PATENT SPECIFICATION (11) 1 585 961

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(21) Application No's. 35173/76 35174/76 (22) Filed 24 Aug. 1976

(23) Complete Specification Filed 23 Aug. 1977

(44) Complete Specification Published 11 Mar. 1981

(51) INT. CL.[3] A43D 37/00

(52) Index at Acceptance A3B 26E5

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(54) IMPROVEMENTS IN OR RELATING TO APPARATUS SUITABLE FOR USE IN THE MANUFACTURE OF SHOES

(71) We, THE BRITISH UNITED SHOE MACHINERY COMPANY LIMITED, a British Company, of Union Works, Belgrave Road in the City of Leicester, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention is concerned with improvements in or relating to apparatus suitable for use in the manfacture of shoes, more especially apparatus suitable for use in performing a roughing operation on marginal portion of the bottoms of shoes, especially shos of a high-heeled style. The term "shoe" where used herein is used generically as indicating outer footwear generally and as including an article of footwear in the course of its manufacture.

There is described in our Patent Specification No. 1137254 an apparatus suitable for use in performing a roughing operation on marginal portions of shoe bottoms comprising a shoe support for supporting a last carrying a shoe, and tool supporting means for supporting a rotary roughing tool, between which tool supporting means and shoe support relative movement can take place whereby a tool supported by the tool supporting means can be caused to operate progressively along a marginal portion of the bottom of a shoe supported by the shoe support.

In said apparatus, for controlling such relative movement, cam means, in the form of a flat template having a shape corresponding to the plan shape of the bottom of a shoe being operated upon, is provided by which the relative movement between the shoe support and the tool supporting means can be controlled in directions extending lengthwise and widthwise of the bottom of a shoe supported by the shoe support, while fluid pressure operated means is provided for controlling the pressure applied between the tool and the shoe bottom, as the tool is caused to operate progressively as aforesaid, and in this manner the heightwise position of such tool in relation to the shoe bottom is also controlled.

Furthermore, in said apparatus means is provided whereby the pressure applied between the tool and the shoe bottom as aforesaid can be varied during the operation of the tool progressively along the marginal portion of the shoe bottom. This facility to vary the pressure has proved especially useful in operating upon shoe bottoms having a pronounced heightwise contour, e.g. high-heeled ladies' fashion shoes, where the tool, in progressing from the toe end to the heel end of a shoe, firstly operates "uphill' from the toe portion to the ball region of the shoe bottom, and thereafter operates "downhill" from the ball region to the waist region of the shoe bottom and towards the heel seat portion thereof. It will be appreciated that when the tool is operating "uphill" it will tend to "dig" into the material of the marginal portion of the shoe bottom, whereas on the "downhill" operation, it will tend, because the shoe bottom is in effect falling away from it, to "bounce". The facility of varying the pressure as aforesaid can be used successfully to avoid any uneven roughing which could otherwise result.

It has been found, however, that in the machine described, the mass of the tool supporting means gives rise to relatively high inertia forces, so that the operating speed of the machine may in some circumstances have to be set at a level which is lower than is acceptable to a shoe manufacturer.

It is one of the various objects of the present invention to provide an improved apparatus suitable for use in performing a roughing operation on marginal portions of shoe bottoms, in the operation of which

apparatus higher operating speeds can be achieved than has previously been the case.

There is hereinafter described in detail, to illustrate the present invention by way of example, an apparatus suitable for use in performing a roughing operation on marginal portions of the bottoms of shoes, especially shoes of a high-heeled style, this apparatus (hereinafter called "the illustrative apparatus") comprising a shoe support for supporting, bottom uppermost, a last carrying a shoe, and tool supporting means for supporting two rotary roughing tools in the form of radial wire brushes in tandem relationship lengthwise of the shoe support. It will be appreciated, however, that the invention is also applicable to an apparatus wherein tool supporting means is provided for supporting a single rotary roughing tool.

The tool supporting means of the illustrative apparatus includes two carriers, in the form of forwardly extending carrier arms, between each of which and the shoe support relative movement can take place in directions extending both lengthwise and widthwise of the bottom of a shoe supported by the shoe support. The tool supporting means also comprises two tool supports, one mounted on each of the carriers for pivotal movement thereon about an axis extending generally lengthwise of the bottom of a shoe supported by the shoe support, whereby a tool supported by each tool support can be moved relative to its carrier in a direction extending heightwise of such shoe bottom.

In the illustrative apparatus, means is provided for effecting movement of the shoe support along a path extending in a direction lengthwise of a shoe supported thereby, thus to cause relative movement in said direction to take place as aforesaid between the carriers and the shoe support, and the carriers are mounted, one at either side of the path of movement of the shoe support, for pivotal movement, independently of each other, each about an axis extending heightwise of the path of movement of the shoe support whereby tools supported by the carriers are caused to move widthwise of said path. Thus, in the operation of the illustrative apparatus, as relative movement is caused to take place between the carriers of the tool supporting means and the shoe support as aforesaid in directions extending lengthwise and widthwise of the shoe bottom, tools supported by the tool support can be caused to operate progressively along opposite marginal portions of the bottom of a shoe supported by the shoe support, movement of the tools in a direction heightwise of the shoe bottom, and thus movement of the tool supports relative to their associated carriers, being determined by engagement of the tools with the shoe bottom and varying with the heightwise contour of the shoe bottom, while the carriers are maintained in a predetermined heightwise position in relation to the shoe support during the roughing cycle.

Each tool support of the tool supporting means of the illustrative apparatus has acting thereon adjustable resilient means comprising a fluid pressure operated piston and cylinder arrangment, the cylinder of said arrangement being mounted on the carrier associated with such tool support. The adjustable resilient means is effective, when the apparatus is in use, to urge the tool supported by the tool support into engagement with the bottom of a shoe supported by the shoe support. By adjusting the pressure applied to the fluid pressure operated piston and cylinder arrangement, the pressure applied by the tool to the shoe bottom can be adjusted.

Also acting on each tool support is a damping arrangement in the form of a hydraulic piston and cylinder arrangement. The damping arrangement is effectively a one-way damping arrangement which acts to resist upward movement of the tool support, i.e. movement thereof away from the shoe support, while allowing downward movement, i.e. movement of the tool support towards the shoe support, to take place without a substantial restriction. To this end, the piston of said arrangement has one or more ports therein for the restricted passage of hydraulic fluid therethrough, which piston also incorporates a flap valve which is closed when the fluid is pressurised by the tool support being urged upwardly and is opened when the tool support moves downwardly relative to the carrier. The flap valve comprises a large bore aperture covered by a flap which closes said aperture under fluid pressure during upward movement of the tool support, whereas during downward movement thereof the fluid is effective to cause the flap to uncover the aperture and allow the passage of hydraulic fluid therethrough.

The illustrative apparatus also comprises a rotary tool grinding arrangement comprising, associated with each roughing tool, a support for a grinding stone, actuating means being provided by which relative movement, in a direction heightwise of the shoe support, can be effected between each carrier and associated support for a grinding stone, whereby the tools supported by the tool supports associated with each carrier can be ground. In carrying out a grinding operation, the actuating means of the illustrative apparatus is effective to cause relative movement of approach to take place between each carrier and its associated grinding stone support, whereby a brush can be ground on a stone supported by said stone support, and thereafter to cause rela-

tive movement of separation to take place therebetween to return the carrier to a desired heightwise position in relation to the shoe support, in which position a brush which has thus been ground can be supported by its tool support with a work-engaging surface thereof in a datum position. In the illustrative apparatus, each carrier supports one such actuating means as hereinbefore described, and each actuating means is effective to cause the carrier by which it is supported to be moved towards and away from the grinding stone support associated therewith. Thus, each actuating means comprises a first mechanism for effecting relative movement of approach of the carrier supporting it towards the grinding stone support associated with it, and for subsequently effecting relative movement of separation therebetween, the distance moved in such relative movement of approach being the same or substantially so as the distance moved in such movement of separation. In addition, each actuating means also comprises a second mechanism effective to cause only relative movement of approach of the carrier towards its associated grinding stone support. Thus, after each grinding operation performed on the brushes supported by the tool supports, whereby each brush is ground to a new limit as determined according to the distance moved by the carriers under the influence of the first and second mechanisms, each carrier is returned through a distance determined by the first mechanism, which distance is a constant or substantially so, to a position in which the work-engaging surface of each brush is disposed in the datum position.

When the illustrative apparatus is in a rest condition, each tool support rests on its associated carrier in a rest position as determined by abutment stop means. As above stated, each tool support can move heightwise of the shoe support upon engagement with a shoe bottom, and thus, in order to prevent heightwise movement of each tool support when the tool supported thereby is brought into engagement with a grinding stone, increased pressure is applied to each tool support, by means of the fluid pressure operated piston and cylinder arrangement associated therewith, when the actuating means is caused to operate as aforesaid, thus to urge the tool support, and the tool supported thereby, into engagement with the grinding stone of the grinding stone support, and to lock each tool support in its rest position on its carrier.

The illustrative apparatus also comprises fluid pressure operated means, in the form of two fluid pressure operated piston and cylinder arrangements, one associated with, and supported by, each carrier and acting on the tool support associated therewith, such means being effective to move each tool support relative to its carrier in a direction heightwise of the shoe support at the end of a roughing operation by the tool supported thereby in a cycle of operation of the illustrative apparatus. Alternatively, in other apparatus in accordance with the invention and other otherwise similar to the illustrative apparatus, the piston and cylinder arrangement constituting the adjustable resilient means may be double-acting to achieve the same effect, or, again, fluid pressure operated means may be provided, comprising two fluid pressure operated piston and cylinder arrangements, one associated with each of the carriers, said means being effective to move the carriers themselves, and thus the tool supports therewith, in a direction heightwise of the shoe support at the end of a roughing operation by each of the tools supported by the tool supports. Whichever arrangement is used, however, it will be appreciated that each tool is lifted away from the shoe bottom, along marginal portions of which a roughing operation has been performed thereby, independently of corresponding movement of the other tool. That it to say, each tool is lifted at the end of its own operation independently of the other tool.

Whereas in the illustrative apparatus, the downward force applied by the adjustable resilient means is constant during a roughing cycle, in other apparatus in accordance with the invention and otherwise similar to the illustrative apparatus, the force thus applied can be varied during such roughing cycle, so that differences in material e.g. between the forepart and waist regions of the shoe bottom may be accommodated. Furthermore, where the piston and cylinder arrangement constituting the adjustable resilient means is double-acting, in treating certain materials requiring a very light rough, it may be desirable to apply an upward pressure by said means, counteracting the weight of the tool, rather than change to a lighter, less abrading tool, which would otherwise be required.

The illustrative apparatus also comprises, for effecting rotation of the rotary roughing tools supported by each of the tool supports of the tool supporting means, drive means comprising, for each tool, a first driving pulley (constituting a rotary drive member) supported for rotation on the carrier associated with the tool, a second drive pulley (constituting a further rotary member) carried on a tool shaft supported by the associated tool support, on which shaft the tool is mounted, and an endless drive member in the form of a timing belt interconnecting the drive pulleys. In the illustrative apparatus, a drive shaft on which

the first drive member is mounted is coincident with the axis about which the tool support is mounted for pivotal movement on the carrier; more specifically the tool support is mounted on said drive shaft. Furthermore, the tool shaft is caused to rotate in a direction such that the tool supported thereby effects an inward wiping action on a marginal portion of the shoe bottom being operated upon. Similarly, said drive shaft is caused to rotate in the same sense as the tool shaft so that the effect of the timing belt, as the shafts are rotated, will be to tend to lift the tool support about its axis of pivotal movement.

The illustrative apparatus also comprises control means, including cam means, in the form of a flat template, the shape of which corresponds to the plan shape of the bottom of the shoe being operated upon. In the illustrative apparatus, template supporting means is mounted for movement with the shoe support along its path, sensing means being provided, one associated with each carrier of the tool supporting means, and being arranged to co-operate with the template supported by the template supporting means whereby, as the shoe support is moved along its path as aforesaid, the carriers are caused to pivot about their axes, and thus tools supported by the tool supports on the carriers are caused to move in a direction extending widthwise of the path of movement of the shoe support.

The illustrative apparatus further comprises dust extraction means comprising, for each tool, a hood mounted on the tool support for pivotal movement therewith, the hood shrouding the tool supported by said tool support. In addition, the hood serves as a guard for the timing belt by which rotation of the tool is achieved. The hood provides a duct for dust and other waste created during a roughing operation.

In the illustrative apparatus, the duct provided by the hood is connected by means of a swivel connection to a further duct which is fixedly mounted on the carrier and can be connected to a suction source. Alternatively the dust extraction means of the illustrative apparatus may comprise a hood member within which a tool can be accommodated with an operating surface portion thereof exposed, and which is mounted for movement heightwise of the shoe support when the tool support is caused to pivot as aforesaid, wherein the hood member is supported by the tool support, for pivotal movement relative thereto, at a first point spaced from the axis about which said tool support can be pivoted as aforesaid, and is further supported by a lever member, one end of which is pivotally secured to the hood member at a second point and the other end of which is pivotally mounted on a portion of the carrier, the arrangement being such that the distance between said first and second points is the same, or substantially the same, as the distance between said axis and the pivotal mounting of the lever member, and also the distance between the first point and said axis is the same, or substantially the same, as the distance between the second point and said pivotal mounting.

It will thus be appreciated that, with the hood member so mounted, namely by a parallel linkage arrangement, the movement of the hood member, as the tool is moved heightwise, can take place without its angle of inclination to the shoe bottom being varied; variation of such angle would of course take place if the hood member were simply mounted for pivotal movement on the drive shaft with the tool support.

In order to maintain the hood member in the same relationship with the operating surface portion of the tool during heightwise movement of the latter, the first point has to be arranged coincident with the axis about which the tool is mounted for rotation. It has now been found, however, that, for operating on the bottoms of high-heeled shoes, where clearance between the hood member and the shoe bottom may otherwise give rise to problems, an advantage is to be gained by so arranging the hood member that the too, as it progresses "uphill" as aforesaid, in effect withdraws into the hood member, that is to say the upward movement of the tool is at a greater rate than the corresponding upward movement of the hood member, so that, as the tool moves away from the portions of the shoe bottom where maximum clearance is required, the hood member shrouds a greater area of the tool. This is achieved in the illustrative apparatus by spacing the first point from the axis about which the tool is mounted for rotation, the first point thus lying between said axis and the axis about which the tool support can pivot.

For positioning the hood member in an appropriate relationship with the operating surface portion of the tool for any given shoe style, according to the amount of clearance required therebetween, the parallel linkage arrangement is preferably adjustable. To this end, the pivotal mounting of the lever preferably comprises a pivot pin which can be held captive in a desired position along an arcuate slot formed in said portion of the carrier, the centre of radius of said arcuate slot being coincident with the axis about which the tool support can pivot.

In using the illustrative apparatus, the weight of the roughing tool can be the same, or substantially the same, as that of the tool used in the apparatus described in the aforementioned specification. In the opera-

tion of this latter apparatus, however, because of the mass of the tool supporting arms, together with the mass of the actuating means for brush grinding, which are also mounted on the arms, the inertia forces arising are significant as a proportion of the total applied pressure, being of the order of 4 lbs. These inertia forces, furthermore, act as a force additional to the weight of the tools as the tools operate "uphill" from the toe to the ball portion of the shoe bottom, but act to diminish the applied force as the tools operate "downhill"; thus the facility of varying the support pressure for the tool supporting arms has been utilised in order to compensate for the variations in applied pressure arising from these inertia forces.

In the operation of the illustrative apparatus, on the other hand, the inertia forces arising have been reduced to a relatively insignificant proportion of the total applied pressure, being in the order to 4 ozs. This has been achieved by a substantial reduction in the mass of the tool supports, partly by such tool supports being of light construction and also by mounting such supports on carriers similar to the tool supporting arms of the earlier apparatus, which carriers also support the actuating means for brush grinding, but which do not, of course, follow the heightwise contour of the shoe bottom being operated upon, but rather remain at a predetermined heightwise position during the roughing cycle.

Also in the illustrative apparatus, by providing tool supports which extend generally widthwise of the shoe bottom being operated upon (instead of lengthwise thereof, as in the earlier apparatus), viz. by providing tool supports which pivot about an axis extending parallel to the path of movement of the shoe support, firstly a greater degree of clearance can be achieved between the tools and the shoe bottom, thus enabling roughing operations to be performed on more steeply inclined shoe bottom portions, that is to say on shoes having higher heels, than has previously been the case, and further the angle at which the tool is inclined to the vertical can be maintained constant, or substantially so, as the tools operate progressively along the marginal portions of the shoe bottom. By providing a radiussed operating surface on the tools, furthermore, in combination with a constant angle of inclination, an improved, more even, roughing operation can be achieved.

By reducing the inertia forces as aforesaid, and by improving the evennes of roughing, the illustrative apparatus is capable of significantly higher operating speeds than is the apparatus described in the aforementioned specification.

The invention provides an apparatus suitable for use in performing a roughing operation on marginal portions of the bottoms of shoes, especially shoes of a high-heeled style, the apparatus comprising a shoe support for supporting a last carrying a shoe, tool supporting means for supporting a rotary roughing tool, and means for effecting relative movement in a direction extending lengthwise of the bottom of a shoe supported by the shoe support, between said shoe support and the tool supporting means, control means also being provided whereby, as such relative lengthwise movement is effected as aforesaid, relative movement in a direction extending widthwise of such shoe bottom is also effected between said shoe support and the tool supporting means, wherein the tool supporting means comprises a carrier and a tool support mounted on the carrier for movement relative thereto in such a manner that a rotary roughing tool supported by the tool support can move in a direction extending heightwise of the shoe bottom, the arrangement being such that, in a roughing cycle of operation of the apparatus, the carrier is maintained in a predetermined heightwise position in relation to the shoe support, while the position of the tool support in relation to the shoe bottom is determined by engagement of the tool supported thereby with the shoe bottom and varies with the heightwise contour of said shoe bottom as relative movement is effected between the shoe support and tool the supporting means as aforesaid.

The invention further provides an apparatus suitable for use in performing a roughing operation on marginal portions of the bottoms of shoes, especially shoes of a high-heeled style, the apparatus comprising a shoe support for supporting a last carrying a shoe, means for moving the shoe support along a path extending lengthwise of the bottom of a shoe supported thereby, and tool supporting means comprising two carrier arms, one arranged at either side of the path of movement of the shoe support, and each arm supporting a tool support by which a rotary roughing tool is supported, wherein each carrier arm is mounted for pivotal movement such that its associated tool can be moved in a direction extending widthwise of the bottom of a shoe supported by the shoe support, and each tool support is mounted on its carrier arm for pivotal movement such that the tool supported thereby can be moved in a direction extending heightwise of such shoe bottom, the apparatus also comprising control means, including cam means corresponding in shape to the plan shape of the bottom of a shoe being operated upon, the control means being effective, when the shoe support is moved along its path as aforesaid, to cause pivotal movement of the carrier arms

to take place, whereby the rotary roughing tools are caused to operate progressively along opposite marginal portions of the shoe bottom, movement of the tools in a direction heightwise of the shoe bottom, and thus movement of the tool supports relative to their associated carrier arms, being determined by engagement of the tools with the shoe bottom, according to the heightwise contour thereof, while the carrier arms are maintained in a predetermined heightwise position in relation to the shoe support during a roughing cycle of the apparatus.

There now follows a detailed description to be read with reference to the drawings accompanying Provisional Specifications Nos. 35173/76 and 35174/76, of the illustrative apparatus. It will of course be appreciated that this illustrative apparatus has been selected for description merely by way of exemplification of the invention and not by way of limitation thereof.

In the drawings accompanying Provisional Specification No. 35173/76 :-

Figure 1 is a side view, with parts broken away, of the illustrative machine, showing a tool supporting means thereof;

Figure 2 is a side view, on an enlarged scale, showing parts of the tool supporting means shown in Figure 1, and also details of dust extraction means of the apparatus;

Figure 3 is a plan view of the parts of the illustrative apparatus shown in Figure 2;

Figure 4 is an end view of the parts of the illustrative apparatus shown in Figures 2 and 3; and

Figure 5 is a fragmentary view of damping means acting on a tool support of the tool supporting means of the illustrative apparatus.

In the drawings accompanying Provisional Specification No. 35174/76 :-

Figure 1 is a fragmentary end view of the illustrative apparatus, showing alternative dust extraction means thereof; and

Figure 2 is a plan view of parts of the illustrative apparatus shown in Figure 1.

With reference to Figures 1 to 5 of the drawings accompanying Provisional Specification No. 35173/76, the illustrative apparatus, which is generally similar, except as hereinafter described, to the apparatus described in our Patent Specification No. 1137254, is an apparatus suitable for use in performing a roughing operation on marginal portions of the bottoms of shoes, especially but not exlcusively shoes of a high-heeled style, in preparation for the attachment of outsoles thereto by means of cement, and comprises a frame 30 on which a shoe support (not shown) for supporting, bottom uppermost, a last carrying a shoe to be operated upon, and tool supporting means for supporting two rotary roughing tools in the form of radial wire brushes 38, wherein the shoe support is movable in a rectilinear path along an upper surface of the frame 30, and the brushes 38 are arranged in the path of movement of a shoe supported by the shoe support.

The tool supporting means of the illustrative apparatus comprises a plate 44 secured to the frame 30, there being mounted on the plate 44, for pivotal movement about vertical axes, spaced apart one at either side of the path of movement of the shoe support, two arms 106, which extend one along either side of said path of movement. Each arm 106 carries, at an end thereof remote from the pivotal mounting, a sensing roll 120, the rolls being arranged to track along opposite edges of cam means in the form of a template (not shown) supported by template supporting means movable with the shoe support, as described in detail in the aforementioned Patent Specification. In a cycle of operation of the illustrative apparatus, the arms are urged inwardly, to bring the rolls 120 into engagement with the template, by fluid pressure operated means (not shown) acting on ends of the arms remote from the rolls 120, said means being effective, at the end of a cycle of operation, to move the arms 106 outwardly, prior to the shoe support being returned to an initial, loading, position, as described in detail in the aforementioned Patent Specification.

Each arm 106 has integral therewith an upstanding portion 48' which carries a bracket 50' in which a transverse pivot pin 52 is carried, there being mounted on each pin 52 an arm 58, constituting a carrier of the illustrative apparatus. Each carrier arm 58 overlies its associated arm 106 and is mounted for pivotal movement therewith about a vertical axis as aforesaid. Each arm 58 is also mounted for pivotal movement about the axis of its pin 52, and is supported, in a limit position (as shown in Figure 1), on a rod 78' upstanding from a bracket 76' carried on the associated arm 106.

The initial heightwise position of each arm 58 can be set by means of a knob 458, so that an initial datum position may be set for each brush 38. The knobs 458 each form part of a device 404 for setting the heightwise position of each arm 58, and thus of the brush 38 supported thereby, not only for an initial setting but also for ensuring that each brush 38 returns to a given datum after a grinding operation has been performed thereon. To this end, each device 404, which is described in detail in our Patent Specification No. 1217675, includes actuating means comprising a first mechanism, effective first to cause relative movement of approach between the arm 58, and thus the brush 38 supported thereby, and a grinding stone support (not shown), whereby the brush 38

can be ground on a grinding stone (not shown) supported by its support, and thereafter to cause relative movement of separation therebetween, and a second mechanism effective to move the arm 58 through a small distance towards the grinding stone support, whereby after each grinding operation performed on the brush 38, the operative surface of the brush is disposed at its datum position.

Each arm 58 has secured thereto two upstanding brackets 602, 604, spaced apart along the length of the arm 58, and carrying bearings 606 (one only shown in Figure 1) for supporting a drive shaft 608, constituting part of drive means for the tools of the illustrative apparatus. For rotating each shaft 608, a motor 90' is mounted on the arm, above the pivot pin 52, and an output shaft 94' carries a toothed drive pulley 610, which is operatively connected, by means of a toothed endless belt 612, to a further toothed drive pulley 614 on the shaft 608.

Each shaft 608 of the illustrative apparatus further supports, for limited pivotal movement thereon, a support member 616 constituting part of a tool support of the illustrative apparatus. Each support member 616 has an inwardly extending arm portion 618 which carries a stub shaft 620 for a toothed drive pulley 622, said shaft also providing a support for the rotary roughing brush 38. The toothed drive pulley 622 is connected by means of a toothed endless belt 624 with a further toothed drive pulley 626 carried at the end of the drive shaft 608.

Thus, operation of each motor 90' is effective to cause, through the various drive pulleys and endless belts, each tool 38 to be rotated. The direction of rotation of each brush is such that the brush, in operating upon marginal portions of a shoe bottom, effects an inward wiping action on such marginal portions. The rotation of each shaft 608 is thus such that it tends to urge the member 616 supported thereon to rotate so as to lift the arm portion 618 thereof; this tendency is of course countered by the distribution of the weight of the member 616 and also by the weight of the brush 38 supported thereby. For determining the lowermost position of the member 616, and thus of the tool 38 supported thereby, in relation to the arm 58, a stop surface 628 (Figure 2) is provided on a web portion 630 of the bracket 604, this stop surface 628 being engaged by a corresponding stop surface 632 provided at the underside of the support member 616.

In the operation of the illustrative apparatus, each tool 38 is urged downwardly by means of a piston and cylinder arrangement 634 (constituting adjustable resilient means) the cylinder 636 of which is pivotally secured to an upper end of a support member 638 secured on the arm 58. A piston rod 640 of said piston and cylinder arrangement is pivotally secured (see Figure 4) to the support member 616. Thus, introduction of fluid under pressure to the upper end of the cylinder 636 is effective to urge the support member 616, and thus the brush 38 supported thereby, downwardly.

Also secured at the upper end of the support member 638 is a lug 642 between which and the support member 616 a damping piston and cylinder arrangement 644 acts (see Figure 5). This arrangement 644 comprises a cylinder 646 pivotally supported on the member 616 and having a double piston 648, 650 mounted for movement therein, an upper end of a piston rod 652 of the arrangement being pivotally connected to the lug 642. A dust cover 654 is also provided over the upper end of the cylinder 646, which is otherwise open. The upper piston 648 of said arrangement is provided with one or more bleed holes through which air, or hydraulic oil, may pass, during the operation of the illustrative apparatus. The lower piston 650 is similarly provided with bleed holes 656 through which hydraulic oil H can pass as the pistons 648, 650 are moved relative to the cylinder 646 in the operation of the illustrative apparatus. By thus restricting the flow of hydraulic fluid, upward movement of the cylinder 646 relative to the pistons is damped, so that any tendency of the support member 616, and thus of the tool 38 supported thereby, to "bounce" is also damped.

The piston 650 further comprises a flap valve constituted by a central larger bore aperture 658 which is covered by a flap 660. In the operation of the illustrative apparatus, during upward movement of the cylinder 646 as aforesaid, the pressure of the hydraulic fluid H beneath the piston 650 will force the flap 660 into operative aperture-closing condition. When, on the other hand, the cylinder 646 is moved downwardly relative to the piston 650, hydraulic fluid H will be drawn back into the chamber beneath the piston 650, such fluid acting against the flap 660 and causing it to open, thereby eliminating the damping effect of the arrangement 644. (The flap 660 is of course made of resilient material.) The arrangement 644 is thus such that no damping of the downward movement of the tool 38 relative to the shoe support takes place.

The lug 642 further supports a fluid pressure operated piston and cylinder arrangement 662, of which the cylinder 664 is pivotally carried by the lug 642, while a piston rod 666 thereof loosely passes through an aperture 668 formed therefore in an extension 670 of the support member 616. The lower end of the piston rod 666 carries a semi-spherical portion 672. Thus,

introduction of fluid under pressure to a lower end of the cylinder 664 is effective to raise the piston rod 666, and the portion 672 thus engages the underside of the extension 670 of the member 616 and causes said member, and thus the tool supported thereby, to be raised. Such admission of fluid takes place at the end of a roughing operation by the tool at the bottom of a shoe. Because of the arrangement of the portion 672 and the loose fit of the piston rod 666 in the aperture 668, any heightwise movement of the support member 616 during a roughing operation of the illustrative apparatus is not impeded by the piston and cylinder arrangement 662.

The belts 624 of the drive means of the illustrative apparatus are each provided with a guard member 674 which also incorporates a hood or shroud 676 for each tool 38, such hood constituting part of dust extraction means of the illustrative apparatus. To this end, the hood 676 has an extension 678 leading to an outlet aperture 680, a centre point of which is generally coincident with the centre of the axis of the shaft 608.

In order to ensure that the hood 676 does not interfere with the heightwise movement of the tool 38 in a roughing operation of the illustrative apparatus, the combined guard and hood 674, 676 is itself mounted for pivotal movement about the axis of the shaft 608. To this end, the arrangement 674, 676 is fixed to the support member 616.

In order to provide an effective air seal in the dust extraction system, the outlet aperture 680 is provided with a lip and received therewithin a flange 682 of an elbow unit 684 which is secured on an extension 686 of the bracket 604, this extension having formed therein an aperture 688 which can be aligned with the aperture of the elbow unit 684 and further to which can be connected a flexible tube 690 by which the dust extraction means of the illustrative apparatus can be connected to a suction source.

With reference to the drawings accompanying Provisional Specification No. 35174/76, the illustrative apparatus may comprise instead of the dust extraction means referred to above, alternative dust extraction means comprising, for each tool, a hood 676' having an outlet 678' connected by means of a flexible hose 684' to a hollow boss 682' carried on an extension 686' of the bracket 604. This extension has formed therein an aperture aligned with the hollow boss 682', to which also can be connected a flexible tube 690 by which the dust extraction means can be connected to a suction source.

For supporting the hood 676' a pivot pin 750 is carried by the arm portion 618 of the support member 616, on which pin 750 the hood is pivotally mounted. A further pivotal connection is made, above the pin 750, by means of a further pivot pin 752, which is carried at one end of a lever 754. The lever 754 carries at its other end a further pivot pin 756 which can be clamped captive in an arcuate slot 758 formed in an upstanding support plate 760 which is carried by the extension 686' of the bracket 604. The plate 760 is provided with two side support plates 762.

The centre of curvature of the arcuate slot 758 lies coincident with the axis of the shaft 608. Furthermore, the distance between said axis and the pin 756 is the same, or substantially the same, as the distance between the pins 750 (constituting a first pivot point) and 752 (constituting a second pivot point). Thus, adjustment of the pin 756 in the arcuate slot 758 will not affect this relationship. Similarly, the distance between the pins 752, 756 is the same, or substantially the same, as the distance between the pin 750 and the axis of the shaft 608. Thus, the hood 676' is supported by a parallel linkage arrangement.

The pin 750 lies in a plane in which the axis of the shaft 608 and the axis of the shaft 620 also lie, the pin being intermediate said two axes. With this arrangement, it will be appreciated that as the support member 616 is caused to pivot about the axis of the shaft 608, the tool will move upwardly more quickly than the hood 676', the ration between the two movements depending upon the position of the pin 750. The initial position of the hood in relation to a shoe bottom is determined by the position of the pin 756 in the arcuate slot 758. The hood 676' can thus be initially positioned appropriately to the shoe bottom to be operated upon and, as the tool 38 follows the heightwise contour of the shoe bottom, the position of the hood will vary in relation to the operating surface portion of the tool, the arrangement being such that the higher the tool moves, the more it will be retracted within the hood 676'.

The hood 676', which is made of sheet metal, is generally shaped to shroud the rotary roughing tool 38. It is provided with a "door" 764 which pivots about the pin 750, a spring catch 766 being provided for holding the door in position. Furthermore, a flap 768 of flexible material, e.g. leather, is provided which depends from the wall of the hood member remote from the pin 750. Since the brush 38 effects an inward wiping action on the shoe bottom, and thus rotates in the direction of the arrow shown in Figure 1, the flap member 768 is effective to catch any particles of dust which are thrown in a low tangential path from the operating surface of the brush at the point of contact with the shoe bottom thereof. Because the

material is flexible, furthermore, no damage will be done by the flap 768 engaging with the bottom of the shoe.

Whichever dust extraction means is utilised, a cycle of operation of the illustrative apparatus takes place generally in the same manner as described in our Patent Specification No. 1137254. In the operation of the illustrative apparatus, however, the pressure of fluid applied to the piston and cylinder arrangement 634 does not vary during the course of the operation, but rather remains constant. Similarly, the carrier arms 58 are maintained in a predetermined heightwise position during a roughing operation, and at the end of each roughing operation by each tool, the support member 616 associated therewith is caused to pivot to raise the tool out of operative engagement with the shoe bottom by the admission of fluid under pressure to the piston and cylinder arrangement 662.

When it is desired that a grinding operation be performed, the devices 404 operate in the manner described in our Patent Specification No. 1217675. In order to ensure that downward movement of the arms 58 under the influence of these devices does not merely cause the support members 616 to pivot to raise the brushes 38 relative to the arms 58, fluid under high pressure is admitted to the piston and cylinder arrangements 662, thus to lock the support members 616 with the stop surfaces 632 thereof in form engagement with the stop surfaces 628 provided on the brackets 604.

The tools 38 used in the illustrative apparatus are in the form of radial wire brushes, each comprising a plurality of radial bristles mounted on a hub and clamped between two clamp plates 692. The operating surface provided by the bristles is radiussed (as also described in our Patent Specification No. 1217675). By so shaping the work-engaging surface, and further by mounting the brushes for heightwise movement relative to the shoe support pivotally about the axis of the shaft 608 which extends parallel to the path of movement of the shoe support, the portion of the work-engaging surface of the tool engaging with the shoe bottom at any given time will have a constant radius, so that evenness of rough can more readily be achieved.

WHAT WE CLAIM IS:-

1. Apparatus suitable for use in performing a roughing operation on marginal portions of the bottoms of shoes, especially shoes of a high-heeled style, the apparatus comprising a shoe support for supporting a last carrying a shoe, tool supporting means for supporting a rotary roughing tool, and means for effecting relative movement, in a direction extending lengthwise of the bottom of a shoe supported by the shoe support, between said shoe support and the tool supporting means, control means also being provided whereby, as such relative lengthwise movement is effected as aforesaid, relative movement in a direction extending widthwise of such shoe bottom is also effected between said shoe support and the tool supporting means, wherein the tool supporting means comprises a carrier and a tool support mounted on the carrier for movement relative thereto in such a manner that a rotary roughing tool supported by the tool support can move in a direction extending heightwise of the shoe bottom, the arrangement being such that, in a roughing cycle of operation of the apparatus, the carrier is maintained in a predetermined heightwise position in relation to the shoe support, while the position of the tool support in relation to the shoe bottom is determined by engagement of the tool supported thereby with the shoe bottom and varies with the heightwise contour of said shoe bottom as relative movement is effected between the shoe support and the tool supporting means as aforesaid.

2. Apparatus according to Claim 1 wherein a damping arrangement is supported by the carrier and acts on the tool support to restrict upward movement thereof relative to the carrier.

3. Apparatus according to Claim 2 wherein the damping arrangement comprises a hydraulic cylinder having a piston with one or more ports therein for the restricted passage of hydraulic fluid therethrough, which piston also incorporates a flap valve which is closed when the fluid pressurised by the tool support being urged upwardly and is opened when the tool support moves downwardly relative to the carrier.

4. Apparatus according to any one of the preceding Claims wherein resilient means is provided which acts on the tool support whereby, when the apparatus is in use, and a tool is supported by said tool support, to urge such tool into engagement with the bottom of a shoe supported by the shoe support.

5. Apparatus according to Claim 4 wherein the resilient means is adjustable.

6. Apparatus according to either one of Claims 4 and 5 wherein the resilient means comprises a fluid pressure operated piston and cylinder arrangement.

7. Apparatus according to any one of the preceding Claims wherein fluid pressure operated means is provided whereby, at the end of a cycle of operation of the apparatus, the carrier is moved heightwise of the shoe support thus to cause a tool supported by the tool support to be raised out of its operative position.

8. Apparatus accordng to any one of CLaims 1 to 6 wherein fluid pressure oper-

ated means is provided whereby, at the end of a cycle of operation of the apparatus, the tool support is moved heightwise relative to the carrier thus to cause a tool supported by the tool support to be raised out of its operative position.

9. Apparatus according to Claim 6 wherein the piston and cylinder arrangement is double-acting and serves, at the end of a cycle of operation of the apparatus, to move the tool support heightwise relative to the carrier thus to cause a tool supported by the tool support to be raised out of its operative position.

10. Apparatus according to any one of Claims 4, 5, 6 and 9 or to either one of Claims 7 and 8 when tied to any one of Claims 4 to 6 wherein means is provided whereby the force applied by the resilient means can be varied during the operation of a tool supported by the tool support on a shoe bottom marginal portion as aforesaid.

11. Apparatus according to any one of Claims 1 to 8 wherein actuating means is provided by which relative movement, in a direction heightwise of the shoe support, can be effected between the carrier and a support for a grinding stone, whereby a tool in the form of a rotary wire brush can be ground, the actuating means being effective to cause relative movement of approach to take place between the carrier and the grinding stone support, whereby a brush can be ground on a stone supported by said support, and thereafter to cause relative movement of separation to take place therebetween to return the carrier to a desired heightwise position in relation to the shoe support, in which position a brush which has been thus ground can be supported by the tool support with a work-engaging surface thereof in a datum position.

12. Apparatus according to Claim 11 wherein the actuating means comprises a first mechanism for effecting relative movement of approach and separation between the carrier and the grinding stone support, the distance moved in such movement of approach and such movement of separation being the same or substantially so, and a second mechanism effective to cause relative movement of approach only to take place between the carrier and grinding stone suport, whereby, after each grinding operation performed on a brush supported by the tool support, the carrier is returned to a position in which the work-engaging surface of such brush is disposed in said datum position.

13. Apparatus according to either one of Claims 11 and 12 wherein the actuating means is carried by the carrier.

14. Apparatus according to any one of Claims 11 to 13 when tied, directly or indirectly, to Claim 6 wherein increased pressure is applied by the fluid pressure operated piston and cylinder arrangement to the tool support when the actuating means is caused to operate, thus to urge a brush supported by the tool support into engagement with a grinding stone on the grinding stone support.

15. Apparatus according to any one of Claims 1 to 8 and 11 to 14 wherein the tool support is mounted on the carrier for pivotal movement about an axis extending generally lengthwise of the bottom of a shoe supported by the shoe support.

16. Apparatus according to any one of Claims 1 to 8 and 11 to 14 wherein drive means is provided for effecting rotation of a rotary roughing tool supported by the tool supporting means, said drive means comprising a rotary drive member supported on the carrier, a further rotary member on a tool shaft supported by the tool support, on which tool shaft a tool can be mounted, and an arrangement comprising an endless drive member interconnecting said rotary members.

17. Apparatus according to Claim 16 wherein the tool support is mounted for pivotal movement on the carrier about an axis coincident with the axis of the rotary driving member.

18. Apparatus according to either one of Claims 16 and 17 wherein the drive means includes a drive shaft supported on the carrier and carrying the rotary drive member and further wherein the tool support is mounted for pivotal movement as aforesaid on said drive shaft.

19. Apparatus according to any one of Claims 16 to 18 wherein the rotary drive member and the further drive member are in the form of driving pulleys and the endless drive member interconnecting them is in the form of a timing belt.

20. Apparatus according to any one of Claims 16 to 19 wherein the tool shaft is caused to rotate in a direction such that a tool supported thereby effects an inward wiping action on the marginal portion of a shoe bottom being operated upon by such tool.

21. Apparatus according to Claim 20 when tied, directly or indirectly, to Claim 18 wherein the drive shaft is caused to rotate in the same sense as the tool shaft.

22. Apparatus according to any one of Claims 1 to 8 and 11 to 21 wherein the control means includes cam means, in the form of a flat template, the shape of which corresponds to the plan shape of the bottom of a shoe being operated upon.

23. Apparatus according to any one of Claims 1 to 8 and 11 to 22 wherein the shoe support is mounted for movement along a path extending lengthwise of a shoe supported thereby, and wherein the carrier is

mounted for movement in a direction widthwise of such shoe.

24. Apparatus according to Claim 22 wherein the shoe support is mounted for movement along a path extending lengthwise of a shoe supported thereby, and means is provided for supporting a template for movement with the shoe support, sensing means being also provided associated with the carrier of the tool supporting means and arranged to co-operate with a template supported by the template supporting means, whereby, as the shoe support is moved along its path as aforesaid, a tool supported by the tool support on the carrier is caused to move in a direction widthwise of said path.

25. Apparatus according to Claim 24 comprising means for effecting rotation of the template supporting means through 180° about an axis extending lengthwise thereof whereby a template supported thereby is reversed and a roughing operation can thus be performed on left or right shoes according to the orientation of the template.

26. Apparatus according to any one of Claims 23 to 25 wherein the carrier is mounted for pivotal movement about an axis extending in a direction heightwise of the path of movement of the shoe support, whereby a tool supported by the tool support on the carrier can thus be caused to move in a direction widthwise of said path.

27. Apparatus according to either one of Claims 15 and 17 or to any one of Claims 18 to 26 when tied to Claim 17, wherein a hood is mounted on the tool support for pivotal movement therewith and shrouds a tool supported thereby, the hood providing a duct for dust and other waste created during a roughing operation, and further wherein the duct provided by the hood is connected by means of a swivel connection to a further duct which is fixedly mounted on the carrier and can be connected to a suction source, whereby such dust and other waste can be drawn along the duct and further duct to a collecting region.

28. Apparatus according to either one of Claims 15 and 17 or to any one of Claims 18 to 26 when tied to Claim 17, comprising dust extraction means, comprising a hood member within which a tool can be accommodated with an operating surface portion thereof exposed, and which is mounted for movement heightwise of the shoe support when the tool support is caused to pivot as aforesaid, wherein the hood member is supported by the tool support, for pivotal movement relative thereto, at a first point spaced from the axis about which said tool support can be pivoted as aforesaid, and is further supported by a lever member, one end of which is pivotally secured to the hood member at a second point and the other end of which is pivotally mounted on a portion of the carrier.

29. Apparatus according to Claim 28 wherein the distance between said first and second points is the same, or substantially the same, as the distance between said axis and the pivotal mounting of the lever member, and also the distance between the first point and said axis is the same, or subtantially the same, as the distance between the second point and said pivotal mounting.

30. Apparatus according to either one of Claims 28 and 29 wherein the lever member is adjustably mounted at one end thus to vary the pivotal movement of the hood member in relation to the pivotal movement of the tool support.

31. Apparatus according to Claim 30 wherein the pivotal mounting of the lever member comprises a pivot pin which can be held captive in a desired position along an arcuate slot formed in said portion of the carrier.

32. Apparatus according to Claim 31 wherein the centre of radius of said arcuate slot is coincident with the axis about which the tool support can pivot.

33. Apparatus according to any one of Claims 1 to 8 and 11 to 26 comprising dust extraction means comprising a hood member within which a tool can be accommodated with an operating surface portion thereof exposed, said hood member being mounted for movement heightwise of the shoe support, such movement being proportional to the heightwise movement of the tool support.

34. Apparatus according to any one of Claims 1 to 8 and 11 to 33 wherein the tool support supports a rotary roughing tool an operating surface of which is radiussed.

35. Apparatus suitable for use in performing a roughing operation on marginal portions of the bottoms of shoes, especially shoes of a high-heeled style, the apparatus comprising a shoe support for supporting a last carrying a shoe, means for moving the shoe support along a path extending lengthwise of the bottom of a shoe supported thereby, and tool supporting means comprising two carrier arms, one arranged at either side of the path of movement of the shoe support, and each arm supporting a tool support by which a rotary roughing tool is supported, wherein each carrier arm is mounted for pivotal movement such that its associated tool can be moved in a direction extending widthwise of the bottom of a shoe supported by the shoe support, and each tool support is mounted on its carrier arm for pivotal movement such that the tool supported thereby can be moved in a direction extending heightwise of such shoe bottom, the apparatus also comprising con-

trol means, including cam means corresponding in shape to the plan shape of the bottom of a shoe being operated upon, the control means being effective, when the shoe support is moved along its path as aforesaid, to cause pivotal movement of the carrier arms to take place, whereby the rotary roughing rools are caused to operate progressively along opposite marginal portions of the shoe bottom, movements of the tools in a direction heightwise of the shoe bottom, and thus movement of the tool supports relative to their associated carrier arms, being determined by engagement of the tools with the shoe bottom, according to the heightwise contour thereof, while the carrier arms are maintained in a predetermined heightwise position in relation to the shoe support during a roughing cycle of the apparatus.

36. An apparatus suitable for use in performing a roughing operation on marginal portions of shoe bottoms constructed, arranged and adapted to operate substantially as hereinbefore described with reference to Figures 1 to 5 of the drawings accompanying Provisional Specification No. 35173/76.

37. An apparatus according to Claim 36 except that the dust extraction means thereof is constructed, arranged and adapted to operate substantially as hereinbefore described with reference to Figures 1 and 2 of the drawings accompanying Provisional Specification No. 35174/76.

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Printed for Her Majesty's Stationery Office,
by Croydon Printing Company Limited, Croydon, Surrey, 1981.
Published by The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

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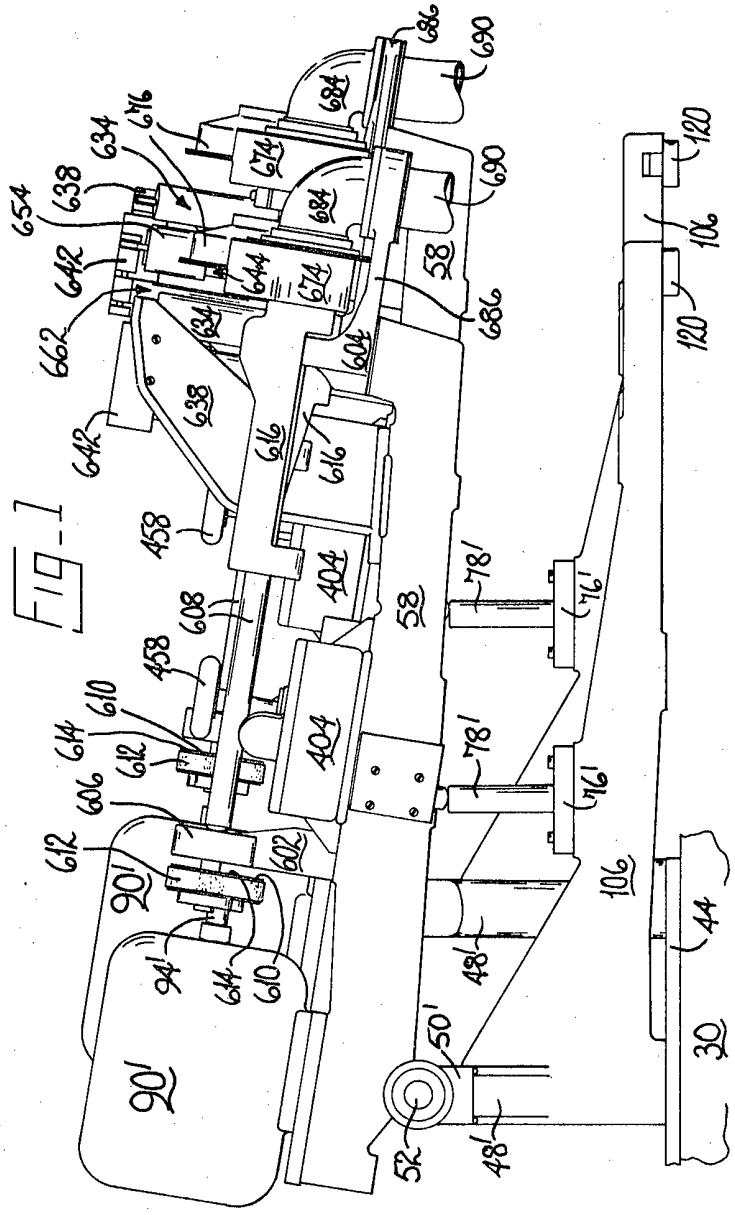

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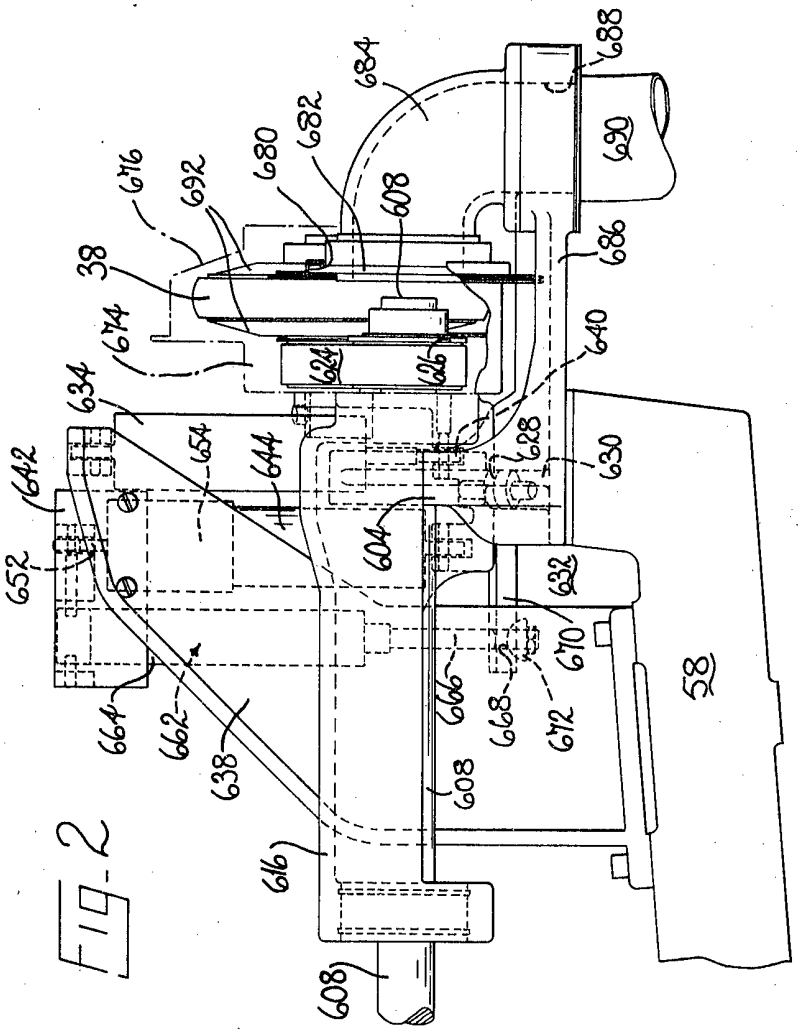

FIG. 2

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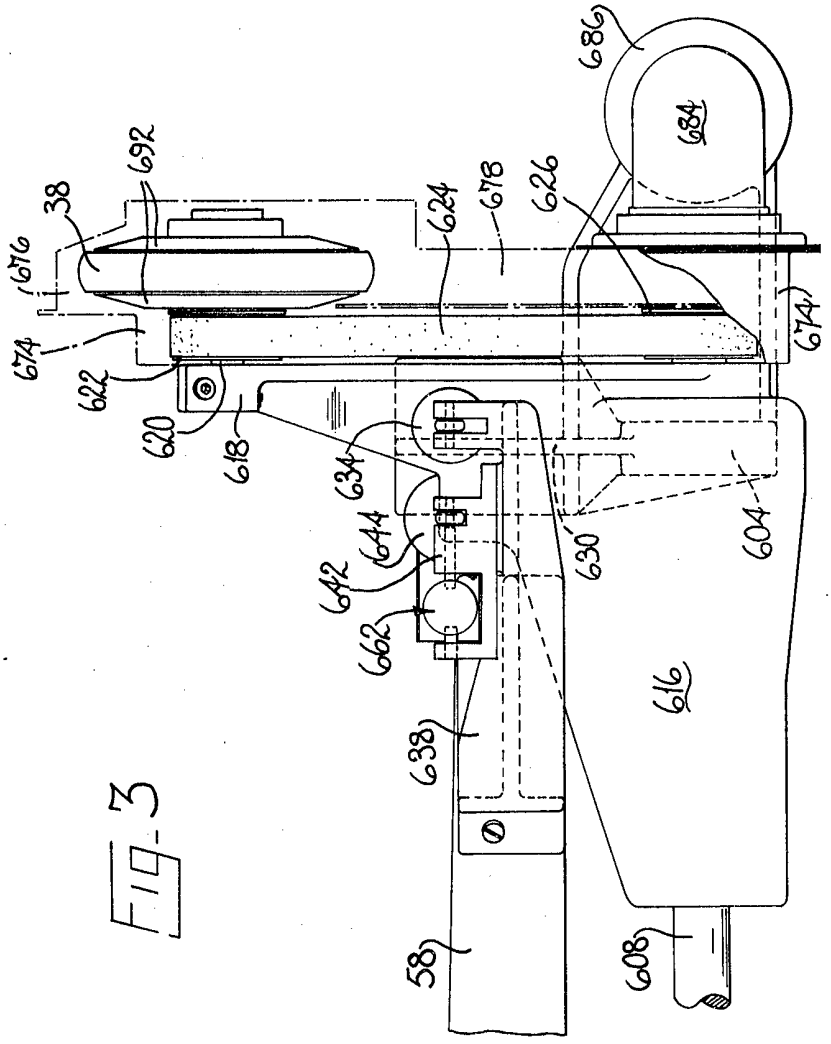

FIG-3

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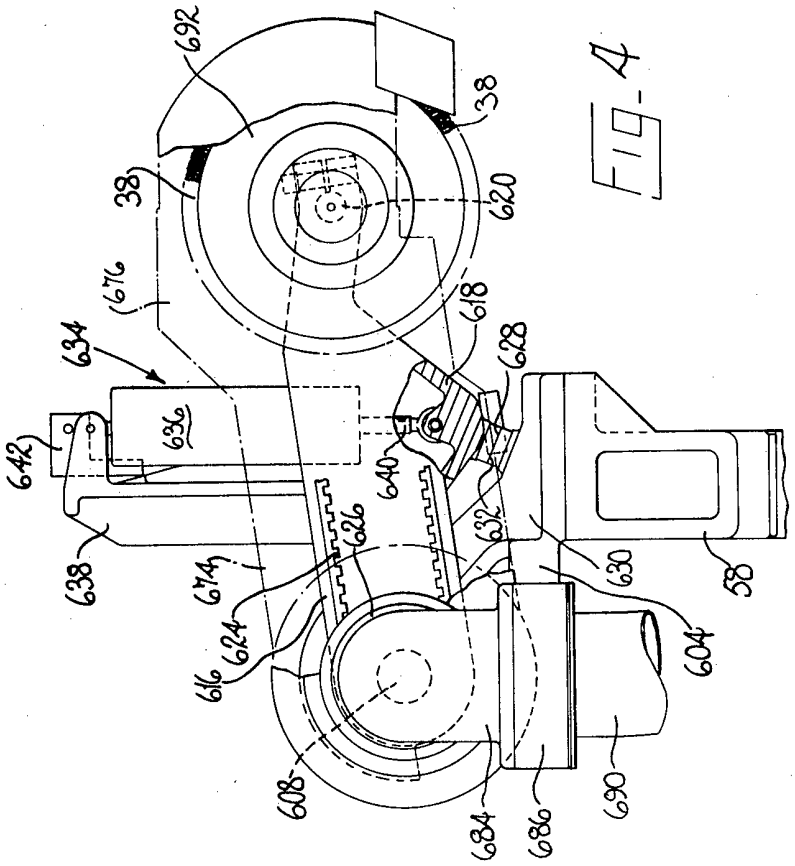

FIG. 4

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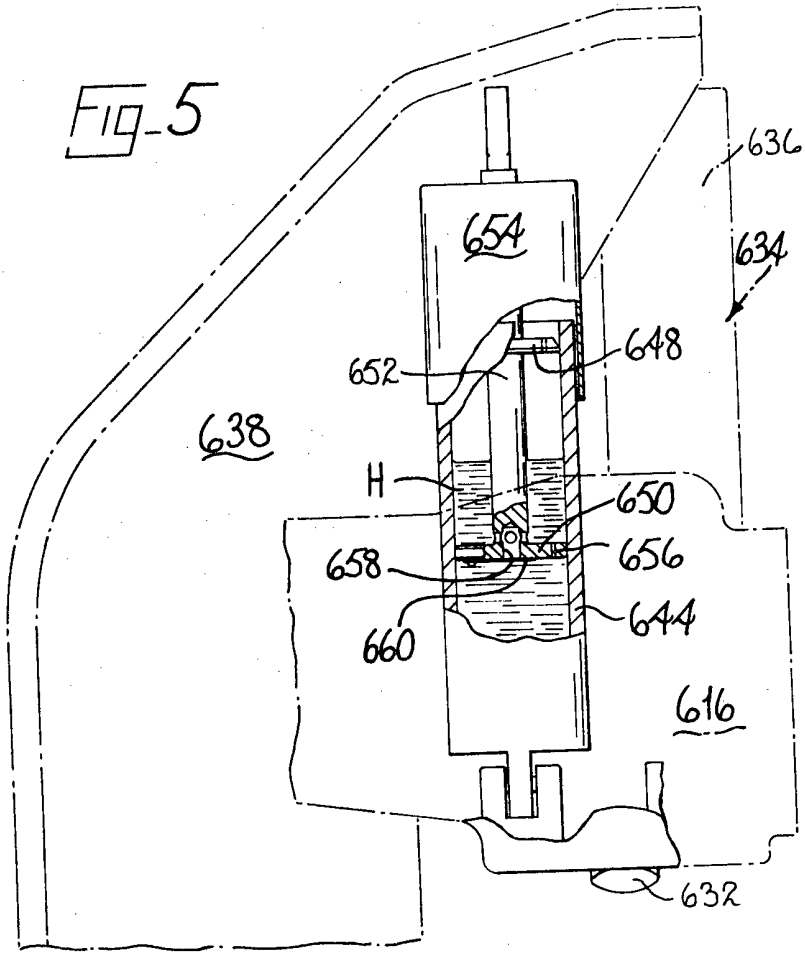
Sheet 5

Fig-5



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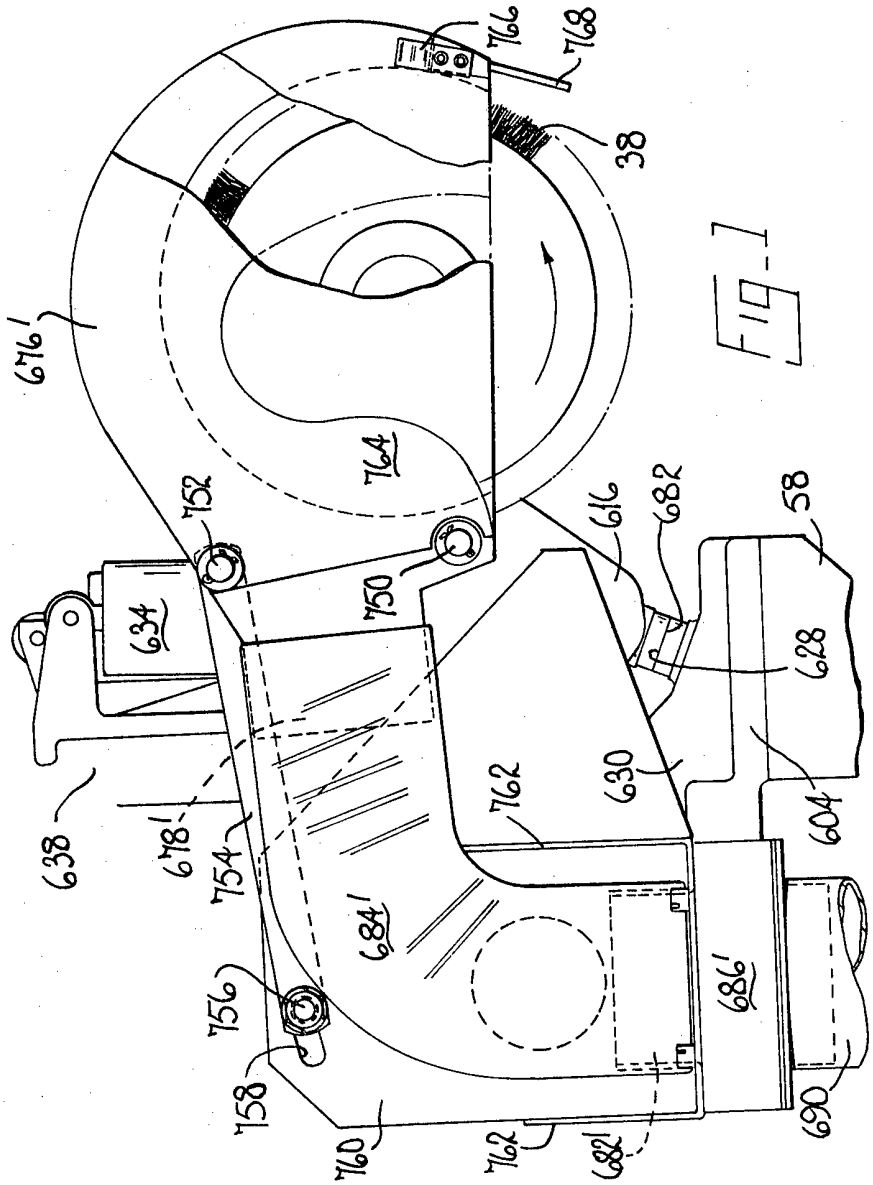

FIG. 1

1585961 PROVISIONAL SPECIFICATION No. 35174/76
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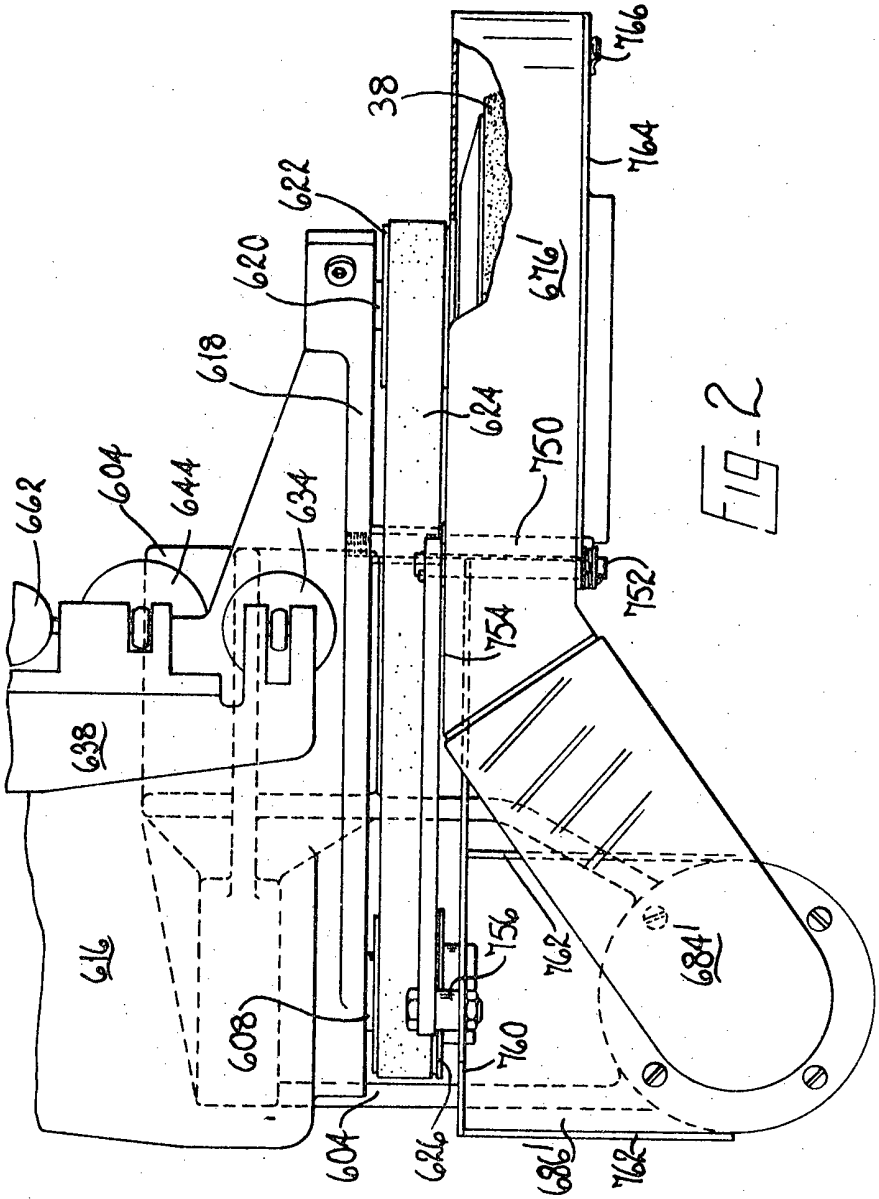

FIG-2