

[54] SCREWDRIVER

144/32; 408/130

[75] Inventor: **Karl-Heinz Weber**, Wolfratshausen, Germany[73] Assignee: **Weber Schraubautomaten GmbH & Co., KG**, Wolfratshausen-Farchet, Germany[22] Filed: **July 10, 1974**[21] Appl. No.: **487,058****Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 340,086, March 12, 1973, abandoned.

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[58] Field of Search 173/152-159;

[56]

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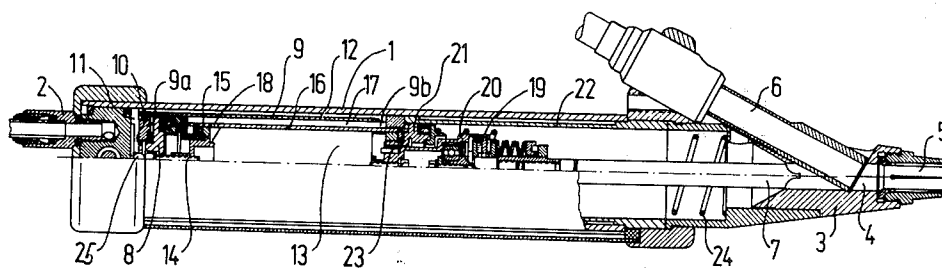
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Primary Examiner—Ernest R. Purser

[57]

ABSTRACT

A screwdriver, comprising a screwdriver blade which can be longitudinally displaced by means of a piston moved in a pneumatic cylinder and which can be set in rotation by means of an air motor, wherein the air motor is journaled on a piston which is secured against rotation.

6 Claims, 3 Drawing Figures

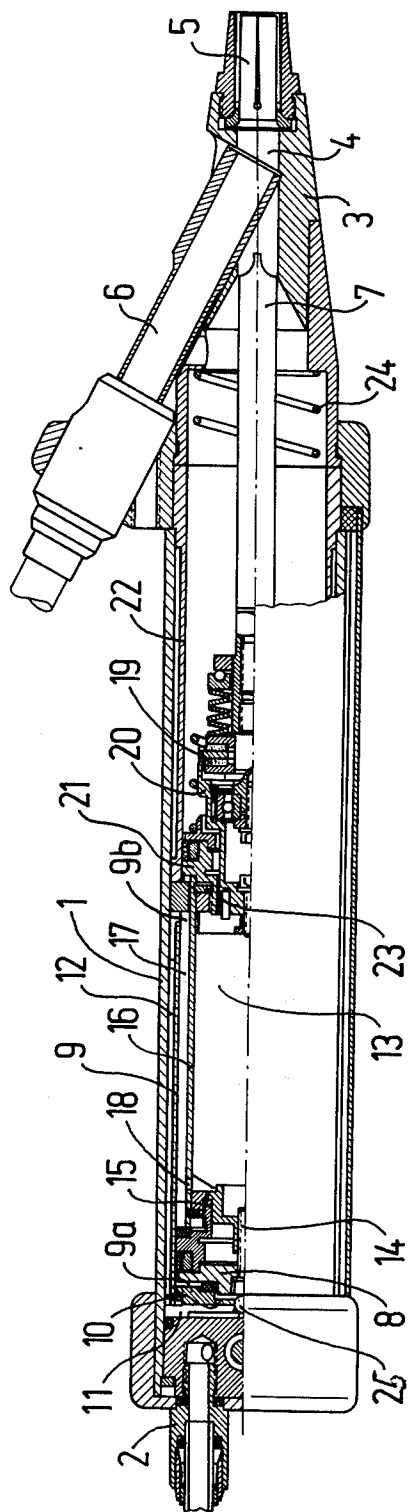
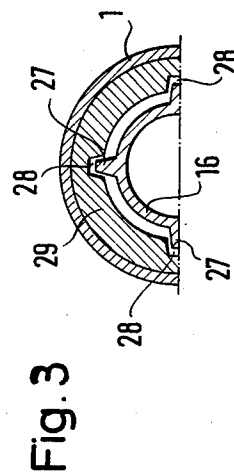
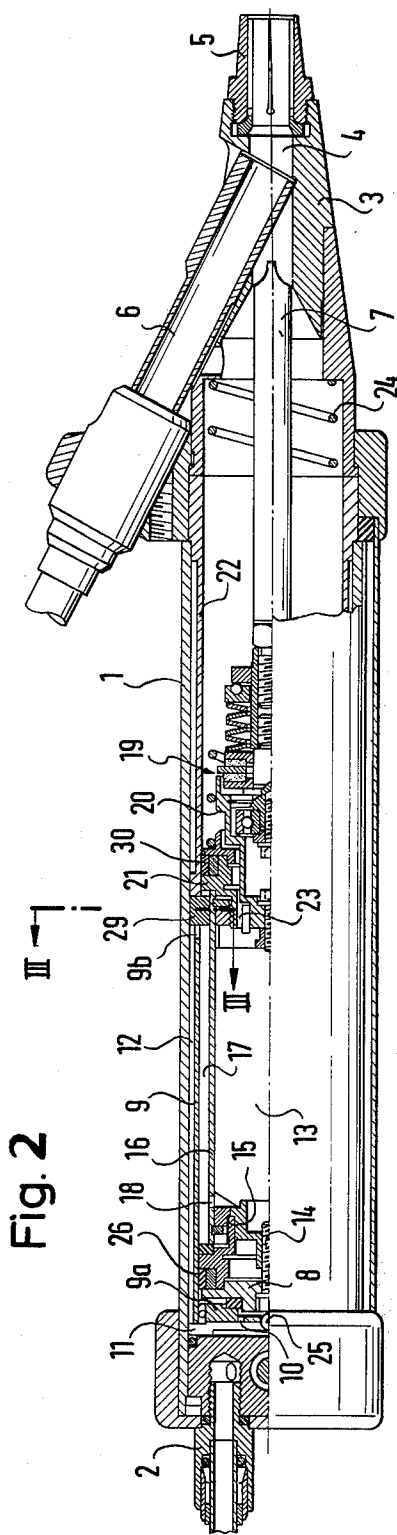


FIG. 1



SCREWDRIVER

This application is a continuation-in-part application of application Ser. No. 340,086 filed Mar. 12, 1973 now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a mechanical screwdriver, in particular a screwdriver for manual operation. Such screwdrivers comprise a screwdriver blade which can be longitudinally displaced by means of a piston moved in a pneumatic cylinder and which can be rotated by means of an air motor via a torque clutch.

In known mechanical screwdrivers of this type, the air motor is stationarily mounted in the screwdriver housing. The mechanical screwdriver is caused to rotate by the air motor via a gear rack which can be displaced relative to said air motor. These known screwdrivers are of considerable length because, in addition to the longitudinal extension of the air motor, there must also be room for the path of the piston which pushes the screwdriver blade. A long screwdriver housing is by necessity heavy, and this is particularly undesirable in the case of screwdrivers for manual operation.

It is, therefore, an object of the invention to reduce the size of mechanical screwdrivers of the general type described above.

It is another object of the present invention, to provide a mechanical screwdriver which requires minimal space even if means are provided for preventing rotation and twisting of the piston and the air motor connected thereto.

BRIEF SUMMARY OF THE INVENTION

This object is accomplished, in accordance with the invention, by journalling the air motor on a piston which is secured against rotation. The air motor together with the piston moves in the axial direction of the screwdriver.

Also, the air motor is secured between the housing and the pneumatic cylinder on the front side of the piston facing toward the screwdriver blade so as to leave an intermediate space; the air motor is sealed at the end adjacent the screwdriver blade and is passed through a sleeve which is coaxial relative to the pneumatic cylinder; and the pneumatic cylinder is open at the end facing toward the screwdriver blade and is connected to an air supply duct so that pressurized air from this duct can flow between the inner wall of the pneumatic cylinder and the outer wall of the housing of the air motor to an air entrance aperture in the air motor housing.

BRIEF DESCRIPTION OF THE DRAWING

The invention is illustrated, by way of example, in the attached drawings, in which:

FIG. 1 is a partial longitudinal section through a first embodiment of a mechanical screwdriver according to the present invention;

FIG. 2 is a partial longitudinal section through a second embodiment of the present invention;

FIG. 3 is a section taken along the line III—III of FIG. 2.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A cylindrical screwdriver housing 1 is provided at its back end with a connection 2 for pressurized air. A

screwdriver head 3 with a channel 4 for screws is connected at the front end. Channel 4 terminates in a spring collet 5 which surrounds said channel coaxially and which is radially resilient to elastically retain the screws which can be introduced into the channel 4 by a screw supply tube 6 which can be swung away outwardly.

A screwdriver blade 7 is provided on the same axis as channel 4 and can be moved back and forth in longitudinal direction in the screwdriver housing 1. This movement is accomplished by means of a piston 8 which is sealed and guided in a pneumatic cylinder 9 mounted in the screwdriver housing 1 so as to be secure against rotation. The rear end of the pneumatic cylinder 9 is closed off by a base 9a which has a calibrated bore 10. This bore proceeds from an air chamber 11 which in turn is connected to the pressurized air connection 2 via a valve. The pneumatic cylinder 9 is dimensioned and disposed such that it, together with the inner wall of the screwdriver housing 1, forms an annular intermediate space 12 which terminates directly in the outer marginal region of the air chamber 11. The pneumatic cylinder 9 is open at 9b and is connected at this point with the air supply duct formed by said intermediate space 12.

An air motor 13 is provided for rotating the screwdriver blade 7. This motor is rigidly connected with the piston 8 at the end facing away from the screwdriver blade 7, by means of a central screw 14 and a mounting sleeve 15. The housing 16 of said air motor 13 is dimensioned and disposed such that an annular intermediate space 17 remains free between the outer wall of the air motor housing and the inner wall of the pneumatic cylinder 9, this space being connected with the interior of the air motor 13 through an air entrance aperture 18.

The screwdriver blade 7 is connected to a drive sleeve 20 via an adjustable torque clutch 19, the sleeve in turn being positively connected to the rotating parts of the air motor 13. The drive sleeve 20 is partially surrounded by a guide ring 21 which is rigidly connected to the front end of the housing 16 of air motor 13. The guide ring 21 acts as a seal in a sleeve 22 which is coaxial relative to the pneumatic cylinder 9. An air exhaust duct 23 for the propulsive air emerging from the air motor 13 is between the ring 21 and the drive sleeve 20.

The mechanical screwdriver described above operates as follows:

In the illustrated position, the screwdriver blade 7 is located in the withdrawn, resting position. A screw is forced through the screw supply tube 6 by pressurized air into the screw channel 4 and from there into the spring collet 5 such that the slot of the screw head is facing toward the screwdriver blade 7. Pressurized air is then introduced into the air chamber 11 through the air connection 2. This pressurized air partially flows through the calibrated bore 10 into the pneumatic cylinder 9 and thereby forces the piston 8 with the air motor 13 secured thereto towards collet 5. Another portion of the pressurized air flows from the air chamber 11 into the annular intermediate space 12, then into the open end 9b of the pneumatic cylinder, through intermediate space 17 between the housing 16 and cylinder 9 and finally reaches the interior of the air motor 13 through the air entrance aperture 18. The motor begins to rotate and thereby imparts rotational movement to the screwdriver blade 7 via the drive

sleeve 20 and the torque clutch 19. The screwdriver blade 7, which is moved towards collet 5 by virtue of the piston 8 movement in the same direction, is already rotating while it moves the pivotable screw supply tube 6 outwardly and engages the screw which is held in the spring collet 5. Hence, a screw which is already rotating and is ready for immediate use is pressed outwardly from the spring collet 5 by the screwdriver blade 7 and is screwed into a workpiece.

After the screw has been screwed into the workpiece, the pressurized air supply to the chamber 11 is ended. A return spring 24 returns the piston 8 with the pressurized air motor 13 into the starting position. The air can escape from the pneumatic cylinder 9 via a non-return valve 25 and via channels 12 and 17 through the motor 13 and duct 23.

Since the air motor is not longer than the displacement path of the piston, the housing is shorter by the length of the air motor, and the powered screwdriver is correspondingly lighter. Furthermore, a drive shaft with longitudinal teeth for the screwdriver can be omitted which again constitutes a structural simplification.

As will be evident from the above, the pneumatic cylinder and the air motor can be supplied from a common air chamber with pressurized air independently of one another. This has the great advantage that the screwdriver blade is set in rotation by the air motor even during the forward movement of the piston. This means that a screw, which has already been set in rotation by the screwdriver blade engaging it, emerges from the screw holder of the mechanical screwdriver. Since this screw is already rotating as it leaves the screwdriver, it is screwed in more accurately and reliably than if rotation were imparted to a screw which is pushed by a non-rotating screwdriver blade as said screw meets the workpiece, as is the case in known mechanical screwdrivers.

In accordance with a second embodiment of the present invention, rotation of the air motor and piston are prevented. This is accomplished by connecting the air motor to the rear side of the piston facing away from the screwdriver. The piston has an annular seal which provides an engagement profile which extends over the length of the housing and which cooperates with an engagement profile counterpart on what might be considered a rotation prevention member. The latter is rigidly secured at a location of the screwdriver adjacent to the front end of the air motor housing when the piston is located in its retracted position. In this manner, it is possible to achieve a rotation-free movement of the piston by means of the air motor without causing difficulties in sealing or without causing an increase in the amount of axial space required.

More specifically, with reference to FIGS. 2 and 3, piston 8 and air motor 13 are prevented from undergoing rotation in the following manner: Air motor 13 is secured with its rear end to the front surface of the piston 8 which faces toward the screwdriver 7. The piston 8 contains a peripheral seal 26 which slides along the smooth inner surface of the pneumatic cylinder 9. The housing 16 of the air motor (see FIG. 3) is externally provided with ridges 27 extending over its entire length. For example, four ridges 27 can be provided at regular intervals. These ridges engage in matching grooves 28 of an annular sealing member 29 which is firmly clamped between the front surfaces of the pneumatic cylinder 9 which face one another and sleeve 22.

The air passage from the intermediate space 12 into the intermediate space 17 is guaranteed by openings at the front end of the pneumatic cylinder 9, as illustrated at 9b. The guide ring 21 contains on its periphery another seal 30 which slides along the smooth inner surface of sleeve 22.

The described arrangement of the torsion prevention member 29 and its coaction with the ridges 27 extending over the entire length of the air motor housing 16, provides good assurance that torsion will be prevented without increasing the amount of axial space required. At the same time, the seal is not impaired in any way, since the torsion prevention member 29 is always located between the two seals 26 and 30.

It is to be understood that the invention is not limited to the particular embodiments shown and described, but only by the scope of the appended claims.

What is claimed is:

1. A screwdriver comprising a housing, a screwdriver blade rotatably and reciprocally mounted in said housing, a cylinder arranged in said housing, a piston reciprocally and non-rotatably mounted in said cylinder for reciprocating said blade, and an air motor journaled on said piston for selectively rotating said blade, said air motor having a front side adjacent said screwdriver blade and a rear side opposite thereto and being connected to said piston at said opposite side, said air motor having a shell spaced from said cylinder so as to leave an intermediate space therebetween and being connected to that side of said piston which faces said blade; said air motor being closed at that end thereof which faces said blade; a sleeve arranged coaxially with respect to said cylinder for guiding said air motor; an air supply conduit means including a first passage between said housing and intermediate space through said cylinder and a second passage between said intermediate space and said air motor through said shell, said air motor having first profile means at its outer circumference, first seal means at the outer circumference of said piston, a ring located between said cylinder and said sleeve, and second profile means fixedly connected to said housing in said ring and cooperating with said first profile means, for preventing relative rotation between said air motor and said housing.

2. A screwdriver according to claim 1, wherein said first profile means extends over the length of said air motor.

3. A screwdriver comprising a housing, a screwdriver blade rotatably and reciprocally mounted in said housing, a cylinder arranged in said housing, a piston reciprocally and non-rotatably mounted in said cylinder for reciprocating said blade, and an air motor journaled on said piston for selectively rotating said blade, said air motor having a front side adjacent said screwdriver blade and a rear side opposite thereto and being connected to said piston at said opposite side, said air motor having first profile means at its outer circumference, first seal means at the outer circumference of said piston, a ring located at a place in said screwdriver adjacent said front face of said air motor when said piston is in its retracted position, and second profile means provided in said ring and cooperating with said first profile means, for preventing relative rotation between said air motor and said housing.

4. A screwdriver according to claim 3, wherein said first profile means extends over the length of said air motor.

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5. A screwdriver comprising a housing, a screwdriver blade rotatably and reciprocally mounted in said housing, a cylinder arranged in said housing, a piston reciprocally and non-rotatably mounted in said cylinder for reciprocating said blade, and an air motor journaled on said piston for selectively rotating said blade, said air motor having a front side adjacent said screwdriver blade and a rear side opposite thereto and being connected to said piston at said opposite side, said air motor having first profile means at its outer circumference, first seal means at the outer circumference of said piston, a second profile means fixedly connected to

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said housing and cooperating with said first profile means, for preventing relative rotation between said air motor and said housing, and guide ring means connected to said air motor adjacent its front face, second seal means on the outer circumference of said guide ring means, said guide ring means being located between said first and second seal means in every position of said motor.

6. The screwdriver according to claim 5, wherein said first profile means extends over the length of said air motor.

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