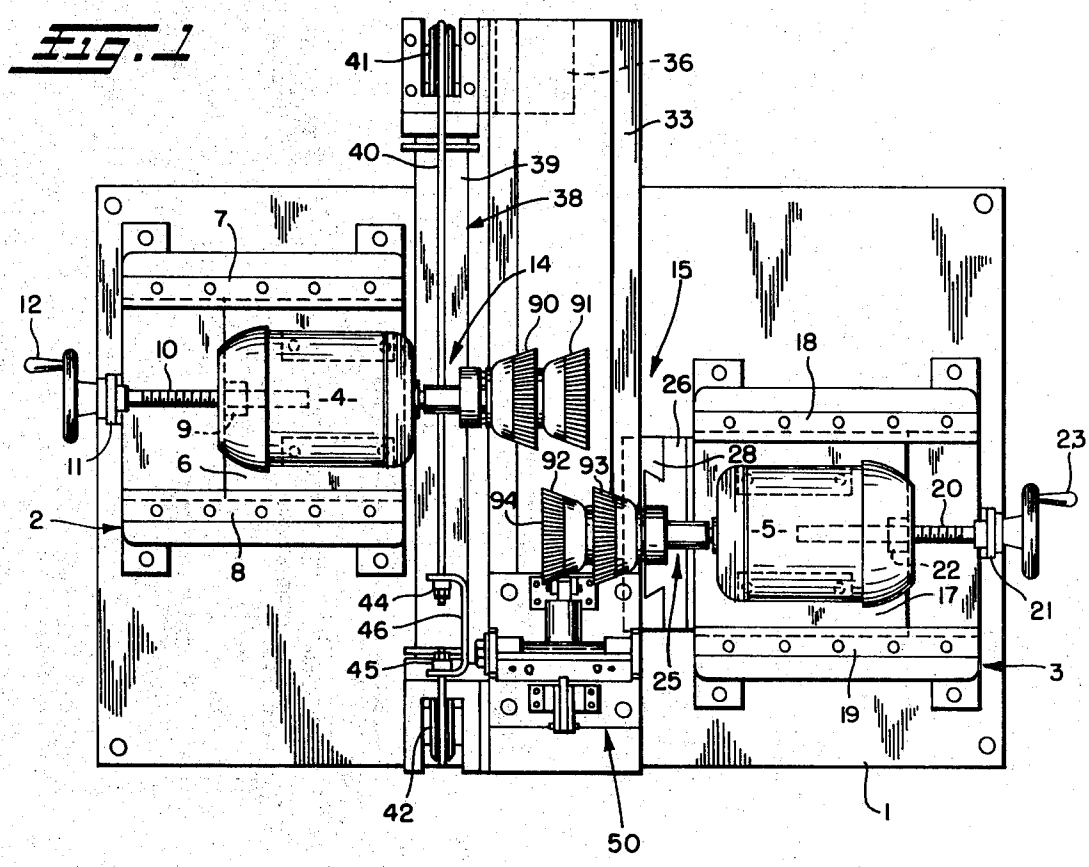
Feb. 9, 1971 J. A. KASNYIK ET AL 3,561,032

BRUSHING MACHINE

Filed Oct. 18, 1968 3 Sheets-Sheet 1

Fig. 1



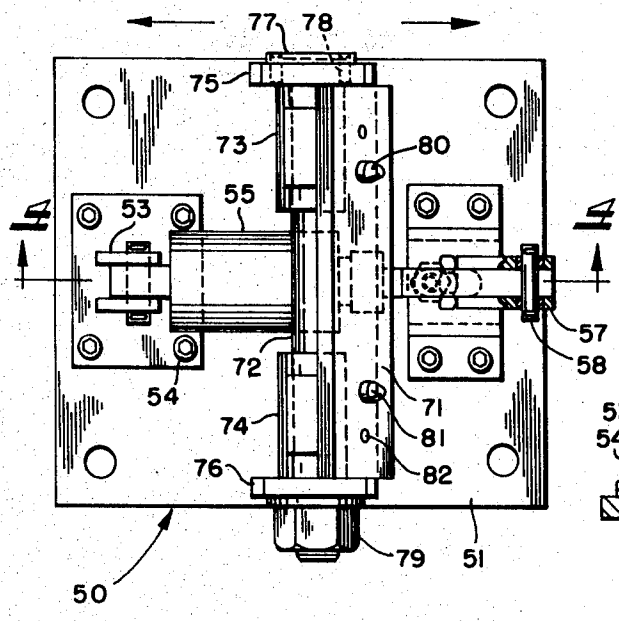
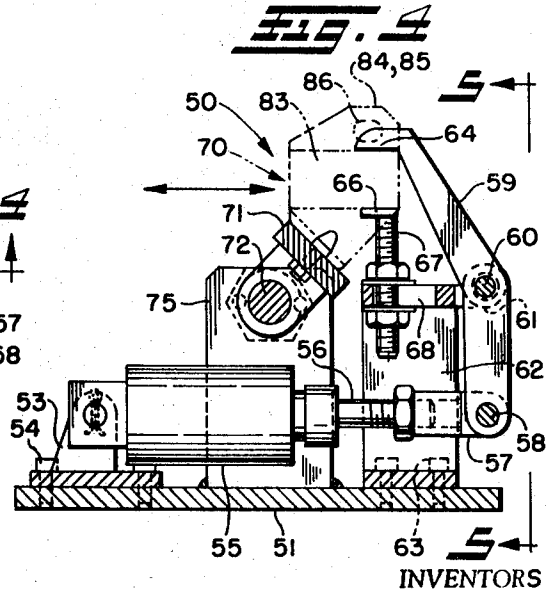


Fig. 3

Fig. 4



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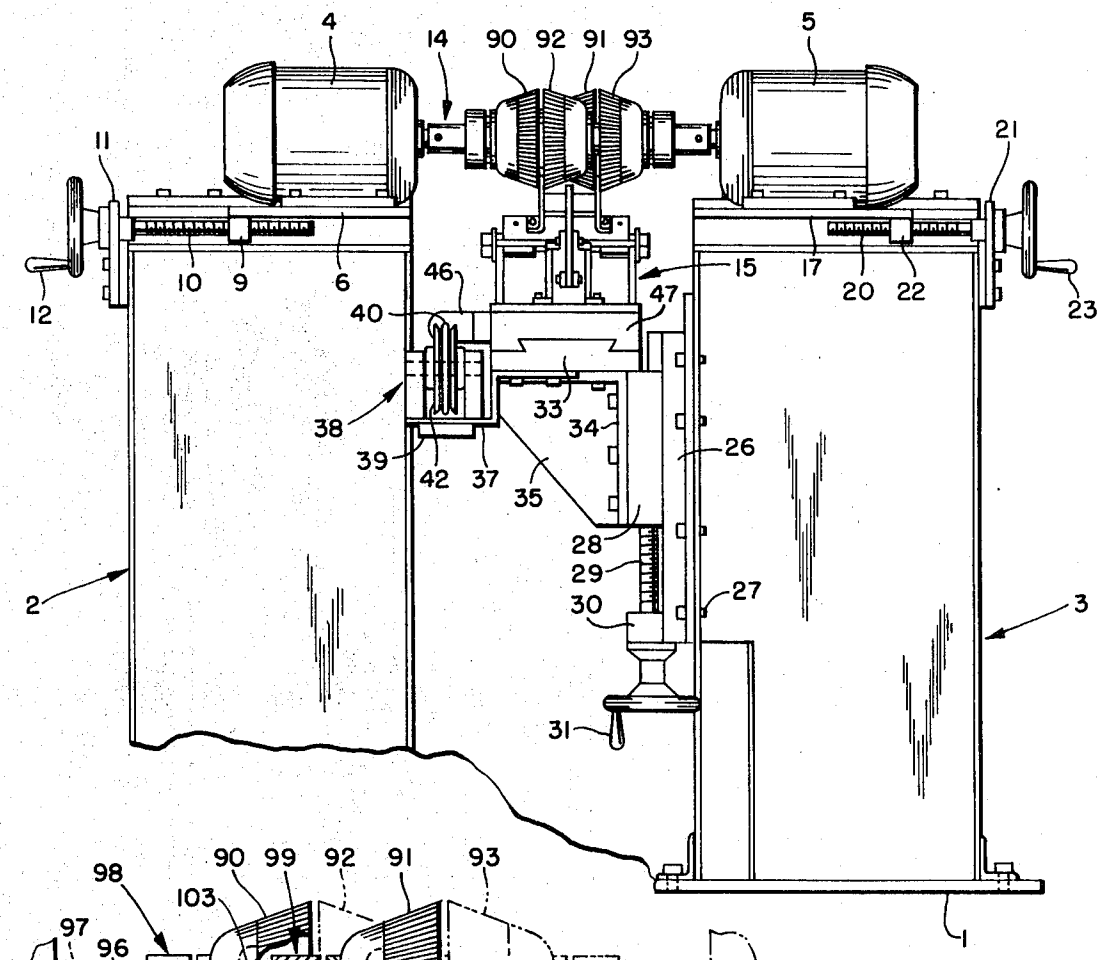
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BRUSHING MACHINE

Filed Oct. 18, 1968 3 Sheets-Sheet 2

Fig. 2



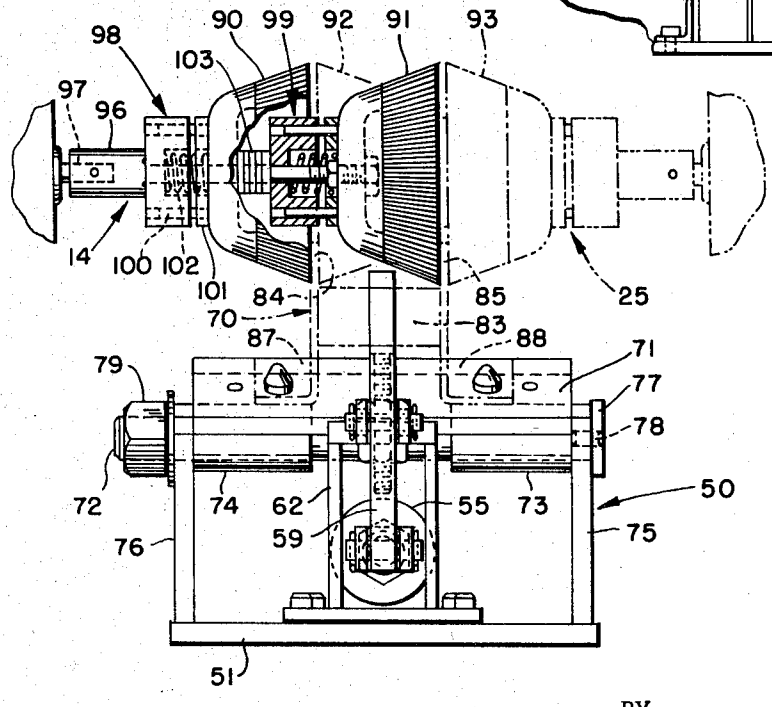


Fig. 5

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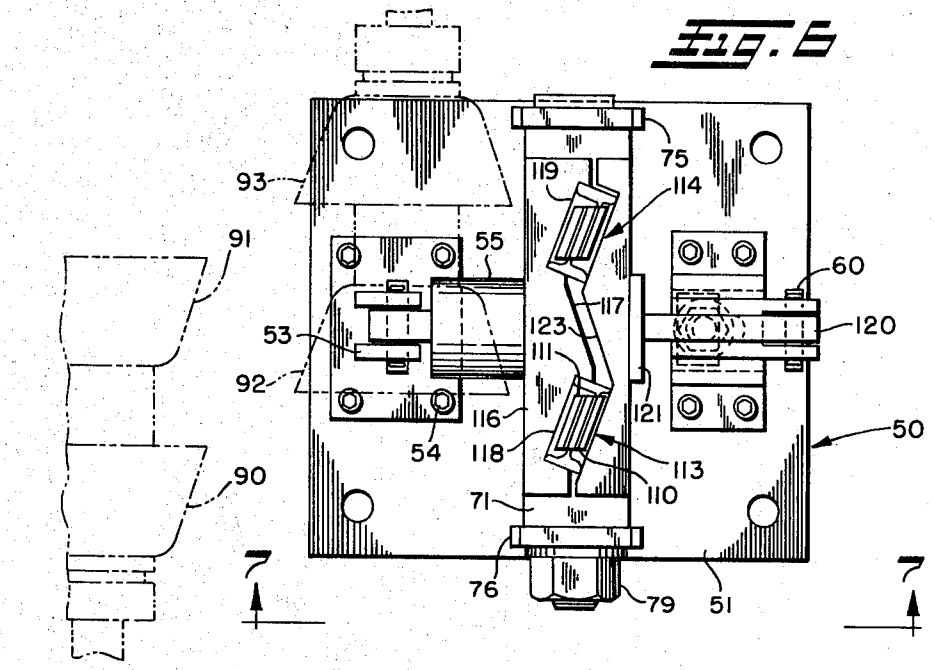
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Feb. 9, 1971 J. A. KASNYIK ET AL 3,561,032

BRUSHING MACHINE

Filed Oct. 18, 1968 3 Sheets-Sheet 3

Fig. 6



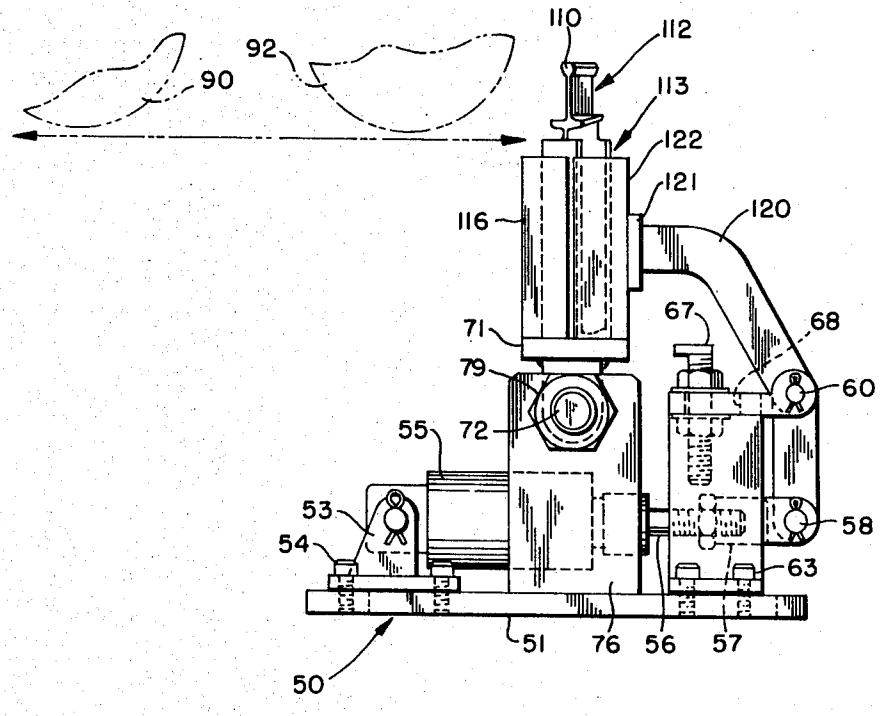


Fig. 7

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3,561,032

BRUSHING MACHINE

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Int. Cl. A46b 13/02
U.S. Cl. 15—21 14 Claims

ABSTRACT OF THE DISCLOSURE

A brushing machine for finishing opposite parallel surfaces comprising a pair of oppositely directed brush spindles, each having a pair of brushes thereon, the inner brush on one cooperating with the outer brush on the other, and a work holding fixture gripping the work and moving the same past the brushes.

This invention relates generally as indicated to a brushing machine and more particularly to a machine for quickly and conveniently cleaning the metallic parallel surfaces of intricate parts.

In the molding of composite rubber-metal objects such as motor mounts, rubber flashing often forms on the exposed metallic surfaces which requires that the parts be subject to a cleaning or flash removal operation. Motor mounts, for example, generally have parallel projecting ears provided with apertures which support thereon the motor or other object. In the rubber molding process, flash often forms on such ears and closes the holes therein. Heretofore, such mounts have been cleaned by a manual brushing operation, generally with hand held tools. The cleaning of such parts has thus been time consuming and costly with the consistency of the finished product being erratic.

Parts such as the root sections of turbine blades must be cleaned or deburred. The parallel end faces of such root sections are at a substantial angle to the blade and accordingly the work is difficult to hold and present properly to a brush face for accurate and efficient finishing.

A principal object is the provision of a brushing machine which includes oppositely directed power driven brush spindles, each having a pair of brushes thereon, the distal brush on one spindle cooperating with the proximal brush on the other to clean the work moving therepast.

It is a further principal object of the present invention to provide a machine for the removal of flash from the projecting metallic parts of composite rubber-metal articles which will do the job in a minimal amount of time and produce a consistently well cleaned product.

Another important object is the provision of a brushing machine utilizing spring loaded cup brushes mounted on oppositely directed brush spindles, the brushing surfaces thereof cleaning the opposite sides of generally planar projecting metal surfaces of the work.

Still another important object is the provision of a machine for accurately holding complex parts such as turbine blades and indexing the same past rotating brushes for precision finishing.

Yet another object is the provision of a brushing machine for the cleaning of metal or composite rubber-metal articles of simplified construction which may readily be adjusted to accommodate different size and types of workpieces.

Still another object is the provision of a brushing machine for cleaning the opposite sides of parallel spaced work surfaces simply by indexing the work through the machine.

Other objects and advantages of the present invention

will become apparent as the following description proceeds.

To the accomplishment, of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

In said annexed drawings:

FIG. 1 is a top plan view of a machine in accordance with the present invention;

FIG. 2 is a front elevation partially broken away of the machine shown in FIG. 1;

FIG. 3 is a top plan view on a somewhat enlarged scale of the work holding fixture;

FIG. 4 is a vertical section of such fixture taken substantially on the line 4—4 of FIG. 3;

FIG. 5 is an enlarged front elevation partially broken away and in section illustrating the workpiece moving between the cooperating brush faces of the machine;

FIG. 6 is a view similar to FIG. 3 illustrating the fixture and machine modified slightly to receive a different type of part such as a turbine blade; and

FIG. 7 is a side elevation taken from the line 7—7 of the FIG. 6 embodiment.

Referring now to the annexed drawings and more particularly to FIGS. 1 and 2, it will be seen that the machine comprises a base 1 on which are mounted two laterally spaced stands 2 and 3 adjustably supporting on the tops thereof brush spindle motors 4 and 5.

The motor 4 is mounted on plate 6 slide guided in gibs 7 and 8 mounted on the top of the stand 2. A nut 9 projects from the underside of the plate 6 and is threadedly connected to adjusting screw 10 journalled in bracket 11 mounted on the exterior of the stand 2. A control handle 12 is provided on the outer end of the screw for rotating the same. The spindle of the drive motor 4 shown generally at 14 projects toward the stand 3 and extends horizontally over the throat 15 or space between the stands 2 and 3.

The drive motor 5 projects in the opposite direction as the drive motor 4 and is similarly mounted on the top of the stand 3 on plate 17 slide guided in gibs 18 and 19. Adjusting screw 20 journalled in bracket 21 is threadedly engaged with the nut 22 projecting from the underside of the plate 17 so that rotation of the screw through handle 23 adjusts the position of the drive motor 5 toward and away from the throat of the machine. The brush spindle 25 of the drive motor 5 projects in the opposite direction as the spindle 14 and is parallel and horizontally coplanar therewith, but axially offset therefrom. The brush spindle 25 like the spindle 14 is cantilevered from the drive motor over the throat 15 of the machine.

Mounted on the interior of the stand 3 within the throat 15 is a slide base 26 secured to the interior of the stand by fasteners 27. The slide is vertically oriented and supports for sliding movement thereon a machine slide 28. Such slide, of course, includes a nut threaded on adjusting screw 29 journalled in bracket 30 at the bottom of the base 26. The screw is rotated by means of the handle 31 vertically to adjust the position of the slide 28.

The slide 28 supports a horizontally elongated slide base 33 by means of the angle brackets 34 which include gusset plates 35. Additional brackets 36 and 37 are secured to the underside of the opposite ends of the slide base 33 and support the opposite ends of pneumatic piston-cylinder assembly 38. Such assembly includes a cylinder 39 having a piston therein to which is secured

flexible cable or rope **40** which extends about sheaves **41** and **42** journalled in fixtures at the opposite ends of the cylinder. The sheaves are, of course, tangent to the axis of the cylinder. The ends of the element **40** are connected at **44** and **45** to bracket **46** secured to the side of slide **47** mounted on the base **33**. The slide **47** supports thereon a work clamping fixture **50** shown in greater detail in FIGS. 3 through 7.

Referring now additionally to such figures, it will be seen that the fixture includes a base plate **51** having corner apertures through which suitable fasteners may extend securing the base plate to the top of the slide **47**. A clevis bracket **53** is secured to the base plate **51** by suitable fasteners **54** and supports the blind end of pneumatic piston-cylinder assembly **55**. The rod **56** of such assembly **55** is adjustably connected to rod clevis **57** which is in turn connected by pin **58** to the lower end of clamp lever **59**. The lever **59** is intermediately pivoted at **60** by means of clevis **61** supported at the front upper end of stand **62**. The stand, like the clevis bracket **53**, is secured to the base plate **51** by suitable fasteners **63**. The upper end of the lever **59** inclines rearwardly and includes a distal clamping portion **64** operative to engage the work when the assembly **55** is extended. A pedestal **66** mounted on screw **67** also assists in supporting the work, the screw passing through slot **68** in the top of the stand **62** and being adjustably secured by the nuts illustrated above and below the slot.

For certain types of workpieces, such as the motor mount **70** illustrated in phantom lines, an additional supporting bar **71** may be provided supported on traverse stud **72** by laterally spaced hubs **73** and **74**. The stud **72** extends through aligned apertures in upstanding ears **75** and **76**. One end of the stud is provided with a head **77** and dowel pins **78** keep the stud from rotating. The opposite end of the stud is threaded and a nut **79** clamps the various parts together holding the bar **71** in adjusted position. The supporting bar **71** is inclined and is provided with pilot pins **80** and **81** removably secured in apertures **82**, a pair being provided at each side of the bar **71**. In this manner, the supporting bar may accommodate motor mounts of different sizes.

Such motor mounts **70** may comprise a block of rubber **83** from which project attaching flanges or ears. At the top lateral edges of the block there extend two ears **84** and **85** provided with apertures **86**. Similar ears having laterally directed inclined flanges **87** and **88** are provided at the bottom of the mount similarly provided with apertures which telescope over the pilots **80** and **81**. The purpose of the machine is to clean or remove flash from the lateral faces of the upstanding ears **84** and **85** above the top surface of the rubber block **83**. Thus the workpiece presents two pairs of oppositely directed planar surfaces with the surfaces of each pair being fairly closely spaced but with such pairs being less closely laterally spaced.

It can now be seen that an operator can quickly place a workpiece **70** on the fixture **50** when the piston-cylinder assembly **55** is retracted and then by extending the piston-cylinder assembly the workpiece will be firmly clamped in position.

To engage the surfaces of the ears **84** and **85** to be cleaned, each brush spindle is provided with two cup brushes, axially aligned and spring loaded toward the distal end of the spindle. Thus the spindle **14** has mounted thereon cup brushes **90** and **91** while the spindle **25** has mounted thereon cup brushes **92** and **93**. The working faces **94** of each of the paired brushes on the respective spindles face in the same direction. The brush **92** cooperates with the brush **90** to clean opposite sides of the ear **84** while the brush **93** cooperates with the brush **91** to clean opposite sides of the ear **85**. Thus with the oppositely directed offset spindles which are horizontally coplanar, the brush on the distal or outer end of one spindle cooperates with the brush on the proximal or inner end of the other spindle. In the at rest position of the machine, the working faces of the cooperating brushes will be substantially in the same vertical plane. When the brushes rotate, the centrifugal force will tend to spread the bristles moving the working face slightly toward the proximal end of the spindle.

As seen more clearly in FIG. 5, each spindle assembly includes an adapter hub **96** securing the spindle assembly to the motor shaft **97**. The brushes **90** and **91** are each mounted on two part hubs seen generally at **98** and **99**. Guide pins **100** project from the smaller portion **101** of each hub into apertures in the larger portion and a compression spring **102** urges the brush axially outwardly. The brush is secured to the smaller portion of each hub while the larger portion is keyed to the shaft or spindle for rotation. Spacers **103** are provided as indicated to obtain the desired brush spacing along the spindle. In this manner, approximately $\frac{1}{16}$ to $\frac{1}{8}$ inch movement is obtained with such springs urging the brushes axially outwardly against the work.

In operation, with the slide **47** at the front of the machine or at the bottom as seen in FIG. 1, the operator simply places the workpiece on the fixture and depresses a start button. This will then immediately extend the piston-cylinder assembly **55** to close the clamping lever **59** holding the workpiece in proper position. As soon as this is accomplished, the piston-cylinder assembly **38** may immediately be energized to move the workpiece through the brush pass. As soon as the slide reaches a predetermined position on the slide base **33**, the piston-cylinder assembly **38** is reversed moving the workpiece back through the brush pass to the starting position thus completing the cycle of operation in a very short time. When the completion of the reciprocatory stroke is obtained, the piston-cylinder assembly **55** may automatically be retracted so that the operator simply then removes the finished work from the machine. Only a single start button need be provided with the machine cycling automatically.

In the embodiment seen in FIGS. 6 and 7, there is illustrated a machine and fixture specially adapted for the brushing or finishing of root sections of turbine blades. As illustrated, with only slight modification of the fixture **50** seen in FIGS. 3 and 4, the machine can be adapted to finish the parallel side edges **110** and **111** of root sections **112** of two turbine blades **113** and **114**.

The bar **71** is clamped in an upright position and is provided with a back or support **116** having a specially profiled front face **117** which includes two skew notches **118** and **119** adapted to receive the unfinished blade portions of the blades **113** and **114**.

The lever **59** of the FIG. 4 embodiment may be replaced by lever **120** which, like lever **59**, is pivoted at **58** and **60**. The upper end of the lever **120** is provided with a transverse bar **121** to which is secured support **122** having a profiled face **123** viz-a-viz face **117** of support **116**. When the piston-cylinder assembly **55** is extended, the faces of supports **116** and **122** cooperate to clamp and properly position the two workpieces or turbine blades therebetween.

For the workpieces illustrated in FIGS. 6 and 7, the brushes may be spaced slightly differently on the respective spindles, this being readily accomplished with the addition of or removal of spacers. Regardless of the type of workpiece, such as the motor mount ears or the turbine blades (either may be considered one workpiece or two, one with four surfaces or the other with two each), the operation of the clamping and indexing fixture will be the same.

It will, of course, be appreciated that a plurality of such fixtures may be provided on a continuous conveyor or the like which will grip the workpiece at the front of the machine and release it at the back of the machine for automatic discharge. It has, however, been found that the reciprocating stroke moving the work past the brushes twice affords an excellent finishing operation. The operator need only then quickly set up the machine to handle the desired size or type of workpiece and such

workpieces can then be placed into the machine to move through the cleaning cycle and removed in a matter of seconds.

As a preferred form of cup brush, it is desirable to use a cup brush in which the bristles are encapsulated in a foamed elastomeric material such as polyurethane. TY cup brushes commercially available from The Osborn Manufacturing Company of Cleveland, Ohio are preferred for the finishing or flash removal operation.

It can now be seen that there is provided a simplified brushing machine which can easily be set up to accommodate various sizes and types of workpieces having a pair of oppositely directed power driven brush spindles each having a pair of brushes mounted thereon with the brush on the distal end of one spindle cooperating with the brush on the proximal end of the other quickly and completely to clean the work surfaces moving therepast.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

We, therefore, particularly point out and distinctly claim as our invention:

1. A brushing machine comprising a pair of oppositely directed power driven brush spindles, a pair of brushes mounted on each spindle, the working face of the brush on the distal end of one spindle cooperating with the working face of the brush on the proximal end of the other spindle to form substantially parallel cleaning zones, and means to move a workpiece through such zones for engagement with said working faces.

2. A machine as set forth in claim **1** wherein said spindles are horizontally coplanar.

3. A machine as set forth in claim **1** wherein the working faces of the cooperating brushes are substantially in the same plane.

4. A machine as set forth in claim **1** wherein said brushes are cup brushes with the working face of the brushes on each shaft facing in the same direction.

5. A machine as set forth in claim **1** wherein said last mentioned means includes a work holding fixture and means to move said fixture normal to the axis of said spindles.

6. A machine as set forth in claim **5** wherein said means to move said fixture comprises a pneumatic cylinder operative to reciprocate said fixture and thus such workpiece past said brushes first in one direction and then in the opposite direction.

7. A machine as set forth in claim **6** wherein said fixture includes a pneumatically operated clamp operative firmly to hold such workpiece to said fixture.

8. A machine as set forth in claim **1** wherein the brushes on said spindles are spring loaded urging the working faces thereof against the work moving therepast.

9. A brushing machine for finishing the opposite faces of projecting laterally spaced workpieces and the like thus providing at least four projecting surfaces to be finished comprising a pair of horizontally coplanar axially offset brush spindles, at least two cup brushes on each spindle, the working face of each brush engaging one of the surfaces to be finished.

10. A brushing machine comprising two laterally spaced stands, a drive motor on the top of each stand, said drive motors being axially offset from each other, brush spindles driven by said motors and projecting over the space between said stands, at least two work engaging brushes on each spindle, a work holding fixture, and means mounting said fixture for movement between said stands in a direction normal to the axis of said spindles.

11. A machine as set forth in claim **10** wherein said last mentioned means comprises a machine slide, and means vertically to adjust the position of said slide.

12. A machine as set forth in claim **11** including means operative to reciprocate said fixture along said slide.

13. A machine as set forth in claim **12** wherein said fixture includes a piston-cylinder operated work holding clamp.

14. A machine as set forth in claim **13** including means operative to adjust the position of said motors and spindles axially of the spindles.

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15—77; 51—112