Nov. 6, 1934. H. GOLDBERG 1,979,325

GRINDING AND POLISHING APPARATUS

Filed Oct. 1, 1931 2 Sheets-Sheet 1

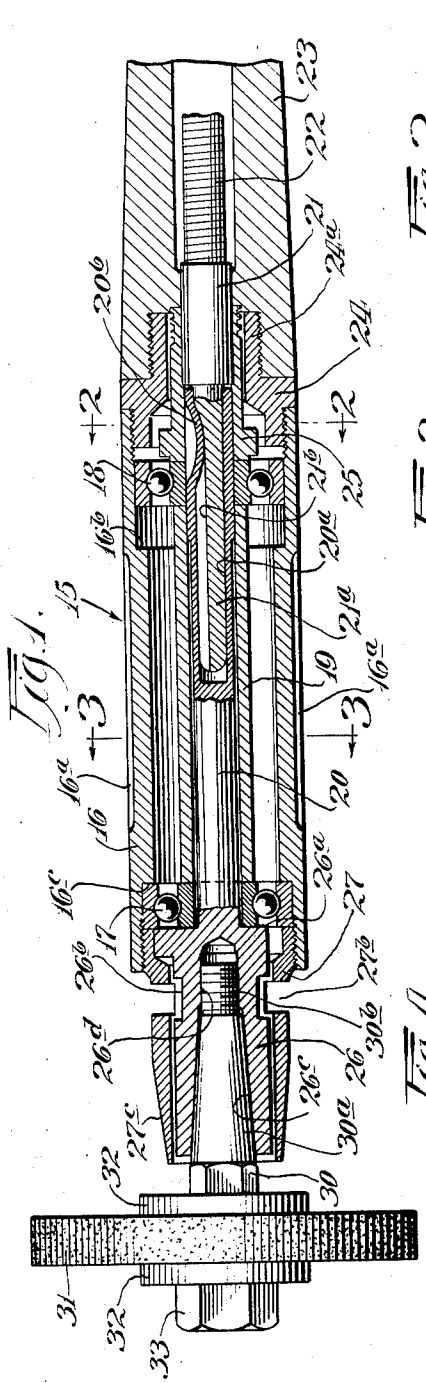


Fig. 1.

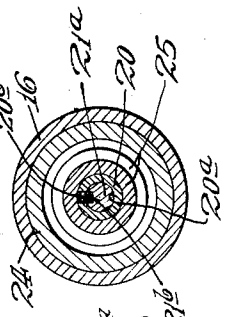


Fig. 2.

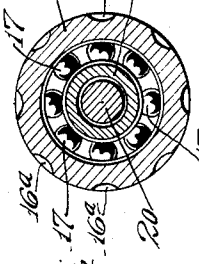


Fig. 3.

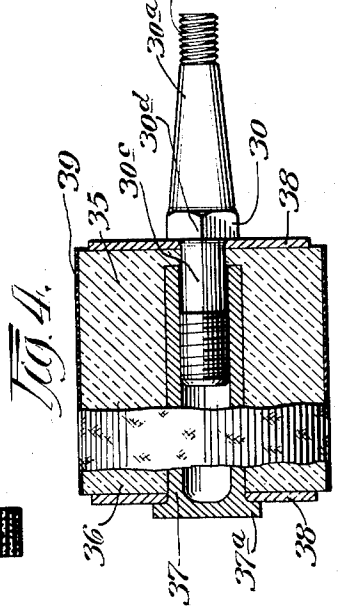


Fig. 4.

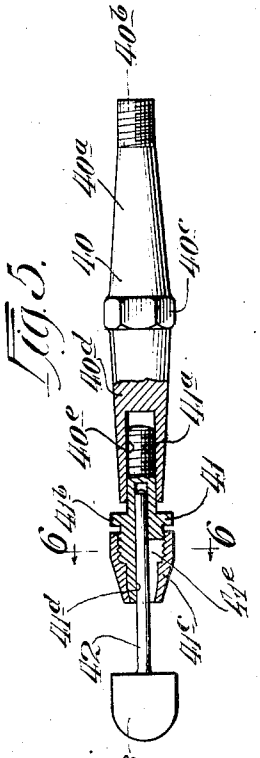


Fig. 5.

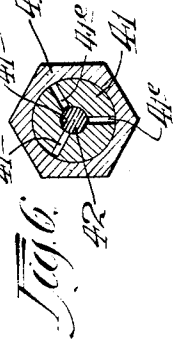


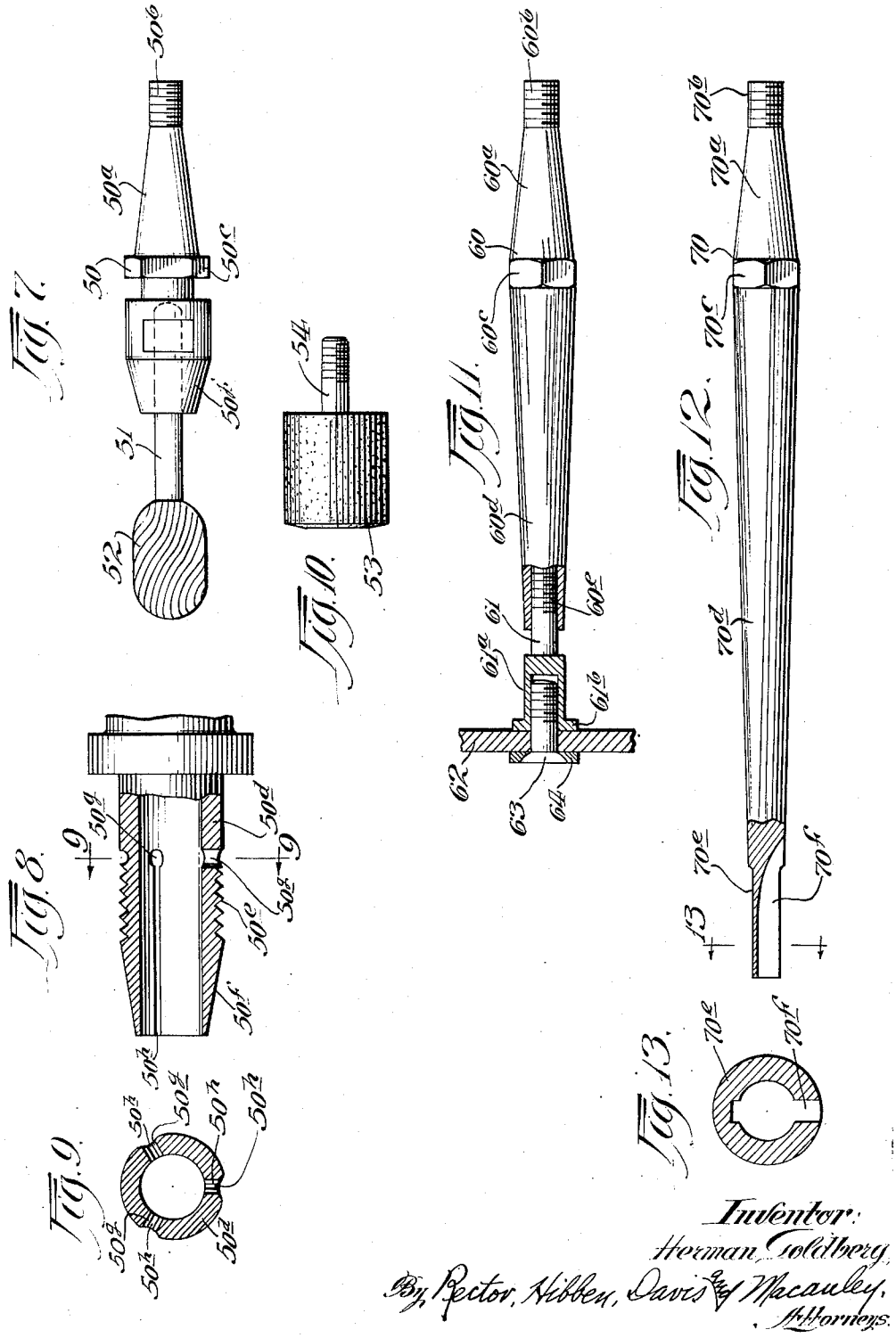
Fig. 6.

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GRINDING AND POLISHING APPARATUS

Herman Goldberg, Chicago, Ill.

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2 Claims. (Cl. 51—170)

This invention relates to improvements in apparatus adapted particularly for use in grinding and polishing operations where it is desired to use a rotary power driven member for operating any one of a plurality of grinding or polishing implements. Heretofore no satisfactory apparatus has been known which would permit of the use of a great variety of implements adapted for polishing, grinding and the like, without the necessity of changing a great number of parts when substituting one tool for another. The principal object of the present invention is to provide an improved apparatus which will permit the ready substitution of one tool for another without requiring the disassembly of any considerable part of the apparatus and without requiring the maintenance of a great variety of parts. A further object of the invention is to provide improved apparatus comprising a rotary member adapted to receive any one of a plurality of different devices having identical parts to interfit therewith. Another object of the invention is to provide an improved apparatus, adapted to be driven by a rotary shaft, and including an improved spindle assembly having means for receiving and operating any one of a great variety of different devices. Other objects relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which one embodiment of the improved spindle assembly and several forms of devices and tools for cooperation therewith, are illustrated.

In the drawings,

Figure 1 shows a longitudinal section of one form of the improved spindle assembly having mounted therein one form of grinding tool which is illustrated in elevation;

Fig. 2 shows a transverse section taken on the line 2—2 of Fig. 1;

Fig. 3 shows a transverse section taken on the line 3—3 of Fig. 1;

Fig. 4 shows an enlarged longitudinal section through a portion of a modified form of grinding or polishing implement mounted upon an arbor adapted to be received by the spindle assembly shown in Fig. 1;

Fig. 5 shows a side elevation of a modified form of spindle, carrying a chuck having mounted therein an emery cone or polishing wheel, the chuck and a portion of the spindle being shown in section;

Fig. 6 shows an enlarged transverse section taken on the line 6—6 of Fig. 5;

Fig. 7 shows a side elevation of another form of arbor adapted to be received by the spindle assembly shown in Fig. 1, this arbor or spindle comprising a chuck in which is mounted a rotary file;

Fig. 8 shows an enlarged longitudinal section through a portion of the chuck illustrated in Fig. 7;

Fig. 9 shows a transverse section taken on the line 9—9 of Fig. 8;

Fig. 10 shows a side elevation of a polishing wheel adapted to be mounted in the form of spindle-chuck shown in Fig. 7;

Fig. 11 shows another form of spindle or arbor adapted to be received by the apparatus shown in Fig. 1 and having mounted therein a mandrel adapted to carry a polishing disk or the like;

Fig. 12 shows a side elevation of another form of spindle or arbor adapted to be received by the apparatus shown in Fig. 1, with the tool engaging portion thereof illustrated in longitudinal section; and

Fig. 13 shows an enlarged transverse section on the line 13—13 of Fig. 12.

As illustrated in the drawings, the spindle assembly, illustrated generally at 15, comprises a spindle tube 16 adapted to be mounted at the end of a flexible driving shaft and having its outer surface longitudinally grooved as shown at 16^a in order to permit it to be firmly gripped by the hands of the operator as he moves it about during the operation of polishing or grinding, for example. This tube 16 is counter-bored from its opposite ends to form two annular shoulders 16^b and 16^c. The counter-bored portions are adapted to receive the two ball bearing assemblies 17 and 18, each of which comprises an inner ring and an outer ring with a series of spherical balls mounted between the two rings. The outer ring of one of these ball bearing assemblies 17 fits against the shoulder 16^c and the inner rings of the two bearing assemblies are spaced apart by a spacing sleeve 19 in which is mounted the spindle shaft 20. This shaft has secured thereon the inner rings of each of the two bearing assemblies 17 and 18 and the end thereof within the bearing 18 is internally bored as shown at 20^a to receive the stem 21^a of an end fitting 21 which is the terminal portion of a flexible shaft 22. This flexible shaft is mounted within the usual complementary flexible casing 23 and is adapted to be driven at its other end by a suitable source of power. The stem 21^a

of the fitting 21 is provided with a longitudinal keyway 21^b which is engaged by a key 20^b, formed by pressing inwardly a part of the wall of the internally bored portion of the spindle shaft 20. In this way a driving connection is established between the flexible shaft and the spindle shaft.

The tube 16 is internally threaded outwardly from the bearing assembly 18 and this part is engaged by the locking nut 24, the body portion of which is of the same outer diameter as the tube. This nut 24 has an externally threaded extension 24^a to which the flexible casing 23 is attached, the casing having preferably the same external diameter as the nut 24 and the tube 16. The extremity of the spindle shaft 20, within the nut 24, is externally threaded for engagement by an internally threaded grease sealing nut or tube 25 which bears against the outer end of the bearing assembly 18 and extends through the nut 24 to the outer end thereof.

At the other end of the assembly 15, the spindle shaft 20 is provided with an integral head 26 having an annular shoulder 26^a at its inner end which bears against the outer end of the bearing assembly 17. The tube 16 is internally threaded adjacent the bearing 17 for engagement by the inner end of a locking sleeve 27 which serves to hold the bearing assembly 17 firmly in place against the shoulder 16^c of the tube. The head 26 is provided on opposite sides with flat faces 26^b adapted to be embraced by a wrench for holding the head and the spindle shaft against rotation and the locking sleeve 27 is provided on opposite sides with transverse slots 27^b which are adapted to permit the insertion of a wrench for this purpose. The locking sleeve 27 extends to the outer end of and slightly beyond the head 26 and the outer end portion thereof is tapered annularly as shown at 27^b. The head 26 is provided with an internal tapered socket 26^c which extends inwardly from the end thereof in axial alignment with the axis of the spindle shaft 20 and this socket terminates at its inner end in communication with an internally threaded tubular bore 26^d. The socket 26^c and the threaded bore 26^d are adapted to receive cooperating parts of various spindles or arbors which are employed in the operation of a great variety of grinding, polishing or other tools. As shown in Fig. 1, the head 26 of the spindle shaft has mounted therein the tapered shank 30^a of a spindle or arbor 30 which terminates at its inner end in a cylindrical threaded portion 30^b having threaded engagement with the bore 26^d of the spindle shaft. As shown particularly in Fig. 4, the spindle 30 is provided at its other end with a cylindrical portion 30^c which is externally threaded near its ends. This tubular part of the spindle is illustrated in Fig. 1 as engaging a grinding wheel or disk 31, formed of emery or the like. The disk 31 is engaged on opposite sides by washers 32 and a nut 33 engages the threaded extremity of the spindle 30 so that the disk 31 is securely clamped between the washers 32 with the inner washer held against the portion 30^b of the spindle which is provided with a hexagonal outer part adapted to be engaged by a wrench or the like for the purpose of rotating the spindle during the operation of applying a tool or removing it from the head 26 of the spindle shaft. With this arrangement of the parts, the disk 31 may be readily placed upon the spindle 30 or removed therefrom and the spindle with its supply disk may be readily inserted in or removed from the socket of the head 26. The entire assembly is compactly arranged and may be conveniently manipulated by the operator who grasps the tube 16 during the operation of moving the disk 31 over the surfaces to be ground or polished.

In Fig. 4, there is illustrated the application of the frame arbor 30 to another grinding or polishing implement 35 which, in this instance, is in the form of a cylindrical polishing wheel comprising a cylindrical rubber body 36 mounted upon a metallic tubular hub 37 which receives the portion 30^c of the spindle and has a threaded engagement therewith. The hub 37 has a flange 37^a at its outer end which overlies a washer 38 engaging the end of the rubber body 36 and a similar washer 38, located at the other end of the cylindrical body 36, engages the shoulder adjacent the part 30^d of the spindle. The rubber body 30 is surrounded by a tubular sleeve 39 formed of emery cloth or the like. This sleeve is held against rotation with respect to the rubber body 35 by frictional contact therewith and when the spindle 30 is mounted in the head 26 of the spindle assembly, the device 35 may be employed for polishing purposes.

In Figs. 5 and 6 there is illustrated another form of device adapted to be mounted in the socket 26^c of the head 26. This form comprises a spindle or arbor 40 having a tapered part 40^a which is identical with the part 30^a of the spindle previously described and which terminates at its end in an externally threaded portion 40^b adapted to engage the threaded bore 26^d of the head 26. The spindle 40 is provided at an intermediate point with a hexagonal part 40^c adapted to be engaged by a wrench or the like and the outer end thereof is in the form of a tapered member 40^d which has an internal'y threaded bore 40^e. This bore 40^e is adapted to be engaged by any one of a variety of devices having a threaded stem. In this instance it is shown as being engaged by a collet chuck 41 which has a threaded stem 41^a engaging the bore 40^e. This collet chuck has an intermediate portion 41^b of hexagonal external contour for engagement by a wrench and the other end thereof is externally threaded for engagement by a clamping sleeve 41^c. The chuck has an internal bore 41^d and the walls of this bore are longitudinally split as shown at 41^e so that when the locking sleeve 41^c is threaded onto the body of the chuck, it engages the outer tapered wal's thereof and contracts the chuck upon a stem 42 which may have mounted upon the outer end thereof an emery cone or grind'ng body 43. With the use of this arbor 40, a great variety of grinding or polishing devices may be employed inasmuch as the chuck 41 may be replaced by a great variety of other forms of mandrels or chucks and with the employment of any chuck, a great variety of grinding or polishing bodies may be employed upon separate identical stems 42.

In Figs. 7, 8, 9 and 10 of the drawings, there is illustrated another form of arbor adapted to receive other forms of implements adapted for use in grinding, polishing or other operations. This arbor 50 has a tapered stem 50^a similar to the stems 40^a and 30^a previously described, and this part is adapted to engage the tapered socket 26^b of the head 26 with the threaded extremity 50^b forming a connection with the internally threaded bore 26^d of the spindle shaft. The spindle 50, like those previously described, is provided at an intermediate point with a part 50^c

which has a hexagonal external contour for engagement by a wrench. The outer part of the spindle 50 is in the form of a tubular member 50^d which is externally threaded as shown at 50^e and which is tapered toward its outer end as shown at 50^f. This tubular part is provided at the inner end of the threaded portion with a series of outwardly extending apertures 50^g and a longitudinal slot 50^h extends longitudinally from each of these apertures to the end of the spindle. The bore of the part 50^d is adapted to receive a stem 51 which may have secured upon the outer end thereof a rotary file 52 or other body adapted to be employed in polishing or grinding operations. After placing the stem 51 in the bore of the arbor, the clamping sleeve 50^j is passed onto the chuck portion of the arbor in engagement with the threaded part 50^e so that its internally tapered bore engages the inclined part 50^f and thereby contracts the walls of the spindle upon the stem 51 to hold it firmly in place. The rotary file 52 may be replaced by other bodies mounted upon identical stems. For example, there is illustrated in Fig. 10 a cylindrical polishing wheel 53 mounted upon a stem 54 which is identical with the stem 51, except in length.

In Fig. 11 of the drawings there is illustrated another form of spindle or arbor 60 having a tapered part 60^a to fit the socket 26^b and having a threaded portion 60^b to engage the threaded bore 26^d. This spindle or arbor is provided beyond the wrench engaging portion 60^c with an elongated tapered shank 60^d having an internally threaded bore 60^e at its extremity. This bore is adapted to be threadedly engaged by the stem of a mandrel 61 having a head 61^a provided with an internally threaded bore. This head has an outwardly extending flange 61^b against which a disk 62 of emery cloth or the like is adapted to seat. The central part of this disk is engaged by a cap screw 63 which passes through a washer 64 and engages the internally threaded bore of the head 61^a for clamping the polishing disk 62 firmly in place. Obviously, this disk may be replaced by other devices which could be similarly clamped in position.

In Figs. 12 and 13 of the drawings there is illustrated still another form of spindle or arbor 70 having a tapered shank 70^a for engagement with the socket 26^c of the head of the spindle shaft and having a threaded extremity 70^b for engagement with the threaded bore 26^d. This spindle or arbor is provided beyond the wrench engaging portion 70^c thereof with a greatly elongated stem 70^d and the outer end of this part is provided with a cylindrical portion 70^e adapted to have a drive fit in the hub or bore of any desired grinding or polishing tool or other implement which the operator desires to employ. This portion 70^e of the spindle has a longitudinal groove 70^f milled therein from the end of the spindle so that the cylindrical portion is capable of contraction when the hub of the working tool is driven thereon.

It will be observed that all of the spindles or arbors hereinabove described have identical tapered shanks or stems for engagement with the socket in the head of the spindle shaft so that they may be readily interchanged with each other. The construction of the head and locking sleeve of the spindle shaft assembly is such that the spindle shaft may be readily held against rotation during the operation of applying or removing any desired spindle or arbor. The various spindles or arbors illustrated in the drawings are of such design that they permit the application thereto of variety of tools or implements to be employed in grinding, polishing or other operations. It is therefore apparent that a great many operations may be carried on by the use of a single shaft assembly and that one implement may be readily removed and replaced by another without the necessity of disassembling any considerable part of the apparatus and without the necessity of employing a great variety of spare parts.

Although certain embodiments and applications of the invention have been shown and described by way of illustration, it will be understood that the invention may be constructed in various forms coming within the scope of the appended claims.

I claim:

1. The combination in apparatus of the class described, of a rotary flexible driving shaft, a tube mounted at the end of said shaft for engagement by the hand of the operator, a spindle shaft in said tube operated by said driving shaft, a rotary head actuated by said spindle shaft and having a tapered socket provided with a threaded bore at the inner end thereof, a tool carrying spindle having a tapered part to fit said socket and a threaded projection to engage said bore, and a sleeve carried by said tube and surrounding said head, said head having flat surfaces on opposite sides thereof for engagement by a wrench and said sleeve being provided with slots to permit access to said flat surfaces.

2. The combination in apparatus of the class described, of a tube adapted to be held by the operator, spaced roller bearings mounted in said tube, a spindle shaft journaled in said roller bearings, said spindle shaft being provided with a socket, a flexible shaft having a terminal fitting engaging said socket to drive said spindle shaft, a flexible casing surrounding said flexible shaft and having a connection with the end of said tube, said spindle shaft being provided with an enlarged head at the tool end, said head being provided with a socket to receive a tool-carrying spindle, and a locking sleeve surrounding said head and detachably engaging the end of said tube for holding said spindle shaft and one of said bearings within said tube, said sleeve being provided with oppositely disposed slots and said head being provided with opposite flat surfaces adapted to register with said slots.

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