This invention relates generally to fastening drivers and more particularly to a compressed air powered fastening driver for nuts, bolts, studs, screws, and the like.

It is the principal object of the present invention to provide a light, compact, portable fastening driver which is employable wherever a compressed air source is available; and is, due to its portability and compactness, extremely valuable in applications where accessibility is a prime consideration.

It is a further object of the invention to provide a fastening driver having a rotor driven by compressed air with a certain force and speed and a driving member for the fastening operation which is driven by the rotor with a greater force and a lesser speed than that imparted to the rotor.

It is a further object of the invention to provide a compressed air powered fastening driver which will drive a fastening in either a clockwise or an anti-clockwise direction.

It is a still further object of the invention to provide a compressed air powered fastening driver having a rotor and a tool-supporting sleeve, in which the tool supporting sleeve is driven by the rotor as long as a certain resistance to turning is not set up by the fastening, and in which a plurality of settings are available for pre-selection of the drive-cancellation resistance relationship.

It is a further object of the invention to provide a compressed air powered fastening driver having valve means for varying the amount of compressed air delivered to the rotor.

With these and other objects in view my invention generally comprises a fastening driver for nuts, bolts, studs, screws, and the like, having a head portion, a handle portion, a tool-supporting sleeve rotatably mounted on said head portion, a bladed rotor concentrically rotatably mounted upon said tool-supporting sleeve, speed reduction gearing operatively connecting said rotor and said tool-supporting sleeve, and a passageway leading through said handle portion into said head portion whereby compressed air may be directed to impinge upon the blades of said rotor, causing the latter to rotate and, through said reduction gearing, causing said sleeve to rotate.

Figure 1 is a top plan view of the head end of one modification of the fastening driver of my invention.

Figure 2 is a cross-sectional view taken along the line 2—2 in Figure 1, with the adaptor removed from the tool-supporting sleeve.

Figure 3 is a fragmentary side view of the device taken along the line 3—3 of Figure 1, generally illustrating the rotor blades and the flow of air in the head portion.

Figure 4 is a bottom plan view of the fastening driver with the cover partially cut away in the area of the head portion, and the handle partially cut away in the area of the socket.

Figure 5 is a perspective view of the gearing employed in my device, with the rotor being removed for clarity, and the ring gear removed from the tool supporting sleeve for the same reason.

Throughout the several figures, like reference characters refer to like parts. The modification of the fastening driver of my invention which has been shown in the attached drawings will now be described in detail with reference to these drawings. Reference character A designates the head portion of the device, and reference character B the handle portion. Head portion A and handle portion B are formed from two co-operating cast-metal sections 10 and 11 which are joined together by screws 12 in the handle portion and screws 13 in the head portion. The handle portion B is provided with recesses, as indicated at 14, which accommodate the heads of screws 12.

A generally cylindrical passageway 15 extends through handle portion B and communicates with a passageway 16 of generally rectangular cross section located in the head portion A. Passageway 16 follows a circular course within head portion A through substantially 360 degrees, terminating at a wall 17 disposed adjacent the juncture of passageways 15 and 16. The outer end of handle portion B is provided with a threaded socket 18, whereby a flexible hose leading from a compressed air supply may be coupled to the handle, and compressed air delivered through passageway 15 into passageway 16. A poppet valve 19 is disposed within passageway 15 and is normally urged against a valve seat 20 by means of a spring 21, which presses upwardly upon operating button 21A of the valve. To open the valve, operating button 21A is depressed.

A rotating mechanism is mounted within head portion A. This mechanism comprises a tool supporting sleeve 22 which is journaled both in section 11 and in an annular cap member 23 which is associated with section 10; a rotor 24, having blades 25, a hub 26 journaled on tool-supporting sleeve 22, and a web 27; four planetary compound gears 28 rotatably mounted within web 27 of rotor 24 and spaced substantially 90 degrees apart from one another along
a circle concentric with sleeve 22; a ring gear 29 rotatably mounted upon tool-supporting sleeve 22 and a spur gear 32 rigidly secured to, and concentrically disposed with respect to, tool-supporting sleeve 22.

Each planetary compound gear 28 consists of an axle 31 (which is journaled in the rotor web 21), a gear wheel 32 rigidly secured to one end of axle 31, and a gear wheel 33 rigidly secured to the other end of axle 31. Gear wheel 32 is arranged to mesh with ring gear 29, and gear wheel 33 is arranged to mesh with spur gear 30. Gear 32 is slightly larger and has more teeth than gear 33.

An annular collar 34 extends from ring gear 28. Collar 34 has the same internal diameter as gear 28. When the device is assembled, ring gear 29 is held in position upon sleeve 22 by shoulder 34c on the sleeve and by the inward surface of cap member 23.

Two slots 35 are formed in collar 34. Two locking dogs 36 and 37 are pivotally mounted upon pins 32 and 33 respectively which extend inwardly from cap member 23. Locking dogs 36 and 37 are designed to engage slots 35 in collar 34 and hold ring gear 29 stationary when a fastening is being driven.

Cap member 23 is provided with an arcuate slot 40. A stud 41 is mounted by means of nut 42 and washer 43 so that the stud is slidably in slot 40, and the free end 44 of the stud projects inwardly of cap member 23. Tension springs 45 and 46, attached at one end to locking dogs 36 and 37 respectively, and at the other end to the free end 44 of stud 41, are mounted on the stud 41. Tension springs 45 and 46 are provided to urge the dogs into locking engagement with the slots 35.

Guide members, one of which is shown at 45a in Figure 1, guide the course taken by the tension springs between the locking dogs and the stud 41. The tension of the springs 45 and 46 may be varied by loosening nut 42, sliding bolt 41 to a new position, and tightening nut 42. The under surface of washer 43 and the surface of cap member 23 in the area of slot 40 are preferably serrated to insure that there is no sliding of stud 41 once nut 42 has been tightened.

Cap member 23 is provided with a downwardly depending flange 47 (which forms a side wall of passageway 16), and a flange 48, extending from flange 47 at right angles thereto. Flange 48 forms the bottom wall of passageway 16. A plurality of orifices 49 are formed in the bottom wall of passageway 16. The orifices 49 decrease in size the further they are disposed along the passageway 16 from the entrance thereof (see Figure 1). The orifices 49 are formed at a small angle to the direction of travel of the compressed air through passageway 16 (see Figure 3). Blades 25 are curved, as seen in Figure 3, and a plurality of exhaust of ports 50 are provided in the portion of section 11 disposed beneath the rotor blades 25.

A tool adaptor C (see Figure 2), having a shank 51 of square cross-section is partially insertable in the square passageway 52 extending through tool-supporting sleeve 22, so that it can be inserted either outwardly from section 10, or from section 11, dependant upon whether clockwise or anti-clockwise rotation of the fastening is desired. Various fastening gripping tools are mountable upon the adaptor C; for example, if it were desired to drive a one-inch hexagonal nut, then a one-inch hexagonal socket member would be mounted upon the adaptor C.

It will be appreciated that the wide variety of fastenings which may be driven with the device of my invention, require to be driven with widely differing maximum forces. My means for holding ring gear 29 stationary takes this requirement into account. Adjustment of stud 41 in 40 enables the operator of my device to vary the tension of springs 45 and 46 and thereby vary the tendency of locking dogs 36 and 37 to lock ring gear 29. When the fastening which the operator is attempting to drive presents a greater resistance to turning than the operator anticipates in his application of tension to the springs 45 and 46, then locking dogs 36 and 37 come out of engagement with slots 35, ring gear 19 is free to rotate, and no power is transmitted to sleeve 22. Scale 53, on cap member 23 adjacent slot 40, and a suitable indicator on washer 43, enable the operator to develop skill in the setting of tension in the springs 45 and 46.

The operation of the device will now be described with respect to the tightening of a nut. Handle portion B is coupled to a source of compressed air, and shank 51 of adaptor C is inserted in the square passageway 52 of tool-supporting sleeve 22. Suitable means is placed upon the adaptor C. Nut 42 is loosened and stud 41 is moved to a position which applies the desired amount of tension to springs 45 and 46. The socket member is placed in position upon the nut which is to be tightened. Operating button 24a of valve 19 is depressed whereupon compressed air flows through passageway 15 into passageway 16.

As the compressed air travels through passageway 16 some of the air escapes through each orifice 49. Air rushing through orifices 49 impinges upon blades 25 of the rotors 24 causing the latter to rotate. After impinging upon the blades 25, the air is exhausted through ports 50 in section 11.

The rotation of the rotor causes tool supporting sleeve 22 to rotate also but at a greatly reduced speed and with increased force. Rotation is imparted to the tool-supporting sleeve in the following manner. As the rotor 24 rotates, planetary compound gears 28, which are disposed in the web of the rotor, are carried with the rotor. The dogs 36, which lockingly engage slots 35 in the collar 34 of ring gear 29, hold ring gear 29 stationary. Ring gear 29 meshes with gear wheels 32 of the planetary compound gear 28. Gear wheels 32 are caused to rotate about their own axes as well as revolving concentrically about tool-supporting sleeve 22. The motion of gear wheels 32 is transferred to gear wheels 33, since gears 32 and 33 have common axes. The gear wheels 33 mesh with spur gear 30 which is rigidly secured to tool-supporting sleeve 22. Sleeve 22 is driven at a greatly reduced speed compared to that imparted to the rotor 24. Rotation of tool supporting sleeve 22 drives the nut through the adaptor C and the socket member.

When the nut which is being driven is sufficiently tightened the forces resisting the nut are greater than the ability of dogs 36 to remain in locking engagement with slots 35. Locking dogs 36 slip out of the slots 35, and ring gear 29 is permitted to rotate freely about the tool-supporting sleeve. The rotor 24 will continue to rotate as long as compressed air enters passageway 16. Rotor 24 will carry the planetary compound gears 28 and ring gear 29 will continue to rotate, with sleeve 22 remaining stationary. All
rotation ceases when valve 19, is permitted to return to valve seat 21.

It is intended that the present disclosure should not be construed in any limiting sense other than that indicated by the scope of the following claims.

What I claim as my invention is:

1. A compressed air powered fastening driver for nuts, bolts, studs, screws and the like, comprising a head portion, a handle portion, a tool-supporting sleeve rotatably mounted in said head portion, a bladed rotor concentrically rotatably mounted upon said tool-supporting sleeve, speed reduction gearing operatively connecting said rotor and said tool-supporting sleeve, and a passageway leading through said handle portion into said head portion whereby compressed air may be directed to impinge upon the blades of said rotor, causing the latter to rotate and, through said reduction gearing, causing said sleeve to rotate, said rotor including an inwardly extending web that terminates in a hub member, said hub member being journaled on said tool-supporting sleeve, said speed reduction gearing comprising a spur gear rigidly secured to, and concentrically disposed with respect to, said tool-supporting sleeve, planetary compound gears journaled in the web of said rotor, and a ring gear journaled upon said tool-supporting sleeve, each of said planetary compound gears comprising an axle and two gear wheels rigidly secured to opposed ends of said axle, one of the gears of the planetary compound gear meshing with said spur gear, the other of the gears of said planetary compound gear meshing with said ring gear.

2. A compressed air powered fastening driver as defined in claim 1 and means for throwing said reduction gearing out of operative connection with said tool-supporting sleeve comprising a collar extending from said ring gear, said collar being disposed concentrically with respect to said sleeve, slots in said collar, locking dogs pivotally mounted within said head portion, tension springs urging said dogs into engagement with the said slots in said collar whereby said ring gear may be held against rotation, and means for varying the tension applied to said springs, said dogs coming out of engagement with said slots against the action of said springs when the resistance to turning presented by a fastening being driven by said tool-supporting sleeve overcomes the tendency of said springs to maintain said dogs in engagement with said slots.

PETER ISAAC.

REFERENCES CITED

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

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