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FLEXIBLE SHAFT FOR MANICURING MACHINES

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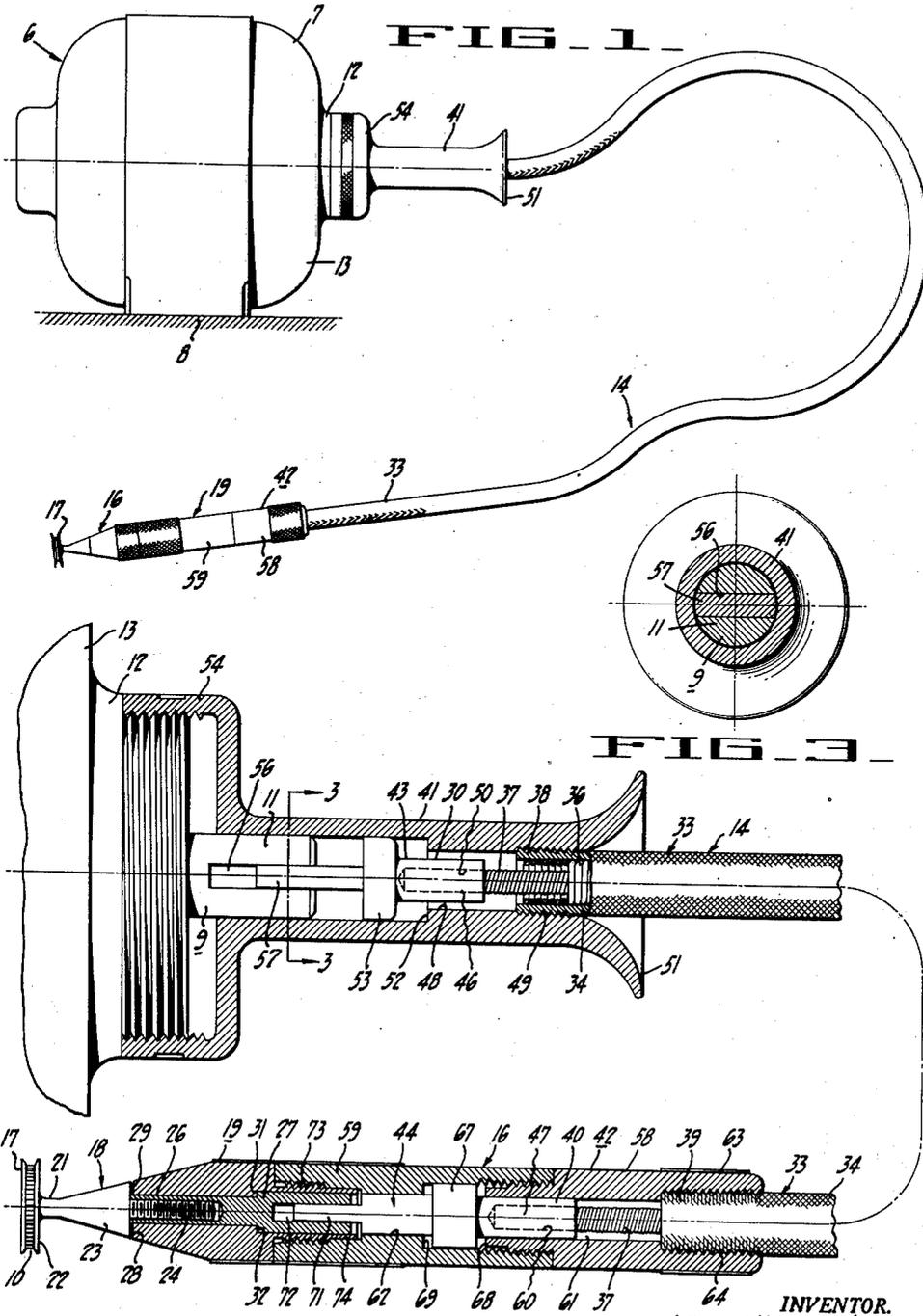


FIG. 2

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# UNITED STATES PATENT OFFICE

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## FLEXIBLE SHAFT FOR MANICURING MACHINES

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1 Claim. (Cl. 64-4)

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The invention relates to power operated manicuring machines of the type utilizing an electric motor and a flexible drive shaft connected thereto and to which in turn may be connected one of a plurality of rotary manicuring instruments.

An object of the present invention is to provide a manicuring machine of the character described having an improved form of flexible drive which affords a smooth and steady driving of the rotary manicuring instrument attached thereto and permits such instrument to be easily held and manipulated in the hand of the operator for precise positioning upon and movement over the finger nail to be manicured, and wherein the usual tendency of the flexible drive to whip or move abruptly in the hand of the operator upon manipulation of the instrument is practically entirely eliminated.

Another object of the present invention is to provide a flexible drive arrangement in a manicuring machine of the character described which affords a simple and rapid changing of various manicuring instruments at the end of the flexible drive.

A further object of the invention is to provide a flexible drive assembly in a manicuring machine of the character described which may be manufactured as an operating unit of the machine and quickly and readily applied to or removed from the electric motor of the machine.

Still another object of the invention is to provide a flexible drive assembly for a manicuring machine of the character described which is designed for long and continuous use, as where employed for commercial operations, and for constant interchanging of the rotary manicuring instruments during such use, without being subject to appreciable wear or lowering of its qualities of operation over a long period of use.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawing accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawing and description may be adopted within the scope of the invention as set forth in the claim.

Referring to said drawing:

Figure 1 is a side elevation of a flexible drive arrangement for a manicuring machine embodying the present invention.

Figure 2 is an enlarged cross-sectional view of

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the opposite ends of the flexible drive, with portions of the drive shown in elevation.

Figure 3 is a cross-sectional view taken substantially on the plane of line 3-3 of Figure 2.

The manicuring machine illustrated in the accompanying drawing includes an electric motor 6 having an exterior casing 7 secured in an appropriate manner to a base 8 and provided with a drive shaft 9 having an end 11 extended centrally through and journaled within a bearing boss 12 formed on one end 13 of the casing 7.

Secured to the boss 12 and to the shaft end 11 and extended axially therefrom is a flexible drive, generally denoted by numeral 14, and which, in turn, is adapted to receive and drive at its outer end one of a plurality of manicuring instruments, the instrument 16 here shown being in the form of a rotary file more fully disclosed and claimed in my co-pending application entitled Rotary Manicuring Instrument, Serial No. 45,472, filed Aug. 21, 1948.

The instrument 16 is composed of a rotary disc-shaped head 17 connected by a driven shaft assembly 18 to a casing 19 forming the hand piece of the instrument. The head 17 has formed in the periphery thereof an annular recess 10 having a width sufficient for the insertion therein of an edge portion of a finger nail to be manicured, and for positioning of the edge of the nail against file serrations formed in the base of the recess. The tool here shown is one of several rotary manicuring instruments which may be used with the machine. Another type of manicuring instrument is disclosed and claimed in my co-pending application, Serial No. 33,077, filed June 15, 1948, for Power Driven Manicuring Device, now forfeited.

The driven shaft assembly 18 here includes a stem 21 extending axially from the rear side 22 of the head into an outwardly tapered stem portion 23 and a reduced threaded end 24 which is threaded into one end 26 of a shaft part 27 journaled for rotation within the hand piece 19. Defined at the juncture between the tapered portion 23 and the end 24 is an annular shoulder 28 which substantially abuts one end 29 of the hand piece 19, thereby limiting the axial movement of the driven shaft assembly in the direction of the hand piece. Longitudinal movement of the driven shaft assembly in an opposite direction is limited by engaged annular shoulders 31 and 32 in the bore of the casing 19 and on the shaft part 27 respectively. Preferably, the end 24 is provided with a tightly threaded engagement within the end 26 of the shaft part so as to nor-

mally retain these elements in connected position but to permit a forced disassembly where required for repair or removal of parts of the instrument.

The principal feature of the present invention is the design and construction of the flexible shaft 14 and its operative connections to the motor casing and drive shaft 11, and to the manicuring instrument case 19 and its driven shaft 27, whereby the drive shaft may be simply and readily applied to or detached from either the motor or the manicuring instrument, and a rapid changing of instruments in the end of the drive shaft permitted, and wherein the drive shaft, when connected to the motor and a manicuring instrument, will provide a smooth and steady driving of the rotary part of the manicuring instrument whereby the latter may be conveniently and easily held in the hand of the operator for precise engagement with and movement over the finger nail to be manicured.

Another feature of the drive shaft and its connections is, as above noted, the substantial elimination of all tendency of the drive shaft to whip or move in the hand of the operator during operation. These and other features, as will be pointed out, are provided in the construction and arrangement of the drive shaft and its connections, whereby a full floating suspension of the driving connection is afforded which, while transmitting a rotary motion, is permitted a free axial movement at the drive connections.

The drive shaft 14 includes an elongated flexible sheath 33, here composed of a fabric covering 34 for a helical wire coil 35 defining a hollow interior within which is mounted for relative rotation a torsional drive element 37. The latter may be composed of a solid wire core, not shown, onto which is tightly wound, in helical fashion, a relatively fine wire, the combination affording an element which is very flexible yet strongly resistant to elongation and torsional strain.

Mounted on the opposite ends 38 and 39 of the sheath 33, and forming longitudinal extensions therefor designed for attachment to the motor casing 7 and the instrument casing 19, are rigid tubular end members 41 and 42 and which in turn house rotary shaft parts 43 and 44, secured to the opposite ends 45 and 47 of the drive element 37, and are formed for attachment to the drive shaft 11 and the driven shaft 27 of the motor and manicuring instrument. Shaft parts 43 and 44 are journaled for rotation within the end members 41 and 42 and are formed at their ends 30 and 40 with end recesses 50 and 60 within which are affixed the opposite ends 46 and 47 of the torsional drive element 37.

The end member 41 is formed with an axial bore 48 therethrough, and which is interiorly threaded over a portion 49 adjacent one end 51 of the member, for receipt of the sheath end 33, the latter being secured within the bore by a turning of the sheath into the threaded portion 49. Preferably, the end 51 of the member is flared to provide a bell-shaped exit opening for the sheath and thereby afford an improved support for the attached end portion of the sheath on manipulation of such end of the flexible drive relative to the rigid end member 41. Forwardly of the threaded portion 49, the bore 48 is enlarged to receive and journal at the opposite end portion thereof the motor drive shaft 9, and there is provided between the two bore sections an annular shoulder 52 which provides a stop for the relative longitudinal movement within the bore

of an enlarged cylinder shoulder 53 provided on the shaft part 43. The end 54 of the tubular member adapted for connection to the motor casing is enlarged, as will be seen in Figure 2, and interiorly threaded for threadable engagement with the boss 12 on the motor casing end 13, the boss 12 being likewise appropriately threaded for engagement with the threaded end 54 of the tubular member.

As here shown and as an important feature of the present invention, the operating connection between the motor drive shaft 11 and the shaft part 43 is effected in an inter-fitting tongue and groove arrangement whereby rotary motion is transmitted while relative axial movement of the shaft end 11 and shaft part 43 is permitted. This is here effected by the provision in the shaft end 11 of a generally rectangular shaped cross slot 56, in which is slidably received a generally flat rectangular-shaped tongue 57 extending from the cylindrical portion 53 of the shaft part 43. As will be seen from Figure 2, the axial dimension of the cylinder portion 53 is small compared to the distance provided between the shaft end 11 and the shoulder 52, so that a substantial amount of axial movement of the shaft part 43 is permitted within the tubular member 41, and correspondingly a substantial amount of axial movement is provided for the tongue 57 within the cross slot 56 in the drive shaft. By reason of the non-circular form of the cross slot and tongue, rotary movement is transmitted and by reason of the slidable connection between the tongue and shaft slot, relative longitudinal or axial movement of the connected parts is permitted. As will also be seen from Figure 2, concentricity is maintained between the member end 54, motor boss 12, motor shaft 9, tongue 57 and shaft part 43, whereby, upon threading of the end 54 of the drive shaft onto the motor boss, an automatic insertion of the tongue 57 into the shaft slot 56 will be effected.

At the opposite end of the flexible drive, the tubular end member 42 is composed of a pair of threadably attached sections 58 and 59, formed with aligned and registering axial bores 61 and 62 therethrough for journaling therein of the shaft part 44. One end 39 of the sheath may be secured in one end 63 of section 58 by a threading of the sheath into an interiorly threaded portion 64 in the same manner as described in connection with the opposite end 33 of the sheath. The torsional element 37 projects from the end of the sheath into the bore 61 and is secured at its end 47 in the end recess 60 provided in the shaft part 44, as above described, thereby securing the torsional element and shaft part for joint rotation. The shaft part is formed with an enlarged cylindrical portion 67 which is mounted longitudinally between one end 68 of section 58 and an interior shoulder 69 provided in the bore 62, whereby limited longitudinal movement of the shaft part is permitted within the bore. The opposite end 71 of the shaft part 44 is formed as a flat tongue which is slidably received in a cross slot 72 provided in the end of shaft part 27, whereby these parts are attached for joint rotation while permitting relative longitudinal movement, as hereinabove described, in connection with tongue 57 and cross slot 56. The adjacent end 73 of the section 59 is interiorly threaded for engagement with a threaded end portion 74 on the instrument casing 19. Preferably, the exterior diameters of sections 58 and 59 and of the hand piece 19 are the same, so as to afford

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a continuous external periphery over these sections, as illustrated in Figure 2. If desired, portions of the periphery of these members may be knurled to facilitate holding in the hand of the operator. The concentricity of the driven shaft 27 within the hand piece 19, and the shaft 44 within the section 59, provides an automatic insertion of the tongue 71 into the cross slot 72 upon threadably engaging the instrument hand piece into the end of the section 59. The threaded connection between sections 58 and 59 is intended to be a relatively tight one thereby retaining these sections together as a unitary chuck for the instrument casing.

As will be understood, the drive connection at both ends of the flexible drive is afforded, by reason of the tongue and slot arrangement, a full floating axial movement. In the ordinary manipulation of the manicuring instrument in use and the corresponding relative movement of the attached end of the flexible drive, a relative longitudinal displacement between the interior torsional drive element 37 and the sheath 33 takes place. In the present construction, this relative longitudinal movement of these parts of the drive shaft is freely permitted at the end connections and thereby the normal tendency of drive shafts of this character to whip or move inordinately within the hand of the user is practically completely eliminated. Also, by reason of the tongue and slot connection, a rapid attachment and detachment of the drive shaft to the motor may be effected, as well as a rapid attachment and interchange of manicuring instruments at the opposite end of the drive shaft.

As another feature of importance of the drive shaft, longitudinal strain in the drive shaft, as may be occasioned by a direct pulling on the shaft, is taken up by the interior drive element 37. As will be understood, the sheath 33, by reason of its construction above described, will permit limited longitudinal distension and such action will draw the shoulders 53 and 67 of the shaft parts against the shoulder 52 in the end member 41 and against the end 68 of the end section 58, whereby further elongation of the drive shaft is prevented by the interior drive element 37, which, as above described, is strongly resistant to elongation. In this manner, damage to the outer sheath by reason of an unusual longitudinal force applied thereto is prevented by the support of the sheath against such longitudinal strain afforded by the interior element 37.

I claim:

Means for coupling a flexible drive composed

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of a flexible outer sheath and an interior flexible drive element to an electric motor housing and shaft and to a rotary manicuring device comprising, a rigid tubular member connected at one end to said outer sheath and at the other end to said motor housing and having an axial bore therethrough, said bore having an enlarged portion adjacent one end thereof, a shaft part secured at one end to said flexible drive element and provided with means for slidable connection to said motor shaft at its opposite end for joint rotation therewith and having an enlarged cylindrical portion journalled for rotation and limited longitudinal reciprocation in said enlarged bore portion, said enlarged bore portion and said cylindrical portion being dimensioned to provide a bearing surface for said shaft part, a second rigid tubular member secured at one end to said outer sheath and provided with means for connection to said manicuring device at its opposite end and having an axial bore therethrough, said bore having an enlarged portion substantially medially of its length, a second shaft part secured at one end to said flexible drive element and having a slidable connection to said manicuring device for joint rotation therewith, said second shaft having an enlarged cylindrical portion adjacent one end thereof journalled for rotation and limited longitudinal reciprocation in said enlarged bore, the portions of said shaft part adjacent each side of said enlarged cylindrical portion being journalled for rotation in said bore whereby a three point bearing arrangement is provided at the connection between said flexible drive element and said manicuring device for smooth, non-vibrational rotation thereof.

MERRILL KESSLER.

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