

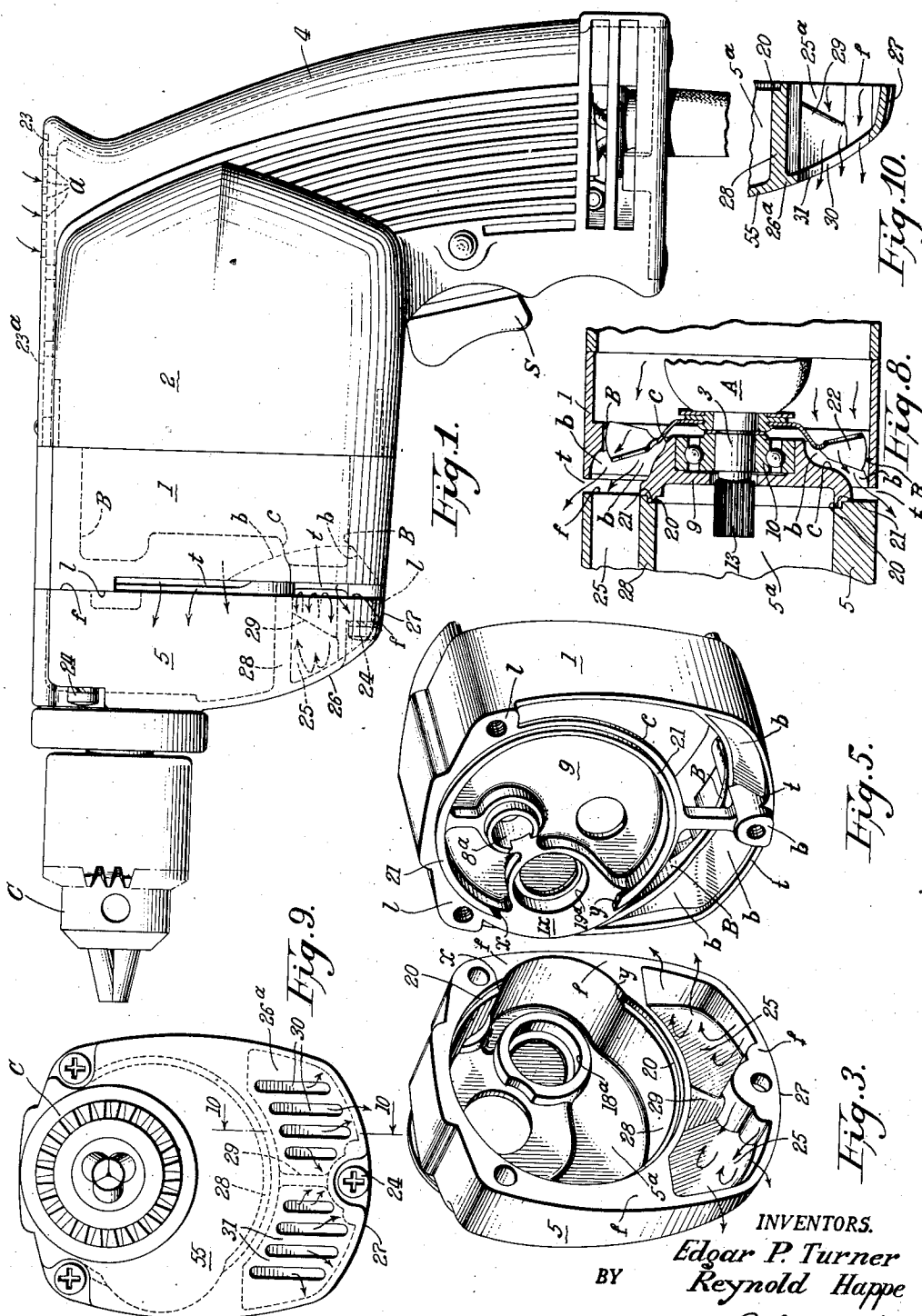
Dec. 14, 1948.

E. P. TURNER ET AL
PORTABLE ELECTRIC TOOL

2,456,571

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

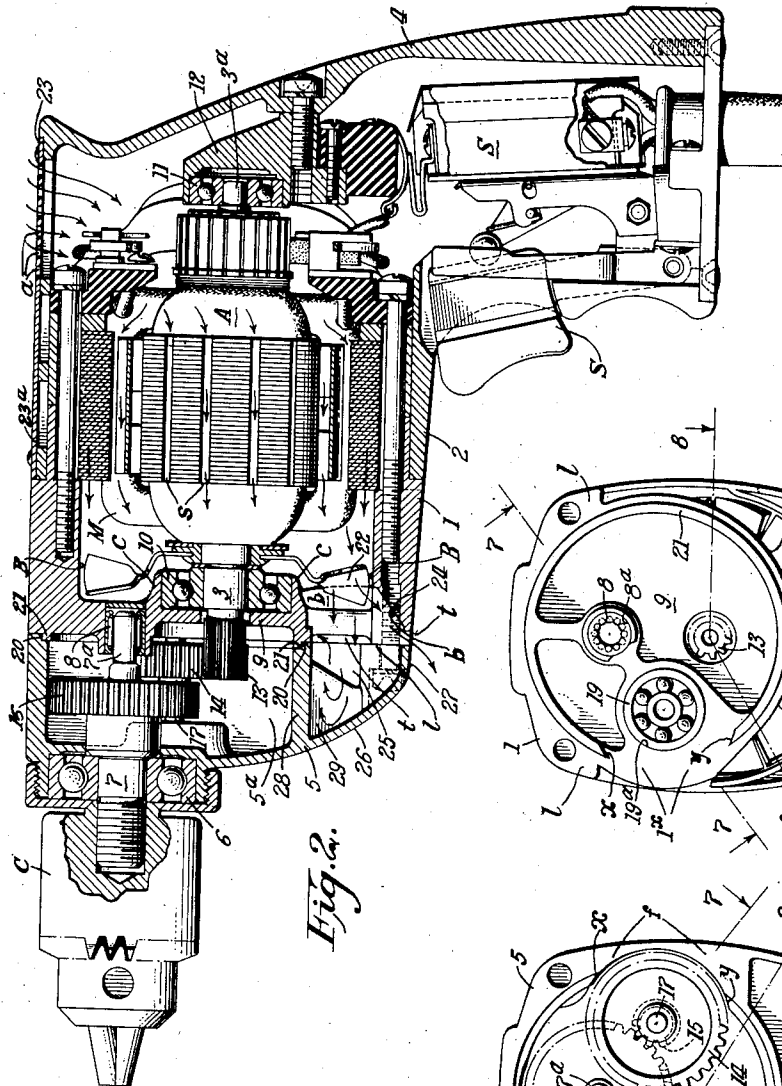


Fig. 2.

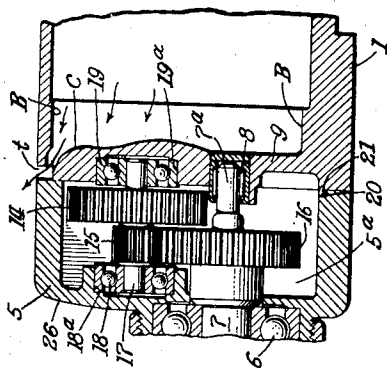


Fig. 7.

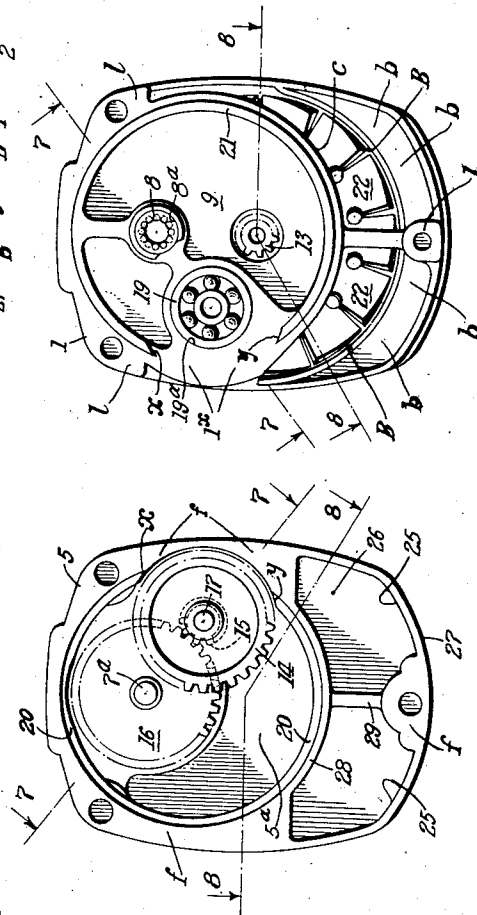


Fig. 6.

Fig. 4.

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PORTABLE ELECTRIC TOOL

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8 Claims. (Cl. 172—36)

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This invention relates to portable tools of the type having an enclosed electric motor, a rotary tool spindle and a train of speed-reducing gears located in a suitable casing and operatively connecting the motor with the tool spindle.

One of the problems in tools of this nature is the dissipation of the heat generated by the motor and by the gear train. Unless this heat is effectively dissipated the tool will become too hot to handle and the motor will be impaired and eventually destroyed.

This invention has as a primary object to provide an improved and simplified construction, the parts of which can readily be made by conventional die casting operations, for effectively ventilating and cooling tools of this nature and for lubricating the gear train.

Another object of the invention is to provide a simplified construction of this nature having a minimum number of parts which may be made by die casting operations from simple molds which are devoid of side-draw parts.

A further object of the invention is to provide an improved ventilating and cooling system for hand tools in which the ventilating and cooling air is caused to flow more nearly in a streamline than heretofore has been possible and in which the air discharged from the tool is directed forwardly and away from the user.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

Fig. 1 is a side elevation of an improved portable electric drill embodying the present invention.

Fig. 2 is a longitudinal sectional view of the drill shown in Fig. 1, with a portion of the drill chuck in elevation.

Fig. 3 is an inside perspective view of an improved gear casing which forms a part of the present tool.

Fig. 4 is an inner face view of the gear casing shown in Fig. 3, with a portion of the tool-spindle-driving gear train therein.

Fig. 5 is a perspective view of one section of a motor housing which cooperates with the gear casing, shown in Fig. 4, to support and house the gear train.

Fig. 6 is a face view of the section of the motor housing illustrated in Fig. 5, showing also the

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initial gear of the spindle-driving gear train, an anti-friction for one of the stub shafts of the gear train and the fan which effects forced ventilation of the motor.

Fig. 7 is a sectional view of the gear casing and motor housing, taken substantially on the lines 7—7 of Figs. 4 and 6.

Fig. 8 is a sectional view taken on the lines 8—8 of Figs. 4 and 6.

Fig. 9 is an outer face view of a modified form of gear casing.

Fig. 10 is a detail sectional view on the line 10—10 of Fig. 9.

Referring more specifically to the drawings, the invention is disclosed as embodied in a portable electric drill comprising a frame consisting of front and rear sections 1 and 2, respectively, having substantially cylindrical outer walls which house an electric motor designated generally as M. This motor has a rotary drive shaft 3 and is controlled by a switch device designated generally as S, located in a hollow pistol-grip handle 4 forming an integral part of the rear frame section 2. Secured to the front end of the frame section 1 is an open faced gear casing 5 in the forward wall of which is journaled, in an anti-friction bearing 6, the forward end portion of a rotary tool spindle 7 adapted to carry a chuck C or other form of tool holder. The reduced rear end 7^a of the spindle 7 is journaled in an anti-friction bearing 8 carried in a socket 8^a provided by a transverse front end wall 9 of the frame section 1. The wall 9 also supports an anti-friction bearing 10 in which the forward end of the motor shaft 3 is journaled, the rear end 3^a thereof being journaled in an anti-friction bearing 11 carried by a transverse portion 12 of the rear frame section 2.

Inasmuch as the specific construction of the motor and the means for supplying and controlling the flow of electric current thereto are generally similar to those disclosed in the United States patent of R. Happe and E. P. Turner, No. 2,396,007, Mar. 5, 1946 and form no part of this invention, detailed illustration and description thereof is deemed unnecessary.

Located within a substantially cylindrical chamber 5^a formed in the gear casing 5, is a series of speed reducing gears comprising a driving pinion 13 carried by the end of the motor shaft 3, a gear 14 which meshes with and is driven by said pinion, a pinion 15 rotatable with the gear 14, and a gear 16 secured upon the tool spindle 7 and driven by the pinion 15. The gear 14 and pinion 15 are mounted upon a jack shaft 17 which

is journaled at one end, in an anti-friction bearing 18 supported in a socket 18^a in the forward wall 26 of the gear casing 5 and at its other end in a similar bearing 19 held in a socket 19^a in forward wall 8 of the frame section 1. The wall 9 is substantially circular and serves as a closure for the open face of the chamber 5^a; the gear casing 5 and the wall 9 having complementary interfitting channel and rib portions 20 and 21, respectively, which form a grease-tight joint to maintain the chamber 5^a substantially filled with grease to lubricate the gears. As shown most clearly in Figs. 3, 4, 5 and 6, a portion of the channel 20 and rib 21 are omitted from x to y adjacent the outer edge of the gear 14. In that area, a grease-tight joint is effected between the frame section 1 and the gear casing 5 by metal-to-metal contact of the flat surfaces x and f of the parts 1 and 5, respectively.

The motor shaft 3 carries, adjacent the bearing 10, a fan 22 which, during rotation of the motor, draws air into the motor casing through perforations a formed in a grille plate 23 which covers apertures formed in the upper wall of the frame section 2. The plate 23 has an imperforate portion 23^a which may serve as a name plate, thereby obviating the necessity and expense of providing a separate plate for the latter purpose.

As shown by the arrows in Figs. 1 and 2, air drawn into the motor casing flows around the stator and through slots s in the armature A, thereby cooling the motor, after which the air is forced forwardly by the fan 22 and outwardly through vent slots t provided between the gear casing 5 and the frame section 1. These slots are formed by cutting away or depressing the forward edge of the frame section 1 between the lands l where it contacts the rear face f of the gear casing for reception of connecting screws 24.

To afford a free and unobstructed flow of air forwardly and outwardly from the fan 22, the forward portion of the outer wall of the frame section 1 is bevelled or flared outwardly and forwardly as indicated at b in Figs. 1, 2, 5 and 6. Likewise the transverse wall 9 of the frame section 1 is rounded as indicated at c , surrounding the bearing 10, to facilitate the free forward and outward flow of the air.

As shown most clearly in Figs. 2, 6, and 8, the fan 22 rotates within, and substantially fills, a substantially cylindrical fan chamber B formed in the forward end of the casing section 1. This, together with the bevelled or flared wall b of the casing section, greatly increases the efficiency of the fan.

The flow of air through the motor casing and motor carries away the excess heat in the motor and maintains it at a safe operating temperature. The air stream created by the fan 22 also serves to absorb and dissipate a substantial amount of the heat generated in the gear casing 5 by the action of the gears therein. This is effected by the provision of air chambers 25 in the lower end of the gear casing. These chambers are formed by a front wall 26, a bottom wall 27 and an upper wall 28 which latter separates the air chambers 25 from the gear chamber 5^a. A rib 29, located between the chambers 25, connects the walls 27 and 28. A portion of the air discharged by the fan 22 flows into the open rear face of the chambers 25, contacts the walls 26, 27, 28 and the rib 29 and picks up heat transmitted thereto from the gear casing. The air then turns, as indicated by the arrows in Figs. 1 and 3, and passes outwardly through the slot t between the gear case-

5 and the frame section 1, carrying with it a substantial portion of the heat generated in the gear casing.

In Figs. 9 and 10 there is disclosed a modified form of gear casing 55 in which the forward wall 26^a is provided with a plurality of parallel slots or apertures 30, forwardly of the chamber 25^a. Air discharged by the fan 22 into the chamber 25^a passes through the chamber and outwardly through the slots 30. The walls 31 between the slots 30 serve as heat dissipating fins which assist in cooling the gear casing.

From the foregoing it will be apparent that this invention has provided an improved construction comprising only three elements, viz: the two frame sections 1 and 2 and the gear casing 5 (all of which may be readily made by simple die casting operations) for effectively cooling the motor, for housing the speed reduction gears and maintaining them in a suitable lubricating grease, and for dissipating the heat generated by said gears. It is to be noted that the cooling air flows in a streamline through the tool and is discharged in a forward direction and away from the user so that the user of the tool is not inconvenienced or annoyed thereby.

Having thus set forth the nature of the invention, what we claim herein is:

1. A portable electric tool including a motor casing comprising united front and rear sections, said rear section having an air inlet, said front section comprising a substantially cylindrical outer wall and a substantially circular front end wall formed integrally with and segmentally spaced from said outer wall, the forward portion of said outer wall being bevelled forwardly and outwardly adjacent a portion of said end wall to afford an outwardly and forwardly inclined air passageway; a motor mounted in said casing and having a rotary shaft; a gear casing secured to said front section but spaced therefrom in the region adjacent the beveled portion of the outer wall of said motor casing; and a fan on said motor shaft for drawing air into said motor casing through said inlet and through said motor and ejecting it forwardly and outwardly through the space between the motor casing and the gear casing.

2. A portable electric tool including a motor casing comprising united front and rear sections, said rear section having an air inlet, said front section comprising a substantially cylindrical outer wall and a substantially circular front end wall formed integrally with said outer wall but spaced therefrom adjacent the lower half of the circular end wall; a motor mounted in said casing and having a rotary shaft; a gear casing secured to said front section and provided with an open faced gear chamber normally closed by said circular end wall, said gear casing being spaced from the front section of said motor casing in the region adjacent the lower half of said circular end wall of said motor casing; and a fan on said motor shaft for drawing air into said motor casing through said inlet and through said motor and ejecting it forwardly and outwardly through the space between the motor casing and the gear casing.

3. A portable electric tool including a motor casing comprising united front and rear sections, said front section comprising a substantially cylindrical outer wall and a substantially circular end wall formed integrally with said outer wall but spaced therefrom adjacent the lower half of the circular end wall, the forward portion of said

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end wall being provided with an outwardly extending arcuate rib; a grease-tight gear casing secured to said front section but spaced therefrom in the region adjacent the lower half of said circular end wall of said motor casing, said gear casing being provided with an arcuate channel adapted to receive said rib; a motor mounted in said casing and having a rotary shaft projecting into said gear casing; a tool spindle journaled in a wall of said gear casing; and a speed reducing gear train located within said gear casing and connecting said motor shaft with said tool spindle.

4. A portable electric tool including a motor casing comprising united front and rear sections, said rear section having an air inlet, said front section comprising a substantially cylindrical outer wall and a substantially circular end wall formed integrally with said outer wall but spaced therefrom adjacent the lower half of the circular end wall; a motor mounted in said casing and having a rotary shaft; a grease-tight gear casing secured to said front section and provided in its upper portion with a substantially circular gear chamber normally closed by said end wall and in its lower portion with an air chamber; and a fan on said motor shaft for drawing air through said inlet and into said motor casing and through said motor and ejecting it forwardly into said air chamber and finally outwardly through the space between the motor casing and the gear casing.

5. A portable electric tool including a motor casing comprising united front and rear die-cast sections, said rear section having an air inlet, said front section comprising a continuous outer wall and a substantially circular end wall formed integrally with said outer wall but spaced therefrom adjacent the lower half of the circular end wall, said front section being provided with a plurality of bearing sockets; a motor mounted in said casing and having a rotary shaft; a die-cast gear casing secured to said front section but spaced therefrom in the region adjacent the lower half of said circular end wall of said motor casing, said gear casing being provided with a plurality of bearing sockets, each aligned with one of the sockets in said front section; a tool spindle journaled in said gear casing; a gear train in said gear casing journaled in bearings in said sockets for connecting said motor shaft with said tool spindle; and a fan on said motor shaft for drawing air through said inlet and into said motor casing and through said motor and ejecting it forwardly and outwardly through the space between the motor casing and the gear casing.

6. A portable electric tool including a motor casing comprising united front and rear sections, said rear section having an air inlet, said front section comprising a continuous outer wall affording a substantially cylindrical fan chamber and having a substantially circular end wall formed integrally with said outer wall but spaced therefrom adjacent the lower half of the circular

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end wall, the forward portion of said outer wall being beveled forwardly and outwardly adjacent the lower half of said end wall to afford an outwardly and forwardly inclined air passageway; a motor mounted in said casing and having a rotary shaft; a gear casing secured to said front section but spaced therefrom in the region adjacent the lower half of said circular end wall of said motor casing; and a fan on said motor shaft operating in and substantially filling said fan chamber for drawing air through said inlet and into said motor casing and through said motor and ejecting it forwardly and outwardly through the space between the motor casing and the gear casing.

7. A portable electric tool having a motor casing comprising separable front and rear sections having side walls together providing a motor and fan chamber, said front section having an integral end wall of which a portion is spaced from its side wall to provide an air passageway; a motor disposed in said chamber and having a rotary shaft journaled in said end wall of the front section of the casing; a gear casing having an outer wall abutting said front section and provided with an inner gear-housing wall complementary to said end wall of the front section in providing a continuation of said air passageway between said inner gear-housing wall and the outer wall of the gear casing, the outer wall of said gear casing having a portion thereof spaced from the front section outer wall in the region of said air passageway; and a fan carried by said shaft at the motor side of said end wall of the front section.

8. A portable electric tool including a motor casing comprising united front and rear sections, said rear section having an air inlet, said front section comprising a continuous outer wall and a substantially circular end wall formed integrally with said outer wall but spaced therefrom adjacent the lower half of the circular end wall, the forward portion of said outer wall being beveled forwardly and outwardly adjacent the lower half of said end wall to afford an outwardly and forwardly inclined air passageway; a motor mounted in said casing and having a rotary shaft; a gear casing secured to said front section but spaced therefrom in the region adjacent the lower half of said circular end wall of said motor casing, said gear casing being provided in its front wall with a plurality of ventilating apertures; and a fan on said motor shaft for drawing air through said inlet and into said motor casing and through said motor and ejecting it forwardly through the apertures in the wall of the gear casing and outwardly through the space between the motor casing and the gear casing.

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No references cited.