This invention relates to a novel apparatus for controlled rotation of a selected actuating head. In particular it relates to a safe and reliable device which rotates a brush for rapidly cleaning and scouring pots and similar utensils.

In the patent application of Foster et al., Serial No. 696,973, now Patent No. 2,944,271, a rotatable cleaning device is described wherein a motor of selected gear reduction or speed is connected via a slip clutch to a flexible cable shaft. The flexible shaft terminates in an outer housing wherein it is coupled to a rotatable unit, as for example, a rotatable brush. For permanent sink installation and operation the motor is stored behind the sink and the bearing-handle protrudes through an opening in one part of the sink, retractable means being provided to store the flexible shaft when not in use.

The scouring action of this prior device is rapid, efficient and safe. However, it does not provide a sensitive control for the speed or duration of rotation of its rotatable working head.

One object of the present invention is to provide a device for rotation of a selected actuating head wherein sensitive finger tip control is provided for the speed and duration of rotation.

Another object of this invention is to provide such a rotatable device which is not affected by water, is safe from overload and electric shock, is easily and effectively maneuverable, is light in weight, and requires practically no maintenance.

Further objects and a fuller understanding of my invention will hereinafter appear from the specification and claims, including the following description of a preferred embodiment illustrative of the invention and shown in the accompanying drawings in which:

FIG. 1 is a side view of the outer housing showing the trigger bar, the brush guard, and a brush-head suitable for use in this invention.

FIG. 2 is an internal assembly view with front half of outer housing removed to show the functioning relationships of the components.

FIG. 3 is an end section view with portions of the shell removed.

FIG. 4 is a top view of the device with portions of the shell removed.

FIG. 5 is a sectional view of the spindle assembly.

FIG. 6 is an enlarged detail cross section of the transmission unit.

FIG. 7 shows the basic assembly with top half of the shell removed.

FIG. 8 is a perspective view of the brush head of FIG. 1.

My device consists essentially of a motor and a speed reduction unit connected to one end of a flexible shaft which in turn is connected at the other end to a speed reduction gear train terminating in the driving portion of a friction clutch. The driving portion of the clutch is integral with a chuck for holding a rotatable working head. The entire gear train and the driving clutch surface form a transmission unit assembly which is selectively engageable by finger control, consisting of a clutch throw arm assembly, with the driven clutch surface chuck assembly, all the shaft whistles being positioned in a pistol shaped outer housing. Mounted under a kitchen sink is a rheostat controlled motor connected through an electrically shock proof flexible coupling, transmitting torque only, to a speed reduction unit to which is connected one end of a flexible shaft, the other end of the flexible shaft being connected to the drive shaft in the device.

The assembled device may be used portably or in fixed position. In fixed position it is preferable to position it in a receptacle nesting in an aperture in the sink top. Under the sink are depending means serving for the up and down motion of the flexible shaft, removing restrictions on the motion of the shaft and reduce vibration of the motor. Raising the device from its receptacle moves an actuating lever associated with the receptacle which closes a switch starting the motor, activating the gear box, cable, gear reduction train in the handset device, and the driving portion of the clutch. The driven portion of the clutch, which actuates the chuck and working head, does not operate until the hander trigger is depressed, thereby mechanically engaging the clutch halves.

Restoring the device into the receptacle opens the switch and stops the motor. The speed of the motor varies by rheostat control, combined with the operation of the speed reducing unit, coupled with the speed reduction resulting from the gear ratio reduction in the device, results in a large range of change speeds adapted to suitably operate working heads of various descriptions and uses. For example, a 3/4 H.P. induction motor with a free speed of about 18,000 r.p.m. could be used with a 4/1 reduction at the motor and 5/4 reduction in the device.

The outer housing preferably consists of a pistol shaped shell longitudinally divided into similar parts with mating edges. Integral with each of the shell halves are partner protuberances extending into the shell cavity for positioning various parts. Within the shell, the flexible shaft terminates in a gear reduction train. The train is connected to and drives the internal cone of a friction clutch. This internal cone is adapted to be thrown by means of a trigger bar into sliding contact with the interior surface of an external clutch cone, associated with which are means for holding the rotatable working head.

Referring to the drawings, the outer housing therein shown, as illustrative of one embodiment of my invention, comprises two similar shell halves with mating edges forming a housing with a pistol grip. Extending laterally from the inner surface of each of the shell halves and integral with them are annular extensions and for positioning the spindle bearing housing 66, an annular bearing extension to hold end bushing 15 for horizontal spindle shaft 65, an extension to provide bearing for clutch throw arm 76, extension pad 17 to provide a bed for screw 18 to hold the grip portion of the shell halves together, and an extension 20 to provide a stop for spring 82. The interior chassis to be positioned within the shell, for positioning the various components, is divided into three parts 21, 22, and 23.

Chassis part 21 comprises a support 24 for guide pin 32 to hold spring 82, a housing 25 for bearing plug 30, a support 27 for the vertical stub shaft 31, and a holder 28 for the upper shaft bushing for the shoulder upper end 41 of the rigid drive shaft 40 which is connected to the flexible driving shaft 39 and a holder 29 for chassis part 22.

Chassis part 22 comprises a longitudinal sleeve with bushing 33 and transverse pads to be inserted between the end fork of the clutch throw arm 76 to support pivot bearings for said arm. These pads are bored and tapped to receive shoulder screws 75 positioned within elongated holes 77 of arm 76.

Chassis part 23 is a sliding thrust component having a longitudinal bearing with one end being adapted to be
positioned into part 22. The other end configuration of thrust component 23 has a bushing 34 and is flanged to provide a thrust surface to be pressed against a thrust washer 58 to drive the clutch components together, removing lateral thrust from the meshed revolving bevel gears and applying it directly to the shouldered hub of the internal cone. It also contains the bearing for the sliding and rotating action with spindle shaft 65.

Attached to shaft 41 is a pinion gear 42 which sits on said shaft shoulder and which meshes with spur gear 49 which is integral with a bevel gear 48, both of which as a unit rotate around the stub shaft 31, the combination of pinion gear and spur gear reducing speed according to design. Meshing with bevel gear portion 48 is a bevel gear-clutch cone assembly comprising the internal cone portion 55 of a friction cone clutch having an exterior surface 56 of clutch facing material which will allow proper clamping and slip and which is aligned with and fixedly connected to a meshing bevel gear 57 with associated bushings. The chassis part 21 with pinion gear 42, vertically mounted spur and bevel gear 49—48, horizontally mounted bevel gear 57, and clutch cone 55 with suitable bearings and bushings together with chassis parts 22 and 23 forms the power transmission unit assembly A.

The spring 82 is positioned on spring guide 32 and is in contact with housing projection 20 as a spring stop.

The assembly B comprises the spindle shaft 65 with spindle bearing housing 66 and associated bushings. The spindle shaft 65 upon which assembly A slides in integral with the external cone portion 73 of the clutch and has an interior surface 69. Integral with the spindle shaft 65 and the external cone portion 73 is a hollow spindle 67 which forms a chuck 76 for holding the rotatable working head, all diameters being concentric about the longitudinal axis of said spindle. The spindle bearing housing 66 is provided with threaded holes 71 to take screws 72 which hold the barrel portion of outer shell halves 10 together.

Clutch throw arm assembly C comprises a Y shaped throw yoke 76 having elongated holes 77 adjacent each of the upper ends and pivot holes 78 spaced from these ends, through which shell extensions 16 are positioned. Attached longitudinally to the tail 79 of the yoke 76 is a trigger bar 81 adapted to extend through a slot in the handle portion 80 of the shell halves.

In the assembly of transmission unit A, the chassis part 22 is pressed into the holder 29 of chassis part 21. The beveled gear 57 with its bearing is slipped onto chassis part 23. Part 23, now carrying bevel gear 57, is pressed into chassis part 22, thus completing the entire chassis of transmission unit A. Thrust washer 58 is dropped into the hub of interior cone 55. Cone 55 with thrust washer 58 is positioned over the flanged end of chassis part 23, engages with hub projection of beveled gear 57 and is secured to it with screws 54. Bevel gear 48 integral with spur gear 49 and washer 50 are aligned with holder hole in chassis part 21 and meshed with bevel gear 57.

Stub shaft 31 is slid into place and pin 51 inserted. Bearing plug 30 is slipped over drive shaft 40. Pinion gear 42 is pressed onto upper end 57, and shaft 40 and seated on the shoulder. The assembly of pinion gear 42, shaft 41, and plug 30 are inserted into chassis part 21 and secured by set screw 43.

In the assembly C of the clutch throw arm, the elongated holes 77 are aligned with the bored pads of the chassis part 22 and shoulder screws 75 are inserted through said pads as said pads.

Transmission assembly A and throw arm assembly C have now been assembled together as a single assembly No. 1.

In assembly B the spindle bearing housing 66 is slipped over the hollow spindle 67 and secured by grip ring 68 forming together an assembly No. 2.

Into the horizontal bearing formed by the various bearing components in assembly No. 1 the spindle shaft 65 of assembly No. 2 is now inserted, the end of the shaft being positioned in bushing 15e positioned in bearing extension 15.

This complete assembly, No. 3, is then positioned in one half of the shell 10, registering with the various integral protuberances extending from the shell for positioning the various parts, providing bearings, holding bushings and providing a spring stop. The pivot holes 78 in the throw arm 76 are positioned on the shell bearing 16. Screw 72 is then installed to secure the nose portion of housing 10 to assembly No. 3.

The second half of the shell 10 is then assembled with the first half, all extensions registering with their partners and also with the internal positioning elements as described and also with outside edges mating. The halves are then fastened together by screws 19 positioned in partner pads 17 in the handle and screws 72 positioned in spindle housing 66 in the barrel. The guard 87 is then slipped over the working head end and held in place by the friction of ribs 88 and positioned by them.

Working heads of the sort described in said prior application may be used with the handset device of this invention by having a shaft engageable with chuck 70. However, particularly outstanding results in speed and cleaning efficiency are obtained by use of two novel types of brushes.

One type, illustrated in FIGURE 8, is intended primarily for dish cleaning and light pot and pan work, has a scouring head comprising a solid-stiff center core of synthetic bristles 92, as for example, nylon, surrounded uniformly by a number of separate clusters of synthetic bristles 93 in a slightly conical arrangement with the outer clusters extending the same distance as the center. The bristles are set in a cup-shaped ferrule 94. The outer bristles are preferably of thinner gauge than the inner bristles. In operation the brush acts differently to smooth as against heavily encrusted surfaces. With a smooth surface the outer tufts splay outward. With a heavily encrusted surface, however, the outer tufts, meeting resistance, bend so as to "cone in" to one another. This "coning in" around the center cone provides a solid concentrated boring action which is exactly what the encrusted surface needs.

Another type intended primarily for heavy duty scrubbing, has a scouring head comprising a stiff conical ring of heavy gauge synthetic bristles surrounding a hollow core. Various types of brushes and other rotatable working heads and brushes may also be used. In operation the shaft 90 of the working head 89 is inserted into the chuck 70, pin 74 engaging with the flat of the shaft 91 of chuck causing it to rotate. The device is then gripped like a pistol. When pressure is applied to the trigger bar 81, the tail 79 of the yoke 76 is screw backedwards around the pivots 16 while the open ends of the Y move forward sliding the transmission unit forward along the spindle and positioning the interior cone 55 of the clutch within the exterior cone 73 causing it to rotate. Operation of the trigger also causes the spring 82 to compress simultaneously with the movement of the transmission unit.

Varying amounts of digital pressure will cause the outer clutch element to grip and rotate or slip, and thus vary the speed of the chuck.

Release of the trigger arm allows the spring 82 to expand, separating the clutch cones and stopping rotation of the chuck. This simultaneous movement of the transmission unit against the resistance of the associated spring provides a very sensitive means of clutch contact with a resulting method of speed control. Sudden release of the trigger provides an additional safety measure by instantaneously separating the clutch cones.

While the preferred embodiment of my invention has been described in detail, it will be understood that I do not wish to be limited to the particular construction set forth, since various changes in the form, material, propor-
tions, and arrangement of parts, and in the details of construction may be resorted to without departing from the spirit and scope of the invention or destroying any of the advantages contained in the same, heretofore described and defined in the following claims.

1. A rotatable cleaning device comprising a pistol-shaped housing having a barrel and handle portion, a chuck, a two-piece friction cone clutch having driving and driven elements, a power transmission unit having a sliding thrust component, digitally operated trigger means and spring means; said driven element being positioned in the forward portion of said barrel, holding said chuck forward thereof and having a shaft extending longitudinally and rearward to the rear of said barrel; said power transmission unit being slidably positioned on said shaft, holding said driving element and being arranged to transmit motion of a rotating flexible driving shaft to said driving element; said digitally operated trigger means being arranged to cause said transmission unit to slide forward so as to provide engagement of said driving and driven elements; said spring means being spaced between said housing and transmission unit and arranged to normally urge said transmission unit rearward.

2. Claim 1 wherein the application of digital pressure to said trigger simultaneously slides said transmission and driving element into driving contact with said driven element and compresses said spring and the release of pressure on said trigger allows said spring to expand and slides said transmission unit out of clutch contact, the varying digital pressure applied to and removed from said trigger being transmitted to and removed from said driven element in varying amounts by said transmission unit.

3. Claim 1 wherein said transmission unit has a speed reducing gear train inserted between said flexible shaft and said driving element, and positioned in the rear of said barrel.

4. A rotatable cleaning device comprising a hollow pistol shaped outer housing having a pistol grip handle portion and a barrel portion, a power transmission unit having a sliding thrust component, spring operated retractable means and a speed reduction gear train positioned in said barrel portion; a friction clutch having a driving cone and a driven cone digitally operated trigger means positioned in said handle portion to move said thrust component and the driving cone of said clutch into contact with the driven cone of said clutch; said spring operated means being actuated by the longitudinal forward movement of said transmission unit and adapted to resist said movement; said chuck and driven cone being integral and concentric with a horizontal shaft upon which said transmission unit slides under actuation of said trigger means; said driving transmission unit transmitting the motion of a rotating flexible driving shaft through said speed reduction gear train to said driving cone; said transmission unit comprising a vertical drive shaft keyed to a horizontal pinion gear meshing with a horizontal spur gear concentric and integral with a horizontal level gear, said horizontal bevel gear meshing with a vertical bevel gear concentric and integral with said driving cone, said gear elements being suitably mounted as a unit with bearings and bushings and adapted to move as a unit.

5. A rotatable utensil cleaning device comprising in combination a hollow holder, a flexible shaft adapted to be connected at one end to a driving means and at its other end to a speed reduction gear train, a friction clutch having engageable driving and driven elements, an actuating lever and a retractable means; the driving element of said clutch being connected to said train so as to form a single assembly; said assembly being mounted in said holder so as to be slideably moveable; said lever being pivotally mounted in said holder so as to move said assembly upon actuation to provide engagement of said driving and driven elements; said retractable means being positioned in said housing to resist such movement of said assembly; the driven element of the clutch being mounted in said holder and having means for holding a working head.

6. A rotatable cleaning device comprising a casing, a chuck spindle, a friction cone clutch, a shifting power transmission unit, having a sliding thrust component and manually operated means for shifting said unit, said chuck spindle comprising an integral driven clutch cone and transmission spindle extending into said casing, all diameters of said cone and spindle being concentric about the longitudinal axis of said spindle; said transmission unit comprising a bevel gear with vertical axial meshing with a bevel gear with horizontal axis integral with a cooperating driving clutch cone, said transmission unit being slidably mounted on said transmission spindle with associated horizontally mounted compression spring abutting said casing, said shifting means comprising a trigger operated throw arm pivoted to said casing and adapted to slide said thrust component of said transmission unit along said transmission spindle, moving said driving clutch cone into contact with said cooperating driven clutch cone and compressing said spring.

7. A pistol type rotatable cleaning device comprising a chuck, a two piece friction cone clutch, a sliding power transmission unit having a lateral thrust component, digitally operated trigger means to move the driving cone of said clutch into contact with the outer cone of said clutch, spring operated means actuated by the longitudinal movement of said transmission unit and a flexible driving shaft, said chuck and driven cone being integral and concentric with a horizontal shaft upon which said transmission unit slides under actuation of said trigger means, said transmission unit transmitting the rotating motion of said flexible driving shaft to said driving cone, said thrust component transmitting lateral thrust to said driving cone, said transmission unit having a speed reducing gear train connected between said flexible shaft and said driving cone, the application of digital pressure to said trigger simultaneously sliding said transmission unit into clutch contact and compressing said spring and the release of pressure on said trigger allowing said spring to expand and sliding said transmission unit out of clutch contact, the varying digital pressure applied to and removed from said trigger being transmitted to and removed from said driven cone in varying amounts by said transmission unit.

References Cited in the file of this patent

UNITED STATES PATENTS

1,024,151 Smith ------------------ Apr. 23, 1912
1,480,461 Nutter ------------------ Jan. 8, 1924
1,510,116 Van Meter ------------------ Sept. 30, 1924
1,581,265 Holtzman ------------------ Apr. 20, 1926
1,777,829 Edgecumbe ------------------ Oct. 7, 1930
1,981,688 Conti ------------------ Nov. 20, 1934
2,301,849 Bialy ------------------ Aug. 18, 1942
2,649,121 Reck ------------------ Nov. 10, 1953