Jan. 5, 1932. J. C. RICHARDSON 1,840,254

POLISHING APPARATUS

Filed June 27, 1929 2 Sheets-Sheet 1

Fig. 1.

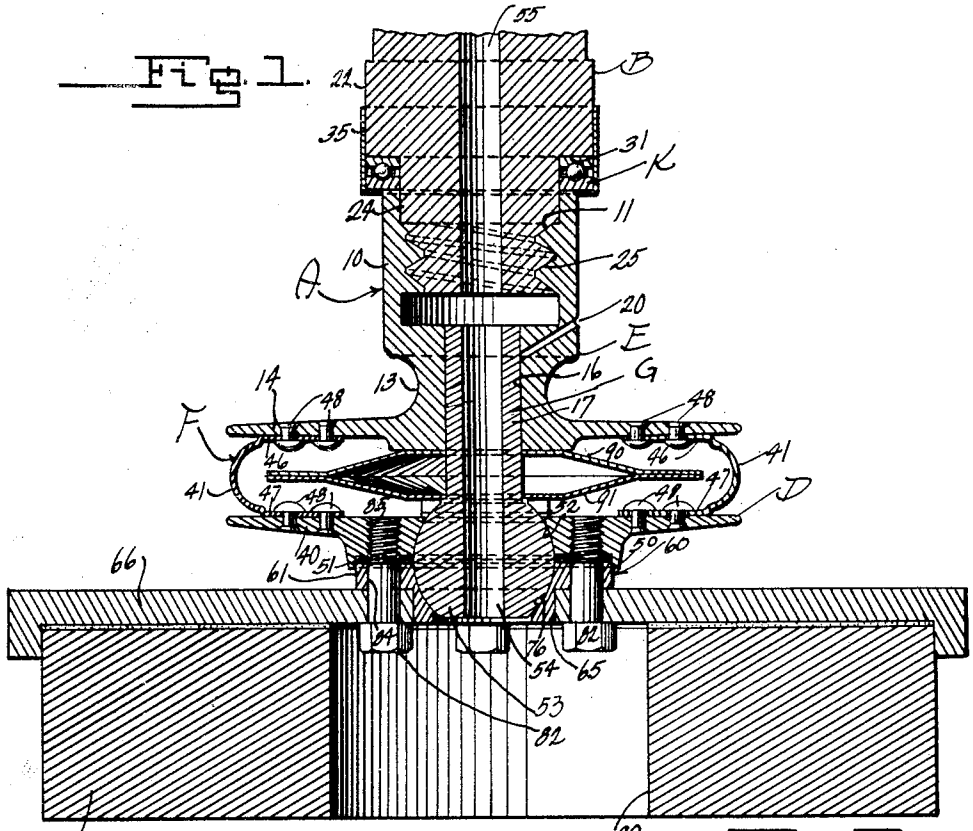


Fig. 3.

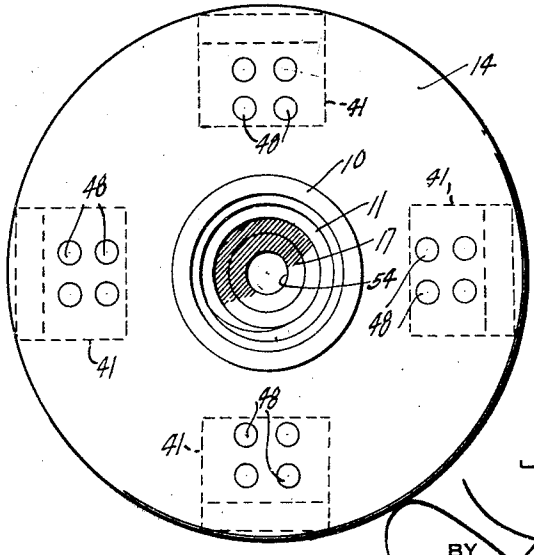
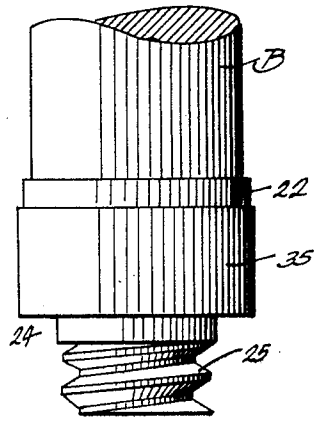


Fig. 2.



INVENTOR.
James C. Richardson

BY Lancaster and Allwine

ATTORNEYS.

Jan. 5, 1932. J. C. RICHARDSON 1,840,254

POLISHING APPARATUS

Filed June 27, 1929 2 Sheets-Sheet 2

Fig. 4.

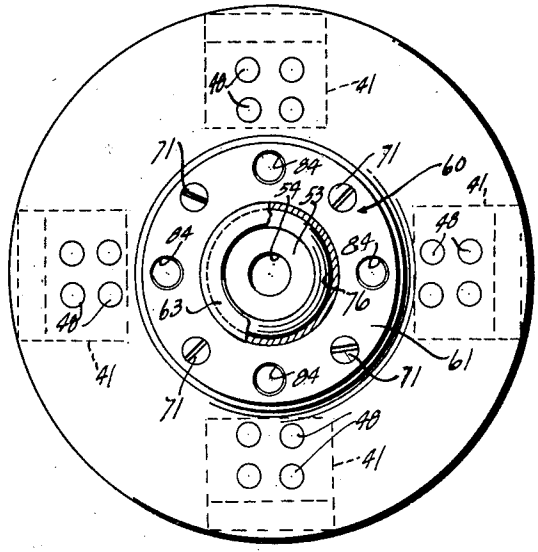
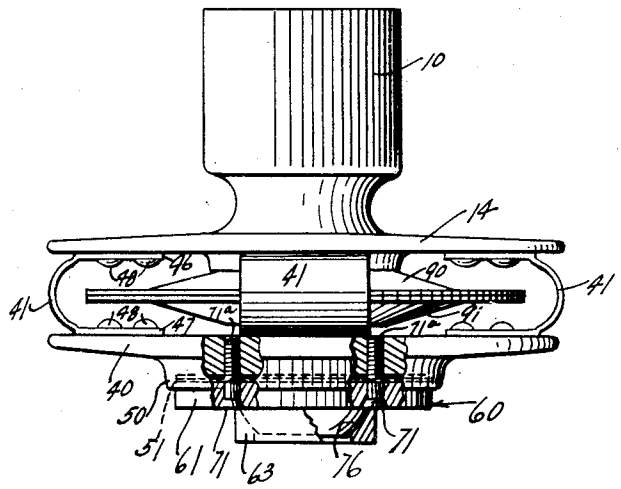


Fig. 5.



INVENTOR.

James C. Richardson

BY Lancaster & Allwine

ATTORNEYS.

Patented Jan. 5, 1932

1,840,254

UNITED STATES PATENT OFFICE

JAMES C. RICHARDSON, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO I. FISCHMAN & SONS, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION

POLISHING APPARATUS

Application filed June 27, 1929. Serial No 374,205.

This invention relates to improvements in polishing apparatus adaptable for the polishing of marble, lenses, and the like.

The primary object of this invention is the provision of an improved polishing head adapted to be used for high speed rotary polishing, and including improved means to resiliently support the polishing stone or element in a resilient and aligned relation with the driving element, against liability of eccentric or gyratory action, and so that the polishing element will adjust itself to the general plane or contour to which it is intended to polish off the article being worked upon.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, wherein for the purpose of illustration is shown only a preferred embodiment of the invention,

Figure 1 is a vertical sectional view taken through the improved polishing head, showing it connected to a power or drive shaft.

Figure 2 is a fragmentary view, partly in section, showing the lower end of the drive shaft where the same is to be connected to the improved polishing head.

Figure 3 is a top plan view of the polishing head with the polishing element disconnected therefrom.

Figure 4 is a bottom plan view, partly in section, of the elements shown in Figure 3.

Figure 5 is a side elevation, partly in section, of details of the polishing head disconnected from the polishing element.

In the drawings, wherein similar reference characters designate corresponding parts throughout the several views, the letter A may generally designate the improved polishing head, adaptable for attachment to a driven or power shaft B. The polishing head A preferably comprises a polishing stone or element C connected to supporting means D. A body portion E is connected with the drive shaft B and resiliently connected as by means F to the means D. Means G cooperating with the means D is associated with the body E for holding the polishing stone C in a concentric rotary relation to the drive shaft B, in a flexible and resilient relation.

The body E preferably comprises a cylindrical shaped socket portion 10, provided with the relatively coarse internal screw threads 11. The cylindrical socket portion 10 is open at the top thereof, and connected by a reduced shank 13 with a relatively flat circular plate 14 at the lower end thereof, which in the assemblage of the polishing head, may be appropriately referred to as the top plate. A cylindrical passageway 16 is provided axially through the body E, extending from the socket opening in the portion 10 thereof through to the bottom of the plate 14. It is adapted to slidably receive the hollow cylindrical shank portion 17 of the aligning member G. The inclined lubricating duct 20 may extend through the body E from exteriorly thereof to the passageway 16, for lubricating the relatively sliding surfaces of the aligning member or joint member G and the passageway 16.

The power or drive shaft B is slightly enlarged near its lower end, at 22, and is of cylindrical formation. It is provided with a reduced shank 24 at the lower end thereof, externally screw threaded with coarse threads 25, shown best in Figure 2 of the drawings. These screw threads are adapted to detachably connect in the screw threaded socket 11 of the body 10 of the polishing head, and they thread onto the threads 11 opposite to the normal direction of rotation of the polish head; it being intended that the drive shaft B shall always rotate in one direction, since there is no need for reversing, and by oppositely threading the connection of the shaft to the head there will be no liability of detaching of the parts during operation.

Due to the above screw threaded connection, to prevent a binding of parts, and permit of easy detachment of the head from the power shaft, it is preferred to provide an anti-friction thrust bearing generally designated at K in Figure 1 of the drawings, which is disposed beneath the shoulder 31 formed at the juncture of the reduced shank 24 with the portion 22 of the drive shaft, and adapted to be abutted by the upper edge of the body 10 when the latter is assembled to the drive shank 24. The said anti-friction

bearing K preferably comprises upper and lower races with ball bearings therebetween, and held in place by a metal connecting collar 35 which may be force-fitted or screw threaded to the end 22 of the power shaft B, as shown in the drawings. Thus, the thrust bearing is at all times held on the lower end of the drive shaft, although the body 10 of the polishing head may be disconnected from the shank 24. It is of course understood that the connecting piece 35 has a lower annular flange which holds the races in position, but does not interfere with the engagement of the body 10 with the lower race of said bearing.

The lower construction D preferably includes a member or so-called bottom plate 40, which is connected in spaced yieldable relation to the plate 14 by resilient substantially U-shaped springs 41. The said springs are arranged in diametrically opposed relation, two sets of the same being provided, with the springs spaced 90° apart about the axis of rotation. The said springs 41 have the convex sides of their concavo-convex portions facing outwardly, and the legs 46 and 47 of said springs are substantially in flat abutment with the facing surfaces of the plates 14 and 40 respectively, and riveted thereto as at 48, as well shown in Figure 1 of the drawings. Thus the arcuated bight portions of the springs 41 are disposed close to the outer margins of the plates 14 and 40, and connect the plates together so as to permit the relative tipping of the same. These springs are relatively strong, and yet they yield under operating influence to perform the objects of the invention. The plate 40 is furthermore provided with a central thickened portion having a depending annular flange 50, defining a downwardly facing socket wherein a plurality of shims 51 may be provided in any approved number, for a purpose to be subsequently described. The said plate 40 axially thereof is provided with a concave socket 52 facing downwardly, which opens at the lower face of the plate and arcuates upwardly in a convergent relation to the top surface of the plate 40. It is adapted to swivelly receive the ball-shaped head 53 of the aligning member G.

The aligning member G, as above mentioned, includes the shank 17, which is of hollow cylindrical formation, and at the lower end thereof it is provided with the ball 53, which swivelly fits into the socket 52. The said shank has a snug sliding reciprocatory seating in the passageway 16 of the body E, and it extends downwardly below the bottom of the plate 14. A passageway 54 is provided through the aligning member G, from end to end, axially thereof, and which aligns with the axial passageway 55 through the shaft B, so that flushing and lubricating fluids may pass downwardly through the shaft B and onto the surface being polished, for a purpose well understood in this art.

The construction D furthermore includes a complementary socket providing member 60, which as is shown in Figures 1 and 5 of the drawings, includes the upper circular body portion 61, of a size to fit in the socket provided by the flange 50, and rest against the shims 51 in said socket. The shims are for the purpose of taking up wear. The member 60 furthermore includes the reduced lower shank 63, preferably circular, and of a nature to fit in the top opening 65 of the polishing stone supporting base 66. The portion 61 of the member 60 is detachably connected with the plate 40 by means of countersunk head machine screws 71, shown in Figure 5 of the drawings, which have a screw threaded connection in screw threaded openings 71ª provided in the plate 40, as shown in Figure 5; these screws 71 being provided in the arrangement shown in Figure 4 of the drawings. They are countersunk at their lower head ends in the member 60. The said member 60 is provided with a concave socket 76 complementary with the socket 52 above mentioned, and converging downwardly from the top surface thereof to the restricted outlet opening at the lower end through the shank 63, as shown in Figure 1 of the drawings, which is adapted, together with the socket 52, to receive the ball 53 of the aligning member G, in a universal jointed relation.

The polishing stone C is preferably of cylindrical formation, although it may be otherwise shaped if desired. It is provided with the relatively large passageway 80 therethrough, and at its upper portion fits in the metal base 66, which in turn above the opening 80 of the stone C, is connected by cap screws 82 with the lower construction D of the polishing head; the member 60 being provided with openings 84 therethrough to permit the cap screws to freely extend therethrough, and the plate 40 has screw threaded openings 85 therein for receiving the screw threaded portions of the shanks of the screws 82. The heads of the cap screws lie beneath the base 66 where the same overhangs the opening through the polishing stone, as shown in Figure 1.

With the parts in the arrangement so far described, the polishing stone is yieldably connected for high speed rotary drive by the power shaft B, thru the springs 41 connected between the plates 14 and 40. In addition there is preferably provided a pair of resilient dish-shaped plates interposed in the space between the ball 53 of the aligning member G and the top plate 14. These plates shown in Figure 1 comprise upper and lower spring disc plates 90 and 91, the former of which is inverted and at its central portion bulged

upwardly to engage the top plate 14, and the lower of which is bulged downwardly to engage the top portion of the ball 53 where it is connected with the shank 17 of the aligning member G. The marginal flanges of the plates 90 and 91 are in abutment annularly about the shank 17 and between the plates 14 and 40 and within the outer confines of the bight portions of the springs 41. Due to the central relatively opposite bowed or dished portions of the springs 90 and 91, the same will resiliently urge the polish head away from the plate 14.

In operation, it can be seen from the above that the polishing stone C will relatively adapt itself to the plane of the surface being polished independent of the angularity of the drive shaft B. The stone will be concentrically disposed at all times with respect to the rotary axis of the drive shaft, preventing gyratory or eccentric movements, and this is mainly due to the novel interposition of the member G which is universally connected with the portion D of the head, and slidably connected axially to the body of the head which is rigidly connected with the drive shaft B. Of course, it is intended that the device shall use a plurality of stones during some polishing actions, since under some circumstances it is intended that the polishing shall first proceed with a rough cutter, and then with a succession of medium cutters, and finally with a fine polishing stone. Due to the interposition of the yielding parts between the plates 14 and 40, there will be a high factor of safety, preventing injury to operators. The device is intended to operate at high speed and will level polish with great accuracy. The flushing liquid will of course pass through the passageways 55 and 54 and through the large passageway in the polishing stone to reach the surface being polished for cleansing and lubricating the same. The parts are mainly of brass and bronze, to prevent rust and corrosion. Due to the self aligning head feature and the yieldability of the stone with respect to the drive shaft, a smooth, flat, and true surface will be insured upon the article being polished.

In lieu of the plate-like dish springs 90 and 91 there may be substituted a block of rubber or coil springs, to perform the function of transmitting the pressure or weight required to give the proper polishing results. It is readily understandable that the reciprocatory action of the shank of the aligning member G enables a variable pressure to be exerted upon the polishing stone, to increase or decrease the frictional engagement with the surface being polished, and yet admit of no eccentric action of the polishing head on the surface being polished. This is mainly due to the reciprocatory action of the shank in the body portion E of the head, and also to the resilient connections above described. No mis-alignment of the polishing stone will occur as the pressure is varied.

When the polishing stones come into contact with irregular surfaces on the article being polished, the same will tilt due to the novel resilient connections without coming out of alignment. The driving springs being independent of the pressure springs transmit the driving force or torque, and also perform the additional function of rubbing down the high spots on the marble or other article which is being polished. It is understandable that when a high spot is encountered upon the article being polished, the driving springs directly thereabove will be slightly compressed, causing an increased pressure on the high spot, with the result that the high spot is ground down until the surface is flush with other surfaces adjacent thereto. This must automatically result wherever a high spot is encountered, and ultimately the surface will be ground true, that is, until the pressure exerted by the connecting springs 41 is equal. All the time that the leveling is being done the polishing stone is truly concentric. It is important that the shank of the aligning member G is relatively short, so that the distance between the polishing stone and the lower connecting end of the drive shaft is relatively small.

Various changes in the shape, size, and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In a polishing arrangement a drive construction, a polisher, bowed springs of the leaf type connecting the polisher with the drive construction so that the polisher is resiliently connected with the drive construction for rotation therewith and to permit angular tipping with respect to the axis of rotation of the drive construction, other spring means acting axially of the drive construction and polisher to force the latter away from the drive construction along the axis thereof, and other means universally connected with the polisher and having an axial sliding connection with the drive construction to hold the polisher in a concentric driving relation with the drive construction.

2. In polishing apparatus a drive shaft having a fluid passageway therethrough, a polishing head having operative connection with the drive shaft and including a resiliently supported polish member, and a universal joint having connection with the polishing member and axially slidable with respect to the drive shaft provided with a passageway therethrough adapted to receive fluid from the drive shaft passageway for transmittal to the polishing member.

3. In a polishing head a drive shaft con-

necting member, a polisher, a member connected to the polisher, means resiliently connecting the last mentioned member to the drive shaft connectable member with a driving connection, and an aligning member having axial slidable connection with the first mentioned member and a universal jointed connection with the second mentioned member.

4. In a polishing head a drive shaft connecting member, a polisher connecting member, a resilient means establishing a rotary driving connection between said members so that the members may tip to change the axial relation thereof, and aligning means having a slidable connection with one of said members and a universal jointed connection with the other of said members.

5. In a polishing head of the class described a body including a body for connection to a drive shaft, a polisher, a member, means to detachably connect the member to the polisher, means yieldably connecting the body to said member to establish a rotary driving connection between them and permit relative axial movement angularly, means associated with the member and the body holding them in concentric rotary operating relation, said last mentioned means including a universal joint connection with the said member and an axial slidable connection in said body.

6. In a polishing device the combination of a drive shaft having an attaching end provided with an axial passageway therein, a polishing head including a portion having a central socket therein, an aligning member including a ball portion and a shank rigid therewith, the shank slidably fitting for rectilinear relative motion in the passageway of said drive shaft, and the ball portion thereof being received in universal jointed relation in the central socket of the polisher head, and means yieldably establishing a drive connection between the said end of the drive shaft and the facing portion of the polisher head so that the latter may tip universally upon the ball portion of said aligning member.

7. In a polishing device the combination of a drive shaft having an attaching end provided with an axial passageway therein, a polishing head including a portion having a central socket therein, an aligning member including a ball portion and a shank rigid therewith, the shank slidably fitting for rectilinear relative motion in the passageway of said drive shaft, the ball portion thereof being received in universal jointed relation in the central socket of the polisher head, means yieldably establishing a drive connection between the said end of the drive shaft and the facing portion of the polisher head so that the latter may tip universally upon the ball portion of said aligning member, said drive shaft having a water conveying passageway axially therethrough and the aligning member having a water conveying passageway axially therethrough for receiving water from the passageway of the drive shaft for discharge into the polisher head.

8. In a polishing device the combination of a drive shaft having an attaching end provided with an axial passageway therein, a polishing head including a portion having a central socket therein, an aligning member including a ball portion and a shank rigid therewith, the shank slidably fitting for rectilinear relative motion in the passageway of said drive shaft, the ball portion thereof being received in universal jointed relation in the central socket of the polisher head, means yieldably establishing a drive connection between the said end of the drive shaft and the facing portion of the polisher head so that the latter may tip universally upon the ball portion of said aligning member, and resilient diaphragm plates peripherally connected together having central passageways therethrough for receiving the shank of the aligning member therethrough, said diaphragm plates being disposed between the said end of the drive shaft and the polisher head for normally urging the latter away from the said end portion of the drive shaft.

9. In a polishing device the combination of a drive shaft, a short attaching body detachably connected to the end of the drive shaft and having an axial passageway therein aligning with the drive shaft, a polisher having a central socket therein, an aligning member provided with a shank slidably mounted for rectilinear movement in the passageway of said attaching body and having a ball head universally jointed in the socket of said polisher member, and means establishing a yieldable driving connection between the said attaching body and the polisher member whereby the latter may tip for universal movement upon the ball head of said aligning member.

JAMES C. RICHARDSON.