists of an inner liner having a channel extending therethrough, an outer liner surrounding the inner liner, and a rubber protecting cover surrounding the outer liner.

5. The nozzle assembly according to claim 4 wherein the outer liner expands at its mating end with the flexible conduit connecting means, and connecting ears extend from the expanded area and lock on the flexible conduit

connecting means in a rotating type of lock connection.

6. A direct pressure blast nozzle assembly comprising a flexible conduit, nozzle connecting means surrounding the flexible conduit, an extension of the connecting means extending beyond the end of the flexible conduit, the inside diameter of the extension being threaded, a highly wear resistant transition piece supported in an unthreaded portion of the extension piece to lie immediately adjacent the end of the flexible conduit, a nozzle having a smaller inside diameter than that of the flexible conduit, threads on the area on the outer periphery of said nozzle which is threaded into the complementary threaded portion of the nozzle connection of the flexible conduit to lie flush against the opposite side of the transition piece, and an outer rubber protector fitting over the threaded connection between the nozzle and the nozzle connecting means, said transition piece bridging the larger inside diameter of the flexible conduit with the smaller inside diameter of the nozzle.

7. The nozzle assembly according to claim 6 wherein the nozzle consists of an inner liner, an outer liner surrounding the inner liner, and an inwardly extending edge at the outer end of the outer liner which fits over the ends of the inner liner.

8. A direct pressure blast nozzle assembly comprising a nozzle, a flexible conduit for supplying abrasive media to said nozzle, said flexible conduit having a larger inside diameter than the inside diameter of the nozzle, means for connecting the flexible conduit with the nozzle, a wear resistant transition section in said blast nozzle assembly, the inner surface of which tapers to bridge the inside diameters of the flexible conduit and the nozzle, and said transition section being metal.

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