April 3, 1951 H. C. STIEGLITZ 2,547,057

POLISHING MACHINE FOR IMPELLER WHEELS

Filed April 6, 1948

Fig. 1

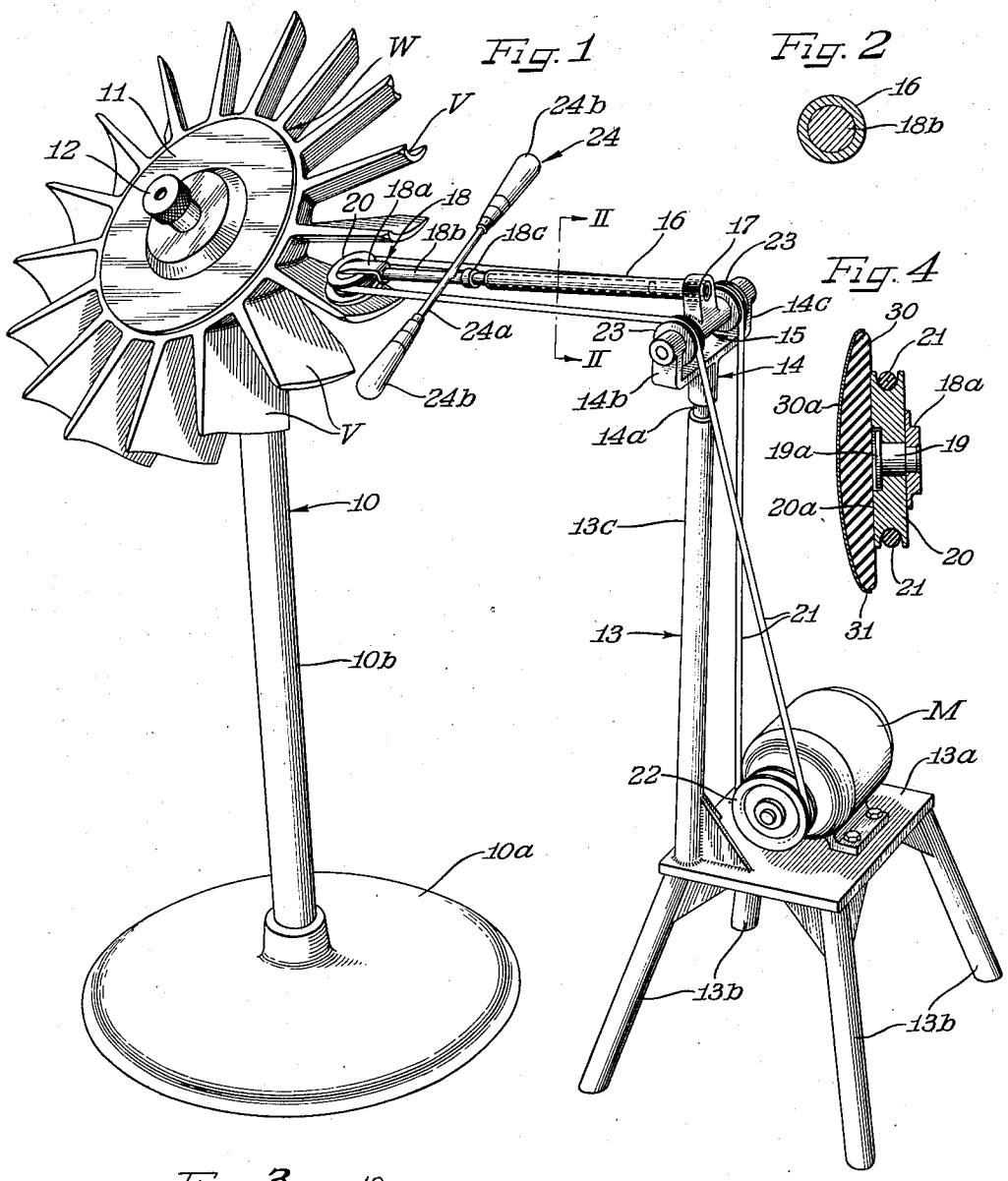
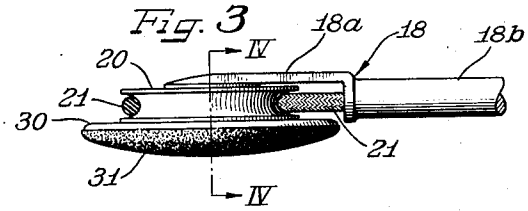


Fig. 2

Fig. 4

Fig. 3



Inventor
Henry C. Stieglitz

by The Firm of Charles H. Kells Attys

Patented Apr. 3, 1951 2,547,057

UNITED STATES PATENT OFFICE

2,547,057

POLISHING MACHINE FOR IMPELLER WHEELS

Henry C. Stieglitz, Cleveland, Ohio, assignor to Thompson Products, Inc., Cleveland, Ohio, a corporation of Ohio

Application April 6, 1948, Serial No. 19,403

7 Claims. (Cl. 51—170)

1

This invention relates to a polishing machine, and particularly to a machine for performing polishing operations upon complex surfaces of a workpiece, such for example, as the vane surfaces of an impeller wheel.

In the manufacture of impeller wheels or similar complex workpieces by milling operations, the surfaces of the vane elements of such wheels after the milling operation are not generally as smooth as required for optimum adiabatic efficiency. Accordingly, it has been customary to polish such complex surfaces by rotating or traveling belt abrasive elements as a finishing operation in the manufacturing process. The term impeller wheels is used herein in a generic sense and is intended to include any element having circumferentially spaced, fluid guiding vanes thereon, including, of course, turbines and inducers.

The polishing of the convexly formed vane surfaces of an impeller, or similar workpiece, may be conveniently performed by a machine incorporating an abrasive element in the form of a traveling endless belt, such, for example, as is described and claimed in my copending application Serial No. 15,536, filed March 18, 1948. However, such a machine cannot be successfully employed to effect the polishing of the concave surfaces of the impeller vanes by virtue of the fact that the generally concave configuration of such vanes effectively prevents the traveling abrasive belt from contacting all portions of the vane surface. It is, of course, possible to employ portable polishing elements of the motor driven, hand held type, but such machines are necessarily of substantial weight and since the weight must be entirely supported by the operator, they are very fatiguing to use. Furthermore, and more important, the amount of surface removed by such hand held, motor driven machines varies substantially over the surface of any particular vane since it is entirely dependent upon how much of the weight of the machine the operator permits the surface being polished to assume. Obviously, such arrangements are very unsatisfactory from the standpoint of speed, cost and quality of the polishing operation.

Accordingly, it is an object of this invention to provide an improved polishing machine, particularly a machine for rapidly and uniformly effecting the polishing of the complex surface of a workpiece such as the vane surface of an impeller wheel.

Another object of this invention is to provide an improved polishing machine wherein a polishing wheel is power driven by a suitable prime mover but is universally, manually movable with respect to the surface being polished, and further, suitably supported so that the operator is

2

required to assume only a small fraction of the total weight of the polishing apparatus.

Still another object of this invention is to provide an improved polishing wheel construction particularly adaptable to polishing generally concave complex surfaces, such as the concave vane surfaces of an impeller wheel.

The specific nature of this invention as well as other objects and advantages thereof will become apparent to those skilled in the art from the following detailed description of the annexed sheet of drawings which, by way of preferred example only, illustrate one specific embodiment of the invention.

On the drawings:

Figure 1 is a perspective view of a polishing machine constructed in accordance with the principles of this invention.

Figure 2 is a sectional view taken on the plane II—II of Figure 1.

Figure 3 is an enlarged scale, side elevational view of the polishing wheel employed in the machine of Figure 1.

Figure 4 is a sectional view taken on the plane IV—IV of Fig. 3.

As shown on the drawings:

For clarity of illustration, the invention has been shown and will be described in its simplest form. Referring to Fig. 1, a work supporting fixture 10 is provided comprising a pedestal having a large base portion 10*a*, and an upstanding tubular support post 10*b*. On the top of support post 10*b*, a conventional work supporting fixture (not shown) is secured in any convenient manner. The details of such fixture form no part of this invention and hence the fixture will not be further described. The fixture is so arranged as to rigidly support a workpiece having the complex surfaces to be polished, such as an impeller wheel W having concave vane surfaces V. A clamping plate 11 and a locking nut 12 are provided, the locking nut 12 being threaded upon a suitable projecting bolt and projecting through the central bore of the workpiece secured to the work fixture (not shown) so as to clamp the plate 11 tightly against the workpiece W and thus rigidly secure such workpiece to the work support fixture 10. Obviously, by loosening of the clamping bolt 12, the workpiece may be angularly indexed about its own axis through any desired angle required to successively position the vane surfaces V in the polishing position.

A frame structure 13 is provided in association with the work fixture 10 and, in the simplest case, such structure may be formed entirely separate of the work fixture 10 or, if desired, may be incorporated in a unitary mounting with the work fixture 10. As shown on the drawings, the frame structure 13 comprises a plate-like platform 13*a* supported by spaced legs 13*b* and

an upstanding tubular support 13c which is suitably secured, as by welding, to one corner of the plate of the platform 13a. The platform 13a may be conveniently utilized to mount an electric motor M or similar prime mover for driving the polishing wheel in a manner to be described.

At the top of support tube 13c, a universal joint structure 15 is provided by which a secondary support tube 16 may be mounted for universal swiveling movement with respect to the frame structure 13. For example, such universal joint arrangement may comprise a yoke 14 having a stem portion 14a rotatable in the top of primary tubular support 13c. A T-shaped yoke element 17 has the opposed arms thereof respectively journaled in the spaced, upstanding arms 14b and 14c of the yoke 14a. The secondary support tube 16 is in turn threadably secured to the stem portion of the T-shaped yoke 17.

A wheel supporting bracket 18 is provided having a wheel supporting flange 18a secured to one end of an elongated rod-like body portion 18b. The body portion 18b is slidably and rotatably received in the bore of the secondary support tube 16 and hence the wheel support bracket 18 may be axially and rotatably shifted with respect to the secondary support tube 16. An enlarged collar portion 18c is formed on the rod-like portion 18b to limit the depth of insertion of the rod-like portion 18b into the secondary support tube 16.

The wheel mounting flange portion 18a has a shaft 19 (Figure 4) suitably secured therein in cantilever relationship. Shaft 19 in turn journals a grooved pulley 20 and retains the pulley 20 thereon by virtue of having an enlarged head portion 19a which seats in a suitable counterbore provided in the outer face of the pulley 20. Pulley 20 is rotated at a suitable speed for polishing operations by a resilient belt 21 which communicates with a pulley 22 keyed to the shaft of the driving motor M. Belt 21 is guided in its peripheral movements around universal joint 15 by a pair of pulleys 23 respectively journaled on the opposed arms of the T-shaped yoke 17. The belt 21 is sufficiently resilient so as to maintain the driving connection between the motor M and the pulley 20 through all of the various positions which the pulley 20 may attain relative to the frame structure 13 through the universal swiveling movements permitted by the universal joint 15 and the rotational and axial movements permitted by the telescopic joint between the secondary support tube 16 and the wheel bracket 18. To facilitate the manual manipulation of the wheel bracket 18 with respect to the support frame 13, a handle unit 24 is rigidly secured to the wheel bracket 18, as by welding, and comprises a central rod portion 24a and handle members 24b suitably secured to each end of the rod portion.

From the foregoing description, it is apparent that the securement of an abrasive surface on the exposed face of the pulley 20 would provide a polishing element capable of following the contours of a very complex surface, including both generally concave and convex configurations. In accordance with this invention, such abrasive surface is preferably formed by cementing or otherwise rigidly securing to the exposed face 20a of the pulley 20 a pad 30 of rubber or similar flexible material. Such pad preferably has an outer face 30a of spherical or spheroidal configuration. A sheet of abrasive material 31 is then cemented to such outer face. Hence the overall configuration of the pulley 20 and the abrasive portion thereof is of generally mushroom shape and such configuration is of particular assistance in achieving the polishing of all of the concave vane surfaces of a workpiece such as an impeller wheel, without marring an adjacent vane.

In operation, the handles 24b are grasped by the operator and the wheel bracket 18 thereby advanced axially outwardly with respect to the secondary support tube 16 to bring the abrasive surface 31 on the rotating pulley 20 into engagement with a selected vane surface of the impeller wheel W. Since the wheel bracket 18 may be freely moved in any direction with respect to the support frame 13, and hence with respect to the vane surface V of the workpiece W, it is apparent that all portions of such surface may be engaged by the rotating abrasive surface formed on the pulley 20. When sufficient polishing has been accomplished, the operator retracts the wheel support bracket 18 into the secondary support tube 16 and thus moves the pulley 20 completely away from the workpiece W. Of course, a slight swiveling movement of the secondary support tube 16 about the vertical axis will also move the pulley 20 laterally out of engagement with the vane surfaces of the workpiece. The workpiece W may then be angularly indexed on the work fixture about its axis to bring the next vane surface V thereof into the proper position for polishing operation.

It should be particularly noted that in all operations, the unsupported mass of the apparatus to be supported by the operator is extremely light and obviously represents only a small fraction of the weight to be supported when employing hand held motor driven devices of the type heretofore utilized. Furthermore, substantially the same pressure may be applied to all surface portions of any particular vane or to the successive vanes, since the operator may safely permit the vane surface to assume substantially all of the support of the swivelly supported polishing wheel. Such arrangement not only greatly reduces the fatiguing effect upon the operator but also greatly improves the uniformity of polish achieved upon the successive surfaces of the workpiece. As a result, the polishing operation is more rapidly accomplished by the operator and a higher quality and more uniform polish is obtained.

It will, of course, be understood that various details of construction may be modified through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. Apparatus for polishing a complex surface of a workpiece comprising a fixture for rigidly supporting a workpiece, a frame structure adjacent said fixture, a wheel bracket, a polishing wheel journaled on one end of said wheel bracket, said wheel having a rounded abrasive surface thereon, an elongated support element telescopingly receiving the other end of said wheel bracket, whereby said wheel bracket may be freely rotatably and linearly shifted with respect to said support element, means for securing said support element to said frame for universal swiveling movements with respect to said frame, whereby said polishing wheel may be shifted to follow the contour of the complex surface of the workpiece, means for rotating said polishing wheel independently of the position of said wheel

bracket, and means for manually manipulating said wheel bracket relative to the workpiece, whereby the abrasive surface of said wheel may be engaged with all portions of the complex surface of the workpiece.

2. Apparatus for polishing a complex surface of a workpiece comprising a fixture for rigidly supporting a workpiece, a frame structure adjacent said fixture, a wheel bracket, a wheel journaled on one end of said wheel bracket, a flexible abrasive pad secured to one end face of said wheel, an elongated support element telescopingly receiving the other end of said wheel bracket, whereby said wheel bracket may be freely rotatably and linearly shifted with respect to said support element, means for securing said support element to said frame for universal swiveling movements with respect to said frame, whereby said polishing wheel may be shifted to follow the contour of the complex surface of the workpiece, means for rotating said wheel independently of the position of said support bracket, and means for manually manipulating said wheel to follow the contour of the complex surface of the workpiece, thereby engaging said abrasive surface of the wheel with all portions of the complex surface.

3. Apparatus for polishing a complex surface of a workpiece comprising a fixture for rigidly supporting a workpiece, a frame structure adjacent said fixture, a wheel bracket, a polishing wheel journaled on one end of said wheel bracket, an elongated supporting element telescopingly receiving the other end of said wheel bracket, whereby said wheel bracket may be freely rotatably and linearly shifted with respect to said support element, means for securing said support element to said frame structure for universal swiveling movements with respect to said frame structure, whereby said polishing wheel may be shifted to follow the contour of the complex surface of the workpiece, a motor mounted on said frame, a resilient belt connecting said motor to said polishing wheel in driving relation, thereby continuously rotating said polishing wheel independently of the position of the polishing wheel with respect to said frame structure, and means for manually manipulating said wheel bracket to follow the contour of the complex surface of the workpiece, thereby effecting the polishing of all portions of said complex surface.

4. Apparatus for polishing a complex surface of a workpiece comprising a fixture for rigidly supporting a workpiece, a frame structure adjacent said fixture, a wheel bracket, a flanged pulley journaled on one end of said wheel bracket, a flexible abrasive pad secured to one end face of said pulley, an elongated support element telescopingly receiving the other end of said wheel bracket, whereby said wheel bracket may be freely rotatably and linearly shifted with respect to said support element, means securing said support element to said frame for universal swiveling movements with respect to said frame, whereby said pulley may be shifted to follow the contour of the complex surface of the workpiece, a motor mounted on said frame structure, a resilient belt connecting said motor to said flanged pulley in driving relation, thereby continuously rotating the abrasive surface of said pulley independently of the position of said pulley with respect to said frame structure, and means for manually manipulating said wheel bracket to move said abrasive surface of the pulley into engagement with all portions of the complex surface of the workpiece.

5. Apparatus for polishing a complex surface of a workpiece comprising a fixture for supporting a workpiece, a frame structure adjacent said fixture, a wheel bracket, a wheel shaft secured to one end of said wheel bracket in cantilever relationship, a flanged pulley journaled on the free end of said wheel shaft, a resilient abrasive pad overlying the entire face of said flanged pulley remote from said wheel bracket, said wheel bracket having an elongated rod-like portion extending perpendicular to the axis of said wheel shaft, a tubular support telescopically receiving said rod-like portion to permit both rotational and axial movements of said wheel bracket with respect thereto, universal joint means for mounting said support tube on said frame structure, whereby said wheel may be manually shifted to follow the contour of the complex surface of the workpiece, a motor fixed to said frame, and a resilient belt connecting said motor to said wheel to said flanged pulley in driving relation.

6. Apparatus for polishing a workpiece comprising a support structure, a motor on said support structure, an upright tubular member secured to said support structure, a shaft supported in said tubular member for rotational movement therein, a yoke secured to said shaft having upstanding arms with aligned openings defining an axis, a bearing member journaled in said openings for pivoting on said axis, pulleys rotatably mounted on the yoke on each side of the bearing member, a second tubular member secured in said bearing member and extending away therefrom, a support arm rotatable and slidable in said second tubular member, a processing member rotatably mounted on the end of said support arm, and a resilient looped belt driven by the motor and trained around the pulleys and processing member to rotate the member irrespective of its position relative to the tubular members.

7. Apparatus adapted to polish the complex surface of a workpiece which comprises a fixture adapted to support a workpiece having a complex surface to be polished, a frame structure adjacent said fixture, a yoke member journaled for rotation on said frame structure about a first axis, an elongated tube pivotally mounted on said yoke member for rotation about a second axis, a support member slidable and rotatable in said tube, a wheel rotatably mounted on said support member, a motor on said frame structure, and a resilient belt driven by said motor and trained over the yoke member and around the wheel for rotating the wheel, whereby the wheel can be positioned as desired about the first and second axes and along the axis of the tube without shifting the motor.

HENRY C. STIEGLITZ.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
306,772	Pratt et al.	Oct. 21, 1884
500,710	Gillette et al.	July 4, 1893
894,807	Bates	Aug. 4, 1908
1,227,622	Hope	May 29, 1917
1,308,933	Cavicchi	July 8, 1919
1,413,928	Mummert et al.	Apr. 25, 1922
1,800,307	Marschke et al.	Apr. 14, 1931
2,447,102	Strand	Aug. 17, 1948
2,484,906	Pond et al.	Oct. 18, 1949