April 2, 1963 G. R. KERN, JR 3,083,946

MINIATURE FLUID DRILL

Filed Sept. 7, 1962

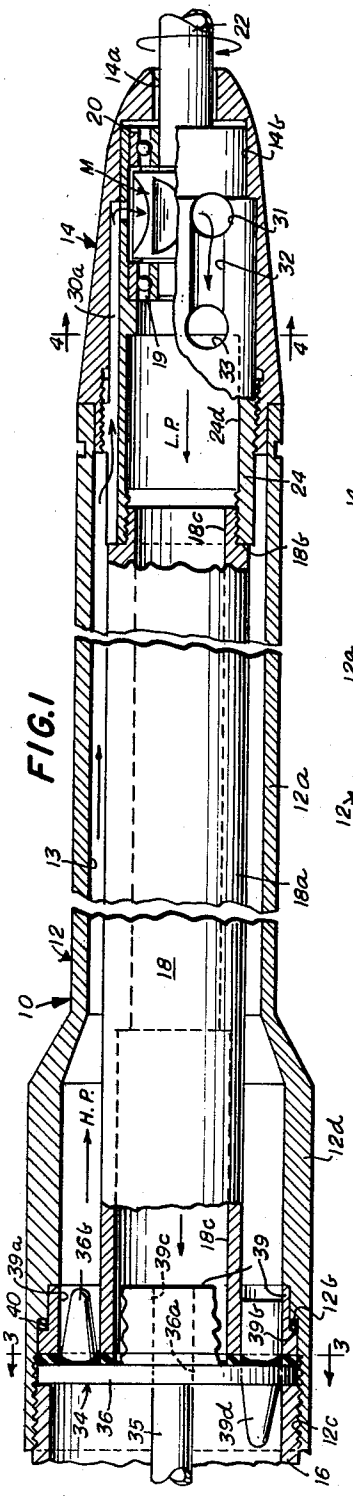


FIG. 1

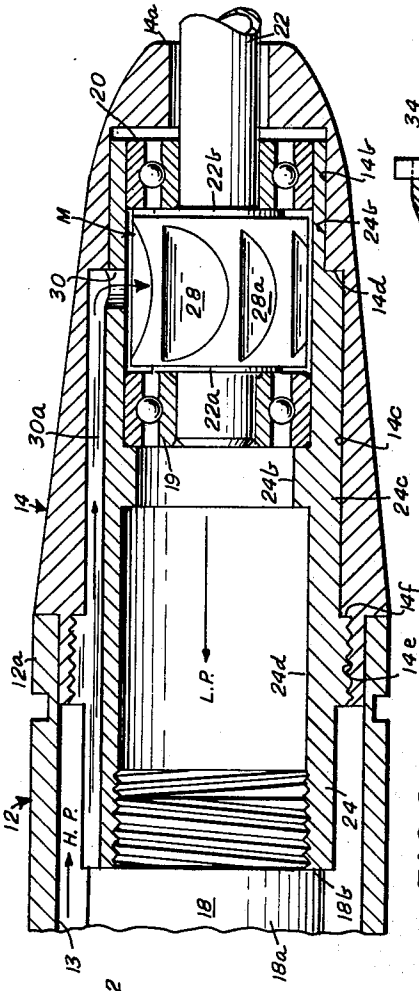


FIG. 2

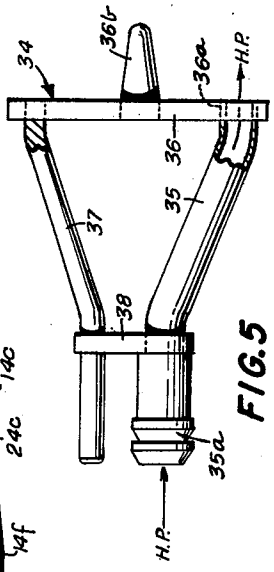


FIG. 5

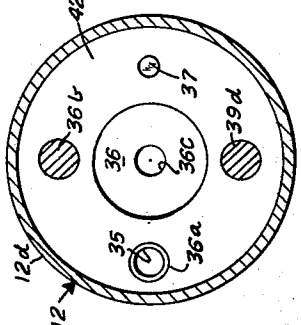


FIG. 3

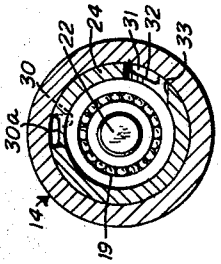


FIG. 4

INVENTOR

GEORGE R. KERN, JR.

BY Beale and Jones

ATTORNEYS

United States Patent Office

3,083,946

Patented Apr. 2, 1963

3,083,946

MINIATURE FLUID DRILL

George R. Kern, Jr., Arlington, Va., assignor to Fairfax Manufacturing Company, Inc., Falls Church, Va., a corporation of Virginia

Filed Sept. 7, 1962, Ser. No. 222,135

4 Claims. (Cl. 253—2)

This invention relates to improvements in miniature fluid drills for various uses that is fluid pressure driven and is a continuation-in-part of my copending application Serial No. 13,177, filed March 7, 1960, which is to issue as Patent 3,053,503, issue date September 11, 1962.

An object is to provide an improved small hand type of drill that is of elongated slender shape for grasping in the hand and for manipulation by the fingers with fluid pressure motor drive for a shaft projecting from the slender front thereof.

Another object of the invention is to provide in an elongated drill a feed of high pressure fluid from the rear end to a motor at the front end with exhaust through the center of the elongated handle to the rear of the drill wherein the motor is mounted in the nose with antifriction bearings each side of the impeller of the motor to reduce vibration yet to provide a relatively high torque.

A still further object of the invention is to provide in a miniature elongated hand drill, a motor housing with a fluid driven turbine element mounted with antifriction bearings to each side thereof in the housing and wherein the housing has a slotted passage to the turbine for high pressure fluid and a slotted passage from the turbine for low pressure fluid exhausted therefrom with a surrounding nose cap to enclose the slotted passages.

A further object of the invention is to provide in an elongated hand drill an assembly of outer casing with a nose piece, a central hollow insert carrying a motor assembly at its front end with the insert received in the rear end of this outer casing and locked in the casing from rear end assembly with fluid pressure supply being provided at the rear and the main low pressure exhaust also provided for at the rear.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter. It should be understood, however, that the detailed description and specific example is given by way of illustration only and, while indicating preferred embodiments of the invention is not given by way of limitation, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

For a more complete understanding of the nature and scope of the invention reference is made to the following description and claims and the drawing in which:

FIG. 1 is a longitudinal cross sectional view of the drill;

FIG. 2 is a cross sectional view of the forward motor end on an enlarged scale;

FIG. 3 is a view along line 3—3 of FIG. 1 showing the rear end of the center insert in the outer casing;

FIG. 4 is a view along line 4—4 of FIG. 1 showing the high pressure supply and low pressure exhaust to the turbine; and

FIG. 5 is an elevational view of a high pressure conductor fitting received in the rear end of the casing and communicating with the center insert therein.

Throughout the description like reference numbers refer to similar parts.

This miniature drill is of a size approximately six inches long and with a one-half inch diameter at its main finger grasping portion which is suitably knurled. While this is termed of a miniature type it is rugged and has many uses in the dental, surgical and even industrial fields.

The drill **10**, comprises in general an elongated outer tubular casing **12**, a nose member **14**, having a tail piece, an inner elongated tubular member **18** carrying in suitable bearings **19** and **20** at its forward end a fluid motor generally indicated at M which drives shaft **22** that may contain or have attached a chuck. High pressure fluid, such as compressed air, is supplied at the tail end and passes to the motor M through an annular elongated fluid pressure passage between outer casing **12** and inner tubular member **18** and exhausts from the motor M mainly through the center of member **18** and towards and through the rear portion **18***a* of the tubular member **18**.

The outer tubular casing **12** has a main body portion at **12***a* extending with a uniform diameter for about two-thirds of its length while its rear or tail end **12***d* is of an enlarged diameter, has an internal shoulder **12***b* and an internal threaded rear end at **12***c* to receive the tail piece **16** which is externally threaded to cooperate therewith. The outside of the main body **12***a* is suitably knurled so as to provide a firm grip for the fingers of the operator. There is formed between the outer casing **12** and the inner tubular member **18** an elongated fluid pressure passage **13** which conducts fluid supply pressure from the rear end forward to the motor M.

The nose piece **14** is tapered to a relatively small front apertured end **14***a* and has an internal small forward bore **14***b*, an enlarged further bore **14***c* whereby a shoulder **14***d* is formed therebetween. It has a further enlarged bore **14***e* at its rear end which is internally threaded with a right hand thread and has a shoulder **14***f* there adjacent.

The inner tubular member **18** has an attached forward end portion **24** that is threadedly attached by a left hand thread to the rear portion **18***a* of tubular member **18** where a shoulder joint is formed at **18***b* between **18***a* and **24**. This forward portion **24** has external portion **24***b* and **24***c* fitting with the bores **14***b* and **14***c* respectively of the nose member **14**. About midway between the ends of the tubular end portion **24** is an annular bore **24***d* whose forward end **24***b* serves as a thrust receiving portion for the rear thrust bearing **19**. The forward antifriction bearing **20** is received in the forward end of member **24**. The nose member **14** is received by a soldered or press fit in the casing **12**.

There is received in the bearings **19** and **20** the shaft **22**. Received on the center portion of shaft **22** is a turbine wheel **28** having fluid force receiving buckets or pockets **28***a* therein and thrust shoulders **22***a* and **22***b* for abutment against the adjacent faces of the inner races of the bearings **19** and **20** respectively.

In the member **24** there is drilled a high pressure fluid supply orifice **30** and an elongated slotted passage **30***a* in the outside of member **24** connects the annular passage **13** with the orifice **30** to supply fluid pressure to drive the turbine **28** of the motor M. Exhaust from the motor M is through an exhaust opening **31** in the member **24** and angularly disposed from supply orifice **30**, see FIG. 1, and a slotted passage **32** formed in the outside of member **24** connects exhaust opening **31** with an aperture **33** leading also through member **24** to the interior low pressure chamber **24***d* therewithin. This low pressure chamber **24***d* communicates with the low pressure elongated passage **18***c* in inner tubular member **18** and conducts the exhaust to the rear.

In FIG. 5 there is shown a high pressure fluid conductor fitting **34** which has a high pressure fluid conduit **35** with a rear coupler portion **35***a* and a circular plate **36** where the forward end of **35** is soldered into an aperture **36***a* in the plate at the outer radial portion thereof. A brace member **37** connects plate **36** with a second

smaller rear plate 38 which interconnects 35 and 37. Attached to the front face of plate 36 is a line up pin 36*b* positioned at a radial distance out from the plate's center and which is received in an aperture 39*a* in a flange member 39 attached to the rear end of the inner tubular member 18.

The rear end 12*d* of the outer casing at 12 receives the flanged end 39 which is formed with a shoulder 39*b* so as to receive a sealing O-ring 40. Through the flanged end 39 there extends an aperture 39*c* which lines up with and receives fluid supply pressure from the conduit 35. Another line up pin 39*d* projects to the rear from flange portion 39 and extends through a mutable line up the aperture in plate 36. A suitable gasket 42 is disposed between the flange portion 39 and the plate 36 on fixture 34.

It will be noted in FIG. 4 that the surrounding interior portion of the nose member 14 cooperates with the slots 30*a* and 32 in member 24 to form the high pressure and low pressure passages.

The shaft 22 may be hollow all the way from end to end and may have a mutable plastic line in its front end to receive a cutting tool.

This drill is light weight yet is rugged and develops a relatively high torque and operates at speeds of about 400,000 r.p.m. It has been found to be highly useful in dental surgery.

I claim as my invention:

1. A drill comprising, in combination, an elongated outer tubular housing having a rear end and a forward end, said forward end having connecting means for receiving the rear end of a nose member, an inner elongated tubular member having connecting means at its rear end for connecting with the surrounding rear end portion of the outer housing, said inner tubular member being radially spaced from the surrounding outer housing thereby providing an annular elongated fluid pressure passage therebetween, said inner tubular member having its forward end projecting beyond said outer tubular housing and seated in the nose member, means detachably securing said inner tubular member to the rear portion of the nose member and a rear thrust bearing receiving recess, a thrust bearing received in the thrust bearing receiving recess, a forward bearing received in the forward end of said inner tubular member and spaced from the rear bearing, a drill shaft received in and extending through said bearings and projecting outwardly in the forward end of said nose member, an annular turbine rotor fixed to said shaft intermediate said bearings and having thrust engaging portions thereon for engaging said bearings, said forward end of the inner tubular member having a high pressure fluid orifice therethrough adjacent said turbine and an exhaust orifice angularly spaced therefrom, a passage means in the inner tubular member conecting the high pressure orifice with the annular elongated fluid pressure passage, a second passage means in the inner tubular member connecting the exhaust orifice and the inner cavity in the inner tubular member for exhausting fluid from the turbine.

2. A drill according to claim 1 wherein said inner tubular member has a forward portion carrying said means for attaching the same to the surrounding nose member and a rear portion having attaching means for joining to the rear of the forward portion, whereby to provide easy assembly through the rear end of the drill.

3. A drill according to claim 2 wherein the means attaching the forward portion of the inner tubular member includes threads and wherein the means attaching the forward portion to the rear portion of the inner tubular member includes threads of an opposite hand to said first mentioned threads.

4. A drill according to claim 1 wherein said connecting means at the rear end of said inner tubular member comprises an annular shoulder portion in the rear end of the outer tubular housing, an annular flanged portion on the rear end of the inner tubular member having an annular shoulder portion thereon and gasket sealing means between said shoulder portions, said annular flanged portion on the rear end of the inner tubular member having high pressure fluid passage means therein communicating with said elongated annular high pressure fluid supply passage to said turbine.

References Cited in the file of this patent

UNITED STATES PATENTS

1,163,642	Darlington	Dec. 14, 1915
1,167,997	Haver	Jan. 11, 1916
2,128,157	Monnier et al.	Aug. 23, 1938
2,591,488	Yost	Apr. 1, 1952