Nov. 16, 1954 F. R. GRIFFIN 2,694,603

CLEANABLE SPIRAL SPRAY NOZZLE WITH REMOVABLE INSERT AND TOOL THEREFOR

Filed May 4, 1953

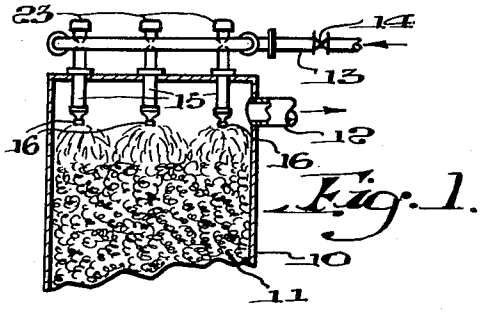


Fig. 1.

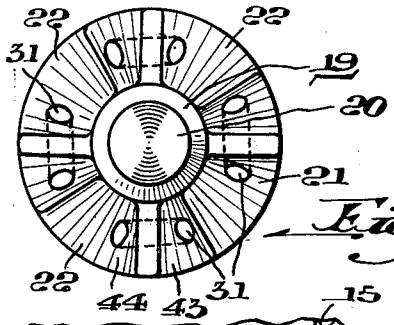


Fig. 2.

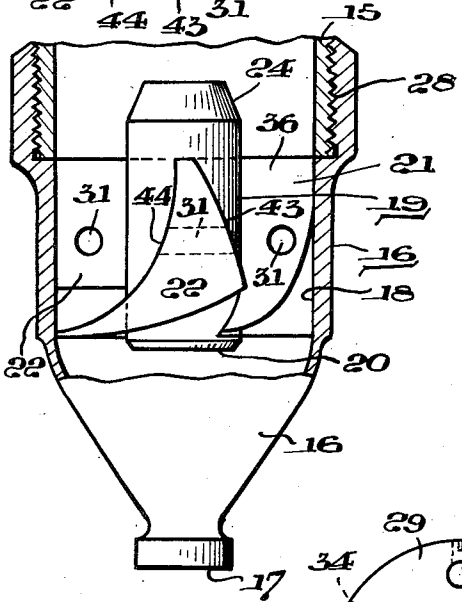


Fig. 3.

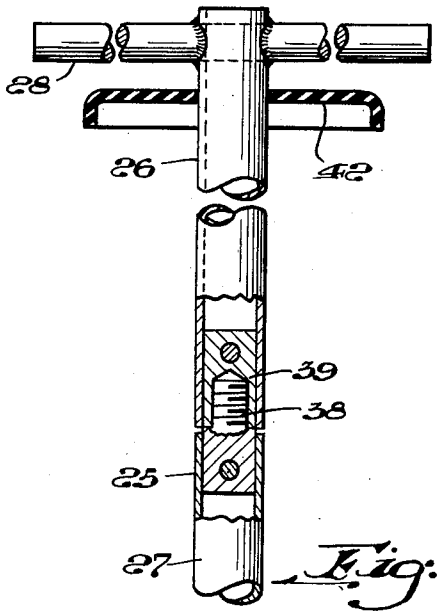
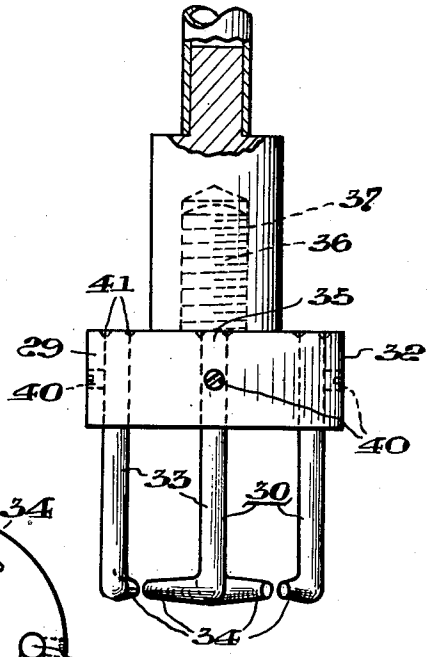


Fig. 4.



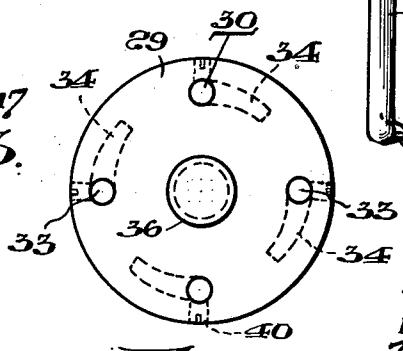


Fig. 5.

INVENTOR.
FRANCIS R. GRIFFIN.
BY
Thomas J. P. O'Brien
his
ATTORNEY.

United States Patent Office 2,694,603 Patented Nov. 16, 1954

2,694,603

CLEANABLE SPIRAL SPRAY NOZZLE WITH REMOVABLE INSERT AND TOOL THEREFOR

Francis R. Griffin, Pittsburgh, Pa., assignor to Koppers Company, Inc., a corporation of Delaware

Application May 4, 1953, Serial No. 352,705

11 Claims. (Cl. 299—120)

This invention relates to improvements in a cleanable spray nozzle with removable spiral insert, having a handle for insertion and withdrawal of the inserts from the nozzles through their attached spray pipes, without the necessity of dismantling the pipes and nozzles through which the liquid to be sprayed is fed and is discharged in the form of a whirling spray by the action of the inserts.

A great deal of difficulty has been encountered in the past in cleaning this type of nozzle. These nozzles, customarily are installed at the end of spray pipes located inaccessibly inside cooling towers, scrubbers, etc., and it is necessary to remove the spiral inserts from the nozzles and piping in order to clean the inserts and to permit rodding out of the spray discharge orifices at the bottom of the spray nozzles.

Formerly the nozzles were made detachable from the liquid supply piping for the nozzles, to permit removal of the nozzles and inserts for purposes of cleaning the same.

This necessitated shutting down the operation of the cooling towers and scrubbers, and purging the same of gas, to permit access of operating personnel to the inserts by detaching the nozzles from the piping inside the scrubbers or towers.

More recently these nozzles were redesigned to permit withdrawal of the inserts through their piping, through access orifices in the piping that are accessible from the exterior of the piping and the gas space containing the nozzles. With such design, the upper portion of the nozzles within which the inserts are seated are made of substantially the same diameter as the piping to permit withdrawal of the inserts through the piping without dismantling the nozzles from the piping. The nozzle inserts have their outermost diameter the same as the inner diameter of the nozzle, so that the insert, formed of vanes spirally directed, cannot be by-passed around the vanes by the liquid discharging through the pipes and nozzles.

With this design, however, to provide for removal of the insert for cleanng of the nozzle, a wire provided with a hook at its top end has been brazed on the spiral inserts, to permit engagement of the hook end with a hooked tool for withdrawing the inserts.

This system has not worked satisfactorily. The wires become bent and pull the spiral insert at an angle, making it difficult to remove. Eventually the wires corrode or break off, requiring shutting down of the operation of the scrubbers or coolers and dismantling of the nozzles to clean them and to replace the inserts.

The present invention provides a simple means by which these inserts may be removed and replaced, and the nozzles cleaned periodically, without dismantling the apparatus or interrupting the operation and service of the scrubbers and coolers requiring the same.

The invention provides for the purpose an arrangement including a removable tool forming a detachable stem for the spiral inserts, which may readily and easily engage and disengage the inserts by manipulation from outside the gas space, and which is of simple construction, durable and inexpensive to manufacture, and has advantages over and eliminates disadvantages of like prior art arrangements and devices for this purpose.

In general, the invention comprises a spray pipe having a nozzle with a removable spray insert therefor having circumferentially arranged spirally directed spaced apart vanes of the same diameter as the nozzle, which

insert is withdrawable through the piping leading to the nozzle from an exterior fitting accessible from the exterior of a scrubbing chamber within which the nozzle is located to spray liquid therein.

The insert is provided with a stem extending from the insert, when seated in the nozzle, outwardly to the exterior fitting and having a handle portion for manipulating the stem by rotation of the same inside the piping to which the nozzle forms the terminal end.

Advantageously the stem is in the form of extensible sections to fit different lengths of pipes and is provided with means for detachably connecting the stem with the insert in removing and replacing the nozzle inserts through the piping in unseating and reseating the inserts in the nozzles for their cleaning, repair, and replacement.

For ease and facility in attaching and detaching the stem to the insert, the stem is provided with an engaging head for engagement with the top of the insert, said head having an outermost diameter substantially the same as the outermost diameter of the insert, for axial coaction with the insert in guiding the engaging head into axial alignment with the insert. For effecting the detachable connection, the head and the insert are provided with complemental means in the same spaced relation around the axis of the stem and insert for their automatic interconnection on rotation of the stem.

Advantageously such complemental means comprises a plurality of hooks on the engaging head each comprising a shank and a tapered terminal end extending laterally of the shank. The shanks are all equally spaced radially from, and circumferentially around, the axis of the stem and head and they all extend an equal distance longitudinally lengthwise of the axis of the stem, with their terminal ends all arcuate and extending in the same direction in equal spaced relation circumferentially of the axis of the head, for insertion in complemental engaging parts in the form of arcuate passages in the vanes on the insert.

The complemental arcuate passages on the inserts are all disposed in equally spaced relation around the axis of the insert in correspondence with the spacing and arrangement of the hooks on the stem, that is, they are radially, circumferentially, disposed around, and longitudinally disposed along, the axis of the insert, distances equal to the spacing of the hooks around the axis of the stem.

This provides a removable tool for removing the inserts in the form of a handle having sectional stem parts and an engaging head of the same diameter as the insert with cooperating complementary detachable male and female parts between the tool and the insert.

Other objects and advantages of the invention will be apparent from the following description which when taken in connection with the accompanying drawings, illustrates the preferred embodiment of the invention.

In said drawings,

Figure 1 is a vertical cross-sectional view of a part of a scrubber or cooler embodying the invention;

Figure 2 is a top plan view of the nozzle insert showing the arrangement and location of the hook recesses or engaging elements around the axis of the insert;

Figure 3 is a vertical cross-sectional view of the lower discharge end of a spray pipe with the nozzle attached and insert in place for spraying;

Figure 4 is an elevational view partly in vertical cross-section illustrating the removable stem for the insert shown in Figs. 2 and 3, in the form of a tool having a detachable engaging head for removable attachment to the insert; and

Figure 5 is a top plan view of the removable engaging head illustrating the arrangement and location of the hooks around the axis of the tool or stem.

Referring to the drawings, there is shown in Fig. 1, the upper portion of a tower **10** having a packing **11** and an outlet **12** for passage of gas, such as coke oven gas, therethrough for intimacy of contact of the gas with a liquid discharged over the packing in the form of a fine spray by means of pipe line **13** having a valve **14** for control of the rate of flow of liquid into the scrubber tower **10**. The liquid which is usually pumped, but may be otherwise fed, through the line **13**, is discharged into the

tower by branch conduits 15 extending inside the tower and terminating in atomizing nozzles 16.

Each nozzle 16 preferably comprises a lower discharge outlet 17 and an upper spiral insert seating chamber portion 18 for supporting a removable spiral insert 19 at a spaced distance above the lower outlet 17.

Each insert 19 comprises a central orifice or jet passage 20 in axial alignment with the outlet 17, and a stationary turbine portion 21 in the form of circumferentially space spiral vanes 22 arranged around the axis of the central orifice 20, coaxial therewith and with the axis of the lower outlet 17.

The nozzles 16 are usually arranged in groups over the packing 11, and function to produce a uniform, dense, flaring bouquet of spray.

The nozzles 16 conventionally are in groups transversely of the tower 10 in the form of a bank of nozzles so positioned inside the tower that they discharge into the gas space above the packing 11 to form a fine mist or spray covering the complete top surface of the packing. The liquid then settles through the packing 11.

In operation it becomes necessary to clean out the nozzles 16 at periodic intervals where these nozzles are inaccessibly installed at the end of pipes 15 located inside cooling towers, scrubbers and the like, 10 as shown in Fig. 1, and to do this it is necessary to remove the spiral inserts 19 in order to clean the same and to permit rodding out of the lower outlet orifice 17 at the bottom of the spray branches 15.

As shown in Figs. 2 and 3, these tapered nozzles 16 customarily have the vane portions 22 of their inserts 19 of the same outermost diameter as the upper portion of the interior of the nozzles, and as shown the nozzles 16 are provided with internal screw thread 28 or bolted flanges, for detachably connecting the nozzles to the ends of branch pipes 15. The branches 15 are also provided at their upper ends exterior to the gas space of the scrubber 10 with removable caps 23 for external access to the insides of the branch pipes 15.

As shown the portion 24 of the inserts 19 containing the axial passage 20 extends above and below the surrounding vanes 22, but this is not essential in all cases.

In accordance with the present invention these spray pipes 15 are also provided with a removable stem 25 for the inserts 19, for ease in inserting and removing the spray inserts 19 for the nozzles 16 through the branch pipe 15 by manipulation through orifices covered by the removable caps 23 exteriorly of the gas space containing the nozzles 16.

Advantageously as shown in Figs. 4 and 5, this removable stem 25 for the spray inserts 19 is in the form of a tool comprising a handle 26 and a handle extension 27 insertable through the branch pipes 15, and which may be manipulated from the exterior of the gas chamber, the handle being in a form that will not pass through the branch pipes upon insertion of the extension 27 into the branch pipes 15 after removal of the caps 23.

The handle comprises a cross bar 28 and the extension 26, is made in a plurality, preferably two, sections like section 27, to accommodate the total length required to reach the insert 19 from the region of the removable cap 23.

The extension 27 is provided with a spiral insert engaging head 29 equipped with means for detachably securing the insert to the stem, the means being such as to coact with corresponding means on the stem for securing the inserts 19 to the stem in seating and unseating the inserts 19 in the nozzles 16 through the branch conduits 15 upon insertion and removal of the inserts 19 through the ends of the branches 15 where they are closed by the removable caps 23.

In the preferred form of the invention, such cooperating means is in the form of hooks 30 on the engaging head 29 and drilled parts 31 of the spiral inserts 19, which drilled parts are engaged by the hooks 30.

The outer diameter 32 of the engaging head 29 is of such dimension that it serves as a guide to insure alignment of the hooks 30 with the drilled recesses or passages 31 in the spiral inserts 19. To this end the outermost diameter 32 of the engaging head 29 is substantially the same as the outermost diameter of the spiral inserts 19 and hence the internal diameter of its seating portion 18 in the nozzles 16.

The hooks 30 are tapered to assist in locating and locking the head 29 in the inserts 19.

Advantageously the hooks 30 are in the form of straight line shanks 33 terminating in transverse tapered ends 34. The shanks 33 are equally spaced from each other around the axis 35 of the head 29, between the axis 35 and the outer circumference 32 of the head. The shanks 33 extend parallel to the axis 35 of the head 29 a distance to project into the spaces 36 between the vanes 22 on the insert to a distance intermediate the upper and lower limits of the vanes 22. The shanks 33 are of equal length and their transverse tapered ends 34 all project in the same direction as each other and are likewise of equal length. Preferably the length of the tapered transverse ends 34 is about the same as the width of the distance between each two of the adjacent vanes 22.

The drilled parts or recesses 31 on the spiral insert 19 are located in their respective vanes 22 at a distance radially from the central axis 20 of the insert substantially the same as the radial distance of the shanks 33 of the hooks 30 from the central axis 35 of the engaging head 29.

The parts 31 are a slightly less distance down from the top of the insert 19 than the length of the shanks on the engaging head, and preferably recesses 31 are of straight form, and extend clear through the vanes 22 for self cleaning of the recesses. The back faces 43 of the vanes 22 are tapered upwardly in the direction of the front faces 44, so that the ends 34 of the hook ride up the back face 43 a slight amount on rotation of the stem, to enter the recesses, and the force of rotation of the stem exerts a slight lifting of the stem, and as the arcuate ends 34 progress further into the straight recess this causes a self locking of the arcuate ends 34 with the recessed portions of the insert, and an initial breaking of the seat of the insert with respect to the nozzle.

The engaging heads 29 for the inserts are provided with a screw threaded bolt 36 for removable engagement with a correspondingly screw threaded socket 37 on the stem 25.

In practice it is not necessary to have a separate stem 25 for each insert or branch conduit 15. Rather, customarily a plant is provided a tool kit designed to service an installation of various size spray nozzles 16 and various length riser pipes 15. Such tool kit has, according to this invention, separate engaging heads 29 suitable for handling each different size nozzle insert 19, a handle with a cross bar 28 for manipulating the engaging head, and a set of handle extensions 27 of various lengths with male and female connections 38, 39 common to each other and to all sizes of engaging heads and to the handle. This provides a combination of various lengths and sizes of tools.

As shown the hook shanks 33 are held in the body of the engaging head by means of set screws 40 for ease of replacement in the event the hooks become bent out of alignment, or the shanks are welded in place as at 41.

As shown, the handle 26 is equipped with a rubber cap 42 to seal off the branch pipes 15 to prevent escape of gas from the riser or branch pipes while the stem 25 for the inserts is being used inside the branches 15 in removing or replacing the inserts 19.

In operation, however, the use of such cap 42 is not absolutely essential, since in practice, in removing and replacing the insert 19, this may be done without shutting down the gas flow through the scrubber 10, and without leakage of gas out through the riser pipe 15 access orifice, while manipulating the handle 26 and stem 25 in the riser or branch conduits, in the following known manner.

The caps 23 are loosened but not fully unscrewed and the valve 14 opened gradually until the liquid overflows lightly out through the loosened cap 23. With the valve 14 so set, the cap 23 can be then removed without an outpouring of gas, since the continued flooding of the risers 15 by the line 13 creates an hydraulic head greater than the gas pressure in the scrubber.

The tool then is inserted with the engaging head 29 thereon through the access orifice until the head or hooks 30 engage the top of the spray insert in the nozzle 16. Slight rotation of the handle 28 turns the hooks 30 until they enter the spaces between the vanes 22 and the body of the head 29 engages the top of the spiral insert 19, whereupon mere further rotation of the handle 28 outside the top of riser pipe 15 engages the tapered hook members 34 inside the engaging recesses or passages 31. The tool is then withdrawn, and a rod inserted to rod out the opening 17. To reinsert a spiral insert, the latter 19 is rotated on the hooks 30 and the tool reinserted in the riser conduit 15 until the insert 19 seats in the nozzle

16. The tool handle 28 is then rotated counter clockwise to disengage the hooks 34 from the slots or passages 31, and then the tool 25 withdrawn from conduit 15, the cap 23 re-secured and valve 14 readjusted.

Instead of controlling the gas outflow as above described by manipulation of valve 14 and caps 23 the outflow of gas can be prevented while manipulating the tool 25 by first inserting the head 29 and then sliding the rubber cap 42 over the access orifice and then further advancing the tool through the conduit 15 and through the rubber cap 42 while the rubber cap is held in sealing relation over the access orifice of the conduit 15.

Instead of having a separate stem 25 individual to each conduit 15 and nozzle insert 19 therefor, a single stem 25 is contemplated for use in common with the inserts for several or many of the branch conduits 15.

The invention as hereinabove set forth is embodied in a particular form and manner but may be variously embodied within the scope of the following claims.

I claim:

1. A cleanable liquid spray apparatus comprising: a gas chamber; a liquid spray pipe extending into the gas chamber from the exterior of the chamber and having a capped access orifice exteriorly of the chamber and a discharge nozzle with a removable spray insert therefor interiorly of the gas chamber, said insert having circumferentially arranged spirally directed spaced apart vanes of the same diameter as the nozzle and being withdrawable through the pipe and by way of the exterior access orifice therefor, a stem for said insert extensible through the pipe from said access orifice to the insert when seated in said nozzle, said stem being in detachable sections and having a handle exterior to the access orifice, said stem being removable from said pipe and detachable from the insert; and means for detachably connecting the stem with the insert when they are inside said pipe and nozzle for removing and replacing the nozzle insert through the pipe in unseating and reseating the insert in the nozzle, for their cleaning, repair and replacement, said means comprising an engagement head on said stem for engagement with said insert and axially alignable with the axis of the insert for their axial coaction when the stem is advanced along the pipe from the access orifice to the insert in the nozzle; a plurality of hooks on the engaging head each comprising a shank and a terminal lateral end, said shanks all being spaced radially from, and circumferentially around, the axis of the head, and all extending a distance longitudinally lengthwise of the axis of the head, and said terminal lateral ends all extending in the same direction and likewise being spaced from each other circumferentially around the same axis as the head for insertion and removal from passages therefor in the insert; and a plurality of circumferential disposed passages in said insert all arranged in spaced relation around the axis of the insert at distances radially out from the axis of the insert, and longitudinally along the same from the top of the insert substantially in correspondence with the radial and longitudinal spacing of the hooks on the engaging head, for automatic attachment and detachment of the head and insert on rotation of the stem by the handle at the exterior access orifice to the pipe.

2. Apparatus as claimed in claim 1, and in which the engaging head has an outermost diameter substantially the same as the outermost diameter of the insert, for guiding the alignment of the head into axial alignment with the axis of the insert.

3. Apparatus as claimed in claim 1, and in which the terminal ends of the hooks and their corresponding passages in the insert are arcuate and of tapered cross-section.

4. Apparatus as claimed in claim 1, and in which the vanes have curved front and back faces, and the back faces incline upwardly toward the front faces, and in which the hooks are equally spaced radially from and circumferentially around, and are of slightly greater length along, the axis of the engaging head and the passages in the insert are spaced at distances radially from and longitudinally along the axis of the insert to correspond equally with the radial and slightly less longitudinal positions of the hooks, for self locking of the hooks in the passages.

5. A cleanable liquid spray apparatus comprising, a removable insert for a spray nozzle having circumferentially arranged spirally directed spaced apart vanes, a

stem for said insert extensible through a pipe from an exterior access orifice thereto to the insert when seated in a nozzle on said pipe, said stem having a handle for manipulation at the access orifice to the pipe and being removable through the orifice and its pipe and detachable from the insert, and means for detachably connecting the stem with the insert when they are inside said pipe and nozzle for removing and replacing the nozzle insert through the pipe in unseating and reseating the insert in the nozzle, for their cleaning, repair, and replacement said means comprising an engagement head on said stem for engagement with said insert and axially alignable with the axis of the insert for their axial coaction when the stem is advanced along the pipe from the access orifice of the insert in the nozzle, a plurality of hooks on the engaging head each comprising a shank and a terminal lateral end, said shanks all being spaced radially from, and circumferentially around, the axis of the head, and all extending a distance longitudinally lengthwise of the axis of the head, and said terminal lateral ends all extending in the same direction and likewise being spaced from each other circumferentially around the same axis as the head for insertion and removal from passages therefor in the insert, and a plurality of circumferential passages in said insert all arranged in spaced relation around the axis of the insert at distances radially out from the axis of the insert, and longitudinally along the same from the top of the insert in correspondence with the radial and longitudinal spacing of the hooks on the engaging head, for automatic attachment and detachment of the head and insert on rotation of the stem by the handle at the exterior access orifice to the pipe.

6. Apparatus as claimed in claim 5, and in which the engaging head has an outermost diameter substantially the same as the outermost diameter of the insert, for guiding the alignment of the head into axial alignment with the axis of the insert.

7. Apparatus as claimed in claim 5, and in which the terminal ends of the hooks and their corresponding passages in the insert are arcuate and of tapered cross-section.

8. Apparatus as claimed in claim 5, and in which the hooks are equally spaced radially from and circumferentially around, and are of equal length along, the axis of the engaging head and the passages in the insert are spaced at distances radially from and longitudinally along the axis of the insert to correspond equally with the radial and longitudinal positions of the hooks.

9. A cleanable liquid spray apparatus tool for removing a spray insert element from a spray nozzle in situ in a liquid spray pipe line comprising: a stem for a said insert extensible through a pipe from an exterior access orifice thereto to the insert when seated in a nozzle on said pipe, said stem having a handle for manipulation thereof at the access orifice to the pipe and being removable through the pipe and orifice and detachable from the insert; and means for detachably connecting the stem with the insert when they are inside a said pipe and nozzle for removing and replacing the nozzle insert through the pipe in unseating and reseating the insert in the nozzle, for cleaning, repair and replacement of said spray nozzle insert, said means comprising an engagement head on said stem for engagement with a said insert and axially alignable with the axis of the insert for their axial coaction when the stem is advanced along the pipe from the access orifice for the pipe to a said insert in a nozzle attached to the pipe, and grasping means on said engaging head in spacial arrangement around the axis of the stem for coaction with complemental means therefor in the same spacial arrangement around the axis of a said insert, for their automatic interconnection and disconnection on manipulation of the stem by the handle at the exterior access orifice to the pipe therefor, and in which the grasping means on said engaging head comprises a plurality of hooks each comprising a shank and a grasping element, said shanks all being spaced radially from, and circumferentially around, the axis of the head and all extending a distance beyond the head longitudinally of the head axis, and said grasping elements being releasably graspably engageable with corresponding parts therefor on a said nozzle insert.

10. A tool as claimed in claim 9, and in which the grasping elements on said shanks comprise terminal ends of the hook shanks of arcuate configuration and of tapered cross-section.

11. A tool as claimed in claim 9, and in which the hooks are equally spaced radially from and circumferentially around, and are of equal length along the axis of the engaging head, for engagement of the grasping elements with corresponding grasping parts on an insert at spaced distances radially from and longitudinally along the axis of the insert in correspondence with the equal radial and longitudinal positions of the grasping elements on the hooks.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,144,816	Cowper	June 29, 1915
1,367,769	Coffey	Feb. 8, 1921
2,116,707	Scillia	May 10, 1938
2,580,385	Hochmuth	Jan. 1, 1952