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Davies et al.

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[54] **ROTARY COATING APPLYING NOZZLES**

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[73] Assignee: **USM Corporation**, Boston, Mass.

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[30] **Foreign Application Priority Data**

Oct. 23, 1973 United Kingdom 49317/73

[52] **U.S. Cl.** **118/323;** 118/317

[51] **Int. Cl.**[2] **B05B 3/02**

[58] **Field of Search** 118/323, 317, 306, 9, 2

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[57] **ABSTRACT**

Apparatus is provided for applying a coating to portions of a workpiece and comprises a nozzle having outlet ports opening into a longitudinal bore in the nozzle, a tube slidably mounted in the bore and means for effecting relative movement between the nozzle and the tube to cover and uncover the outlet port so that coating material can pass therethrough. The nozzle is rotated adjacent a moving workpiece and the ports open into recessed portions formed in the outer end portion of the nozzle which form gaps between the workpiece and nozzle into which the coating is extruded.

12 Claims, 7 Drawing Figures

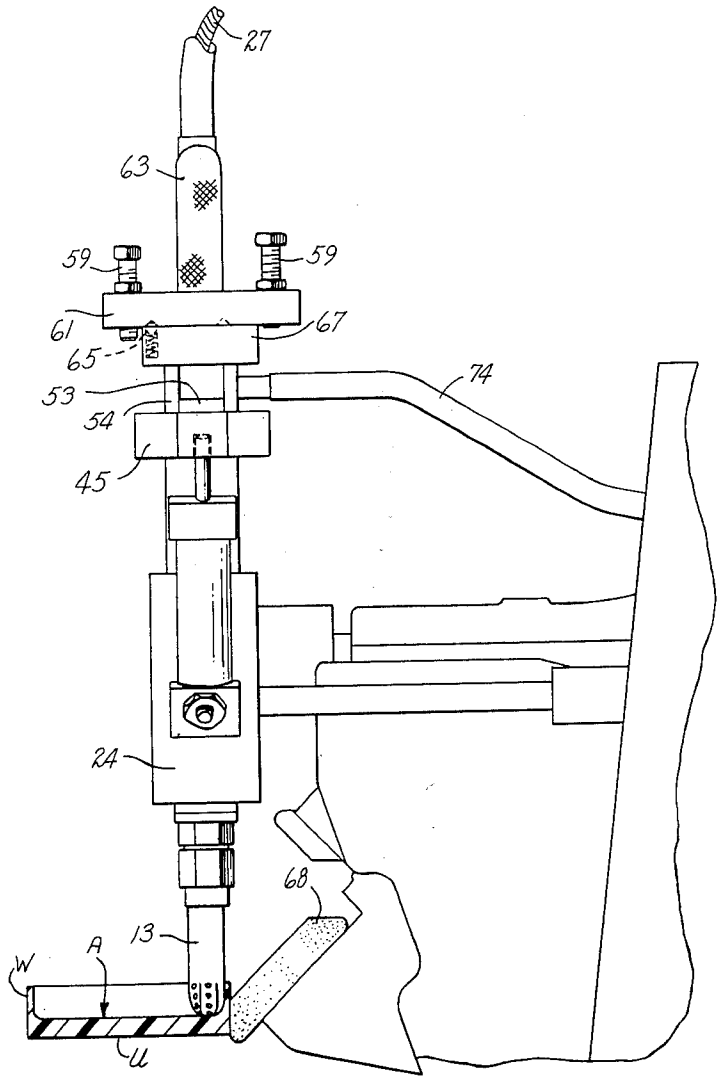


Fig. 1

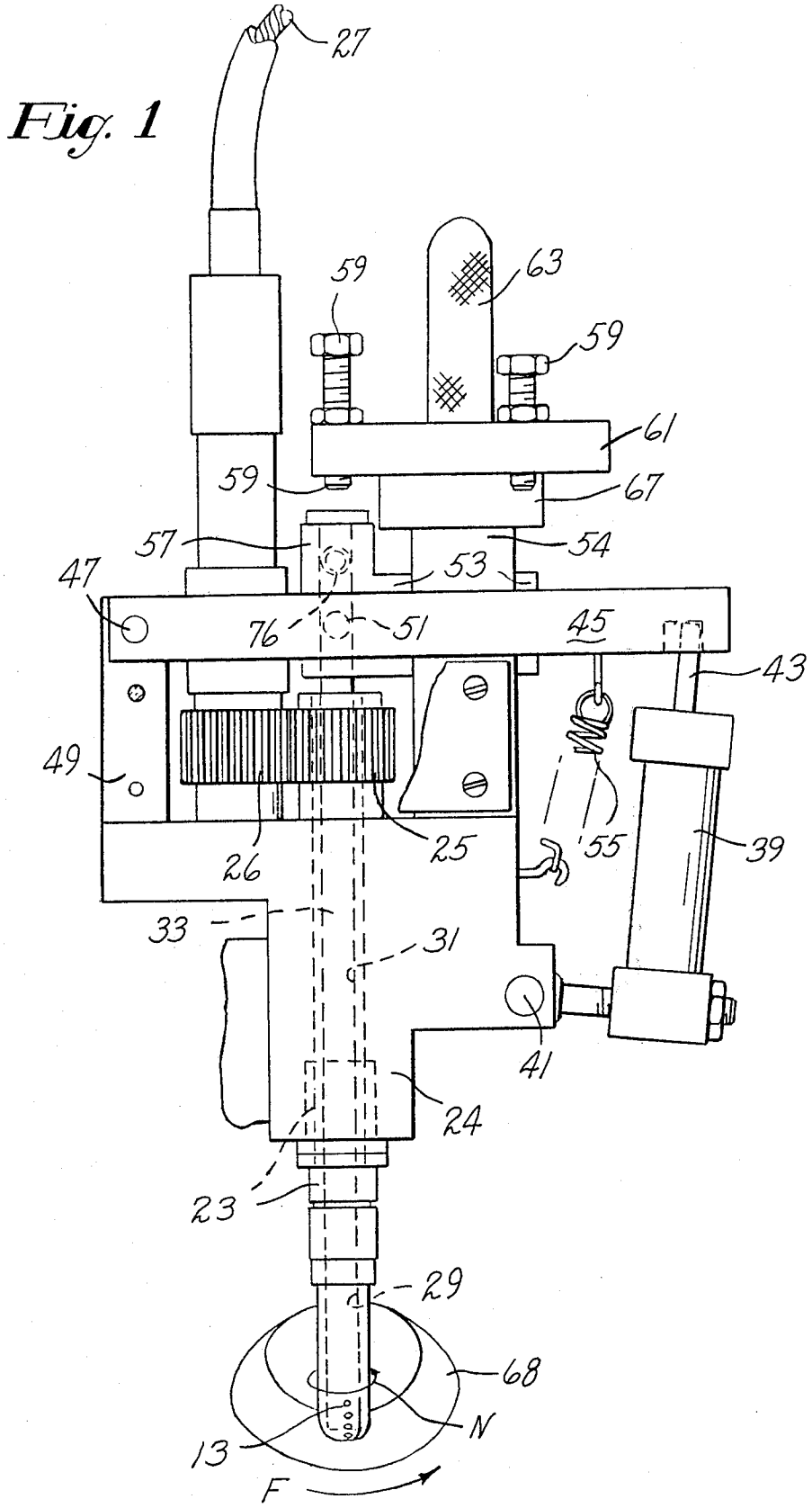

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Fig. 2

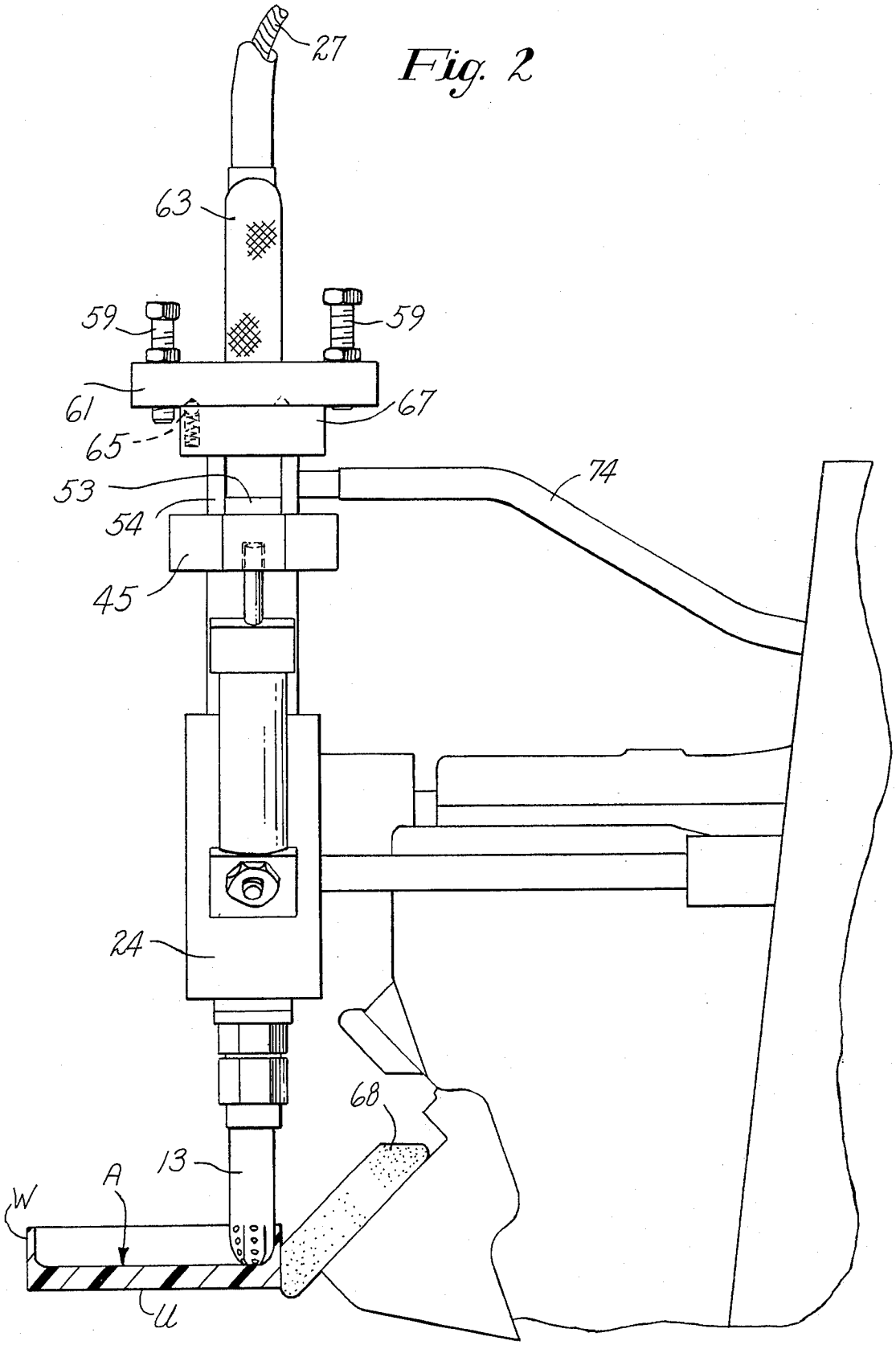


Fig. 3

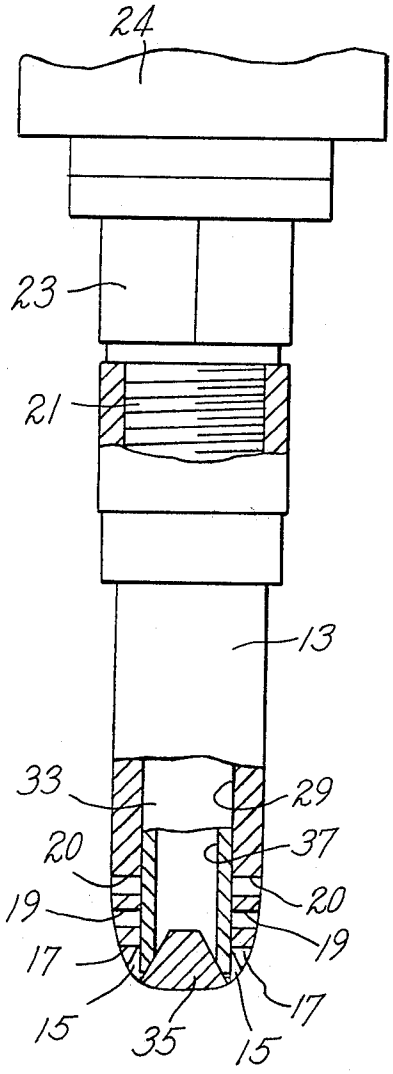


Fig. 4

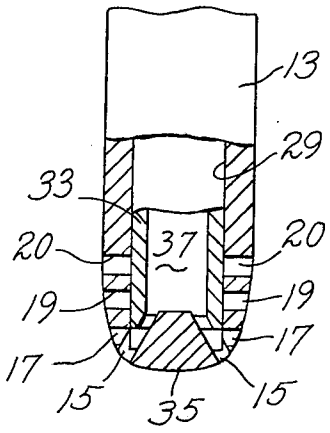


Fig. 5

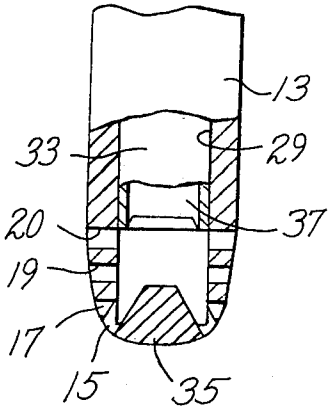


Fig. 6

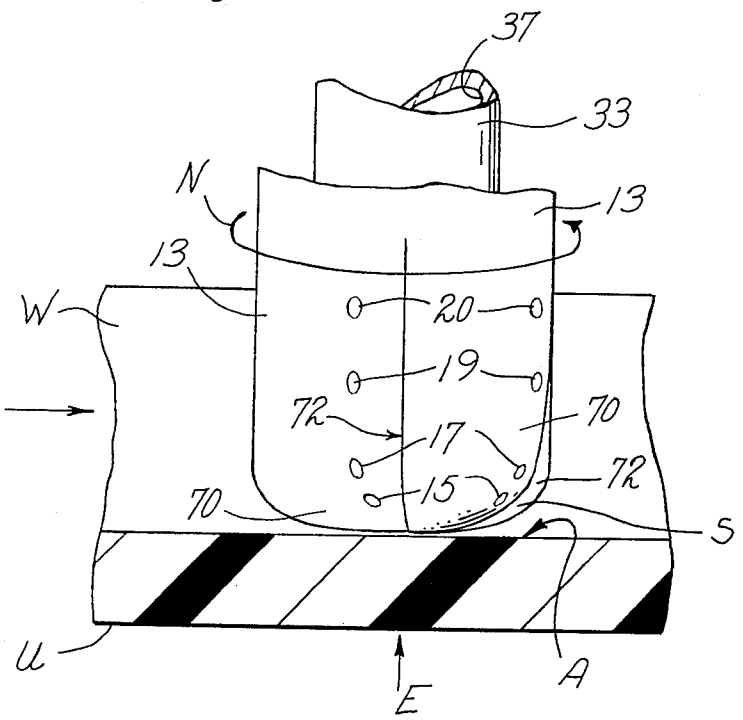
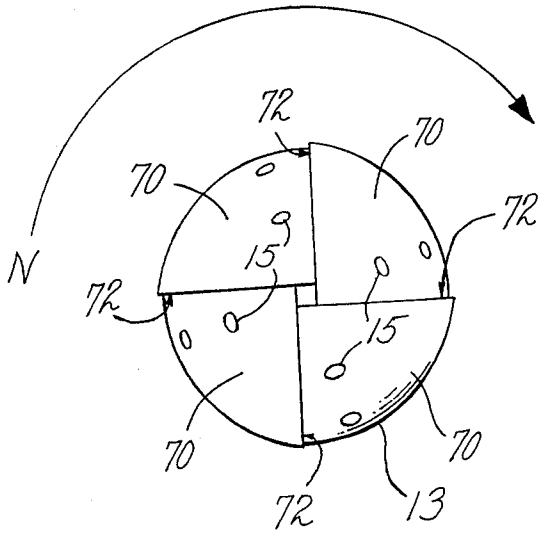

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Fig. 7


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ROTARY COATING APPLYING NOZZLES

BACKGROUND OF THE INVENTION

The present invention is concerned with improvements in or relating to the applying of coatings.

There is hereinafter described to illustrate the invention by way of example apparatus for applying a coating of adhesive composition to a workpiece in the form of a shoe sole unit.

In the manufacture of shoes (the word "shoe" being used herein generically to include outer footwear generally whether complete or in the course of manufacture), a sole unit may be attached to the bottom of a shoe by means of adhesive composition applied to attaching surface portions of the sole unit and shoe bottom. A coating of adhesive composition may be applied only to marginal portions of the sole unit.

Some sole units are provided with an upstanding wall or lip extending around the unit edge, which wall or lip is intended to be adhesively bonded to side portions of a shoe upper.

The illustrative apparatus hereinafter described is particularly suitable for applying a coating of adhesive composition to marginal portions of a sole unit inside a wall or lip portion of the unit including applying adhesive composition to inwardly facing surface portions of the wall or lip.

The illustrative apparatus comprises a nozzle having outlet ports in an outer end portion of the nozzle, through which outlet ports adhesive composition is extruded under pressure on to a sole unit. Adhesive composition is applied progressively to marginal portions of the sole unit as it is guided past the nozzle supported by an operator and aided by a power rotated feed wheel engaged against the edge of the sole unit.

The illustrative apparatus has means which effects rotation of the nozzle about a longitudinal axis thereof to assist spreading of the adhesive composition extruded through the ports in the nozzle.

Adhesive composition is supplied to the nozzle through a tube which is mounted for sliding movement longitudinally in a bore in the nozzle. The adhesive composition is extruded under pressure through an open end of the tube into said bore in the nozzle and out of the nozzle through said ports which open into the bore in the nozzle. To prevent the extrusion of adhesive composition from the nozzle, said tube is seated on a seating formed in said bore at the outer end portion of the nozzle, the seating closing said open end of the tube and the tube in seated position blocks the inner ends of the ports.

To initiate extrusion of adhesive composition from the nozzle, the operator depresses a treadle to cause said tube to be moved longitudinally in said bore in the nozzle thus to move it away from said seating and uncover at least some of said ports in the nozzle. The nozzle is provided with a plurality of such ports positioned around and along the nozzle. The number of ports along the nozzle opened for extrusion of adhesive composition depends on the distance the tube is moved from the seating and the illustrative apparatus includes means for varying how far the tube is moved on depression of the treadle. A sole unit having a wall or lip portion around its edge is presented to the nozzle with the nozzle inside the wall or lip and adjacent thereto and the number of ports along the nozzle required to be opened for the extrusion of adhesive composition, and

thus the distance from the seating the tube is required to be moved depends on the height of the inner surface of the wall or lip of the sole unit to which adhesive composition is to be applied. Adhesive composition is applied to the sole attaching surface of the unit through outlet ports adjacent the outer end of the nozzle.

At the outside of the nozzle, the ports open into recessed portions in the outer end portion of the nozzle which recessed portions form gaps between the nozzle and the sole unit operated on, into which gaps the adhesive composition is extruded. The ports open into outer surfaces of the nozzle which surfaces are curved and recede from the outer end of the nozzle and from the major diameter of the outer end portion thereof, the shape of the outer end portion of the nozzle being such as to form a step face between each of said outer surfaces and each of said outer surfaces slopes inwardly of the nozzle from the peak of a step face to the base of the next step face. The gaps formed between said outer surfaces of the nozzle and the sole unit are generally wedge-shaped and the direction of rotation of the nozzle about its longitudinal axis is such that said outer surfaces lead the step faces following. In other words, the narrowest part of said gap follows its widest part and may effect a buildup of pressure on the adhesive composition extruded, tending to urge the sole unit away from the nozzle. In this way the sole unit may be held out of contact with the nozzle so that the nozzle does not wipe off the adhesive composition applied to the sole unit as it is moved past the nozzle.

On completion of an adhesive applying operation, the operator releases the treadle which effects movement of the tube on to its seating and stopping of the rotary movements of the nozzle and feed wheel. The cutting off of the supply of adhesive composition at the ports by the tube minimizes unwanted drooling of adhesive composition.

SUMMARY OF THE INVENTION

The invention provides, in accordance with one of its several features, apparatus for applying a coating to surface portions of work operated on by the apparatus comprising a nozzle having an outlet port for the coating material which opens into a longitudinal bore in the nozzle, a tube slidably mounted in the longitudinal bore and means for effecting relative movement between the nozzle and the tube lengthwise of said bore whereby the position of the tube relative to the nozzle is changed from an open position in which the outlet port is uncovered so that coating material can pass therethrough to a closed position in which a portion of a longitudinal wall of the tube covers the outlet port and blocks it against the passage of coating material therethrough.

The illustrative apparatus hereinafter described provides a plurality of such outlet ports spaced along the nozzle and the open position of the nozzle and tube can be varied according to the number of outlet ports selected to be uncovered for the passage of coating material therethrough.

In the illustrative apparatus hereinafter described, the coating material is supplied to the nozzle through an open end of the tube which is adapted to be closed by a seating at an end portion of the nozzle in the closed position of the nozzle and tube.

In the illustrative apparatus hereinafter described means is provided for rotating the nozzle about a longi-

tudinal axis thereof during an applying operation to assist spreading of the coating material on the work.

The invention provides, in accordance with another of its several features, a nozzle for use in apparatus for applying a coating to surface portions of work operated on by the apparatus, which nozzle has an outlet port for the coating material, which opens into a recessed portion in the outside surface of the nozzle, and wherein the recessed portion provides a surface having the outlet port opening, which surface recedes to form a slope and provide in collaboration with the work operated on a generally wedge-shaped gap for receiving the applied coating material and wherein the nozzle is adapted to be rotated about a longitudinal axis of the nozzle in a direction in which the widest part of the gap leads and its narrowest part follows so that a buildup of pressure of the applied coating material may be effected.

The illustrative apparatus hereinafter described is provided with a nozzle having a plurality of such outlet ports spaced around said longitudinal axis of the nozzle and a plurality of such recessed portions spaced around the outside surface of the nozzle into which the outlet ports open.

BRIEF DESCRIPTION OF THE DRAWING

A more detailed description of the illustrative apparatus, which apparatus is selected for description by way of exemplification of the invention and not by way of limitation thereof, will now be given, with reference to the accompanying drawings wherein:

FIG. 1 is a front view of a head portion of the illustrative apparatus with parts broken away for the sake of clarity;

FIG. 2 is a right-hand side view of a head portion of the illustrative apparatus showing a section of a sole unit in position to be operated on;

FIG. 3 is an enlarged view, in front elevation and partly in section, of a nozzle and associated parts provided by the apparatus;

FIG. 4 is a fragmentary view, in front elevation and partly in section, of the nozzle and a slidable tube in the nozzle in a different position to its position relative to the nozzle shown in FIG. 3;

FIG. 5 is a view similar to FIG. 4 but showing said tube in a third position;

FIG. 6 is a magnified view in front elevation, of an outer end portion of the nozzle and showing in section a fragment of the sole unit in position to be operated on; and

FIG. 7 is a magnified diagrammatic view of the outer end of the nozzle viewed in the direction of the arrow E in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As best shown in FIGS. 3, 4 and 5, the illustrative apparatus comprises a nozzle 13 having outlet ports 15, 17, 19 and 20 in an outer end portion of the nozzle through which adhesive composition may be extruded. The nozzle 13 has an inner end portion formed like a threaded nut by means of which the nozzle is detachably screwed on to a threaded lower end portion 21 of a rotatably mounted spindle 23, the nozzle being mounted for rotation with the spindle. As shown in FIG. 1, the spindle 23 is mounted for rotation in a fixed head portion 24 and the apparatus includes power operated means for effecting rotation of the spindle 23, said power operated means including a gear wheel 25 fixed on the spindle and a meshing gear wheel 26 which is driven through a flexible transmission shaft 27.

When the nozzle 13 is mounted on the spindle 23 a bore 29 extending lengthwise in the nozzle aligns with a heightwise extending bore 31 in the spindle.

Slidable heightwise in the bore 31 is a tube 33 adapted to extend into the bore 29. The tube 33 is mounted for movement from a lower position in which it closes all of said ports in the nozzle 13. An open lower end portion of the tube 33 is shaped so that in the lower position of the tube it seats on a conical face of a projection 35 formed integrally with a curved end portion of the nozzle 13, the projection 35 closing the lower end of the tube in its lower position, as in FIG. 3.

In operation of the apparatus, adhesive composition under pressure is received in a bore 37 extending heightwise in the tube 33 and forced out through the ports in the nozzle 13 uncovered when the tube is raised from its seating on the projection 35, thus to allow adhesive composition to pass out of the lower end of the tube. The nozzle 13 is provided with four sets of four ports, the set nearest to the outer end of the nozzle having the reference numeral 15 and the set furthest from said end having the reference numeral 20. The ports 20 are equally spaced around a portion of the nozzle 13 which, in cross section, provides a substantially circular outer wall, the ports 15 are provided adjacent a generally curved outer end of the nozzle and the ports 17 and 19 are spaced between the ports 15 and 20 aligned therewith. An operator holds a treadle (not shown) depressed to hold the tube 33 raised. Depression of the treadle closes a switch in an electrical circuit, thereby to cause a solenoid operated valve in an air pressure circuit to open and admit air under pressure to a cylinder 39 (FIG. 1) pivotally connected by means of a pin 41 with the fixed head portion 24 of the apparatus.

Referring to FIGS. 1 and 2, admission of air under pressure to the cylinder 39 effects movement of a piston slidably mounted in the cylinder to move a piston rod 43 fixed on the piston in a direction to raise an arm 45 about the axis of a pivot pin 47 for the arm 45 in a fixed support 49 for said arm. The arm 45 supports the tube 43 and is normally urged downwardly by means of a tension spring 55 to seat the tube 33 on the projection 35. The tube 33 is provided with a head member 57. The arm 45 comprises two branches which straddle the head member 57 and the head member is pivotally connected to the arm 45 by means of trunnion pins 51.

To guide the tube in its heightwise movement and prevent rotational movement, an extension 53 of the head member 57 is received between guide plates 54 provided on the head portion 24 of the apparatus. On depression of the treadle, the arm 45 is raised to raise the tube 33 and uncover selected outlet ports in the nozzle 13. The tube 33 is raised to a position determined by engagement of the head of the tube with an adjustable stop screw 59. The setting of the stop screw 59 determines how far the tube 33 is raised, and thus how many sets of ports in the nozzle 13 are uncovered for the extrusion of adhesive composition. There are three such stop screws 59 mounted in a rotatable turret 61. The stop screws may be preadjusted so that either two, three or four sets of ports are uncovered when the tube 33 is raised and the turret 61 provides quick

means for moving the appropriate stop screw into an operative position. The turret **61** may be rotated by means of a knurled hand grip **63**, and a spring poppet **65** (FIG. **2**) is provided in a turret support **67** to engage in one of three notches provided in the turret, and thus hold the selected stop screw **59** in operative position.

FIG. **2** shows in section a molded sole unit U having an upstanding wall portion W positioned to receive a marginal coating of adhesive composition from the nozzle **13**. The sole unit U is coated with adhesive composition for bonding the unit to the bottom of a shoe and the adhesive is applied progressively to marginal portions of the attaching surface of the sole unit including inwardly facing surface portions of the wall portion W. For feeding the sole unit past the nozzle, the illustrative apparatus is provided with a power operated feed wheel **68** which is rotated in the direction of the arrow F in FIG. **1**. The feed wheel **68** is driven by means of an electric motor through suitable belt and gear wheel connections (not shown) and the position of the feed wheel may be made adjustable to accommodate sole unit wall portions of different thicknesses.

The aforementioned flexible transmission shaft for driving the nozzle **13** is connected directly to the end of a shaft rotated by said electric motor. The illustrative apparatus is organized so that depression of the treadle initiates operation of the electric motor to rotate the feed wheel **68** and the nozzle **13**, at the same time effecting raising of the tube **33** to uncover the appropriate ports in the nozzle **13**.

The wall portion W of the sole unit U is of such a height as to require all of the ports in the nozzle **13** to be opened for the extrusion of adhesive composition and the appropriate stop screw **59** is moved into operative position so that the tube **33** may be raised to the position shown in FIG. **5**. A sole unit with a wall portion of lower height may require only the ports **15, 17** and **19** to be opened while a sole unit having only a relatively low raised lip extending around its edge may require the tube **33** to be raised a distance only to uncover the ports **15** and **17**, as shown in FIG. **4**, and the appropriate stop screw **59** would be moved into operative position according to requirements. If necessary, the nozzle **13** may readily be unscrewed from the threaded portion **21** of the spindle **23**, withdrawn from the tube **33** and a nozzle suitable for the work to be operated on may be screwed on to the spindle, e.g., for a sole unit, which does not have a raised edge portion, a nozzle having only ports corresponding to the ports **15** may be desirable.

The sole unit operated on is guided past the nozzle **13** held by the operator against the driven feed wheel **68**. The nozzle **13** is rotated with the spindle **23** about the tube **33** in the direction of the arrow N in FIGS. **1, 6** and **7** and operated against the direction of feed of the sole unit. It has been found that by rotating the nozzle in said direction any buildup of adhesive composition applied to the sole unit occurs where required, namely, in the corner between the attaching surface and the inner surface of the wall portion. The speed of rotation of the nozzle is about three times the speed of rotation of the feed wheel.

Referring particularly to FIGS. **6** and **7**, each row of ports **15, 17, 19** and **20** opens in an outer curved surface **70** of the nozzle **13**, there being four such surfaces **70** provided by cutaway portions of the nozzle. Each of the surfaces **70** is curved and recedes from the outer end of the nozzle and from the major diameter of the outer end portion thereof. Each surface **70** slopes inwardly of the nozzle to form a step face **72**, the peak of which provides the highest point of the next surface **70**. Referring to FIG. **7**, the adhesive composition is extruded through the outlet ports into generally wedge-shaped gaps S between the surfaces **70** and the attaching surface A of the sole unit being operated on. As the nozzle is rotated in the direction of the arrow N, the surfaces **70** tend to cause a buildup of pressure on the adhesive composition extruded, which tends to force the sole unit away from the outer end of the nozzle. In this way the sole unit may be "stood off" from contact with the outer end of the nozzle as the unit is fed past the nozzle so that it does not wipe off adhesive composition applied through the nozzle.

The adhesive composition is applied progressively to marginal portions of the sole unit operated on from a conveniently mounted pressurized container for the adhesive composition. A valve in the supply system is turned on in order to permit adhesive composition under pressure to be supplied through a supply pipe **74** (FIG. **2**) and an inlet port **76** (FIG. **1**) in the head member **57** to the bore **37** in the tube **33**. The adhesive composition is applied to the work operated on from the open lower end of tube **33** as hereinbefore described. On completion of an applying operation, the operator releases the treadle, whereupon the supply of adhesive is cut off adjacent the outlet ports in the nozzle by the tube seating on the projection **35** and covering the outlet ports, thereby minimizing drooling of adhesive composition from the nozzle, and the electric motor which drives the feed wheel and nozzle is stopped.

What is claimed is:

1. Apparatus for applying a coating to surface portions of a workpiece comprising:

a rotatable nozzle having an outlet port opening into a longitudinal bore in the nozzle;

a tube slidably mounted in said bore;

means for effecting relative movement between said nozzle and said tube lengthwise of said bore from a condition wherein said outlet port is uncovered such that coating material passes therethrough to a condition wherein said outlet port is closed by said tube to block it against the passage of coating material;

means for feeding coating material to said nozzle; and

means for rotating said nozzle about a longitudinal axis thereof during operation of said coating apparatus.

2. Apparatus of claim **1** wherein coating material is supplied by said means for feeding coating material to said nozzle through the interior of said tube and from an open end of said tube into said nozzle, said nozzle having a seat portion adjacent an end thereof for receiving said open end of the tube to close off flow of coating material from said tube.

3. The apparatus of claim **1** wherein said nozzle comprises an outer surface having a recessed portion formed therein and said outlet port opening into said recess, said surface receding into said recessed portion to form a generally wedge-shaped gap for receiving the coating material through said outlet port, the rotational direction of said nozzle being such that the widest part of said gap leads and the narrowest part follows to build up pressure of the applied coating against a workpiece.

4. The apparatus of claim 1 wherein said outlet port is one of a plurality of outlet ports spaced along the length of said nozzle and wherein said means for effecting relative movement between said nozzle and said tube is controllable to uncover a predetermined number of said ports to vary the volume and location of coating being applied to a workpiece by the apparatus.

5. The apparatus of claim 4 wherein said plurality of outlet ports are arranged linearly in a row and which further include a plurality of such rows spaced about the circumference of said nozzle.

6. The apparatus of claim 5 wherein said nozzle comprises an outer surface having a respective recessed portion formed therein for each of said rows of outlet ports with said outlet ports opening into a respective recess, said surface receding into each of said recessed portions to form a generally wedge-shaped gap for receiving the coating material through a respective row of outlet ports, the rotational direction of said nozzle being such that the widest part of each of said gaps leads and the narrowest part follows to build up pressure of the applied coating against a workpiece.

7. The apparatus of claim 6 which further includes means for supporting a workpiece adjacent said outer surface of said nozzle.

8. The apparatus of claim 7 which further includes means for providing relative movement between said nozzle and said workpiece in a direction opposed to the relative movement between said nozzle and said workpiece caused by rotation of said nozzle.

9. The apparatus of claim 8 wherein coating material is supplied by said means for feeding coating material to said nozzle through the interior of said tube and from an open end of said tube into said nozzle, said nozzle having a seat portion adjacent an end thereof for receiving said open end of the tube to close off flow of coating material from said tube.

10. A nozzle for use in apparatus for applying a coating to surface portions of a workpiece operated on by the apparatus, comprising:

an outer surface having a recessed portion formed therein and an outlet port opening into said recess, said surface receding into said recessed portion to form a generally wedge-shaped gap for receiving the coating material through said outlet port such that rotation of said nozzle about a longitudinal axis thereof with the widest part of said gap leading and the narrowest part of said gap following is effective to build up pressure of the applied coating against an adjacent workpiece.

11. A nozzle as set forth in claim 10 wherein said outer surface comprises a plurality of said recessed portions formed about its periphery and a respective outlet port for each of said recessed portions.

12. A nozzle as set forth in claim 11 wherein the outlet port of each of said recessed portions is one of a plurality of outlet ports arranged lengthwise of said nozzle in said respective wedge-shaped gap.

* * * * *