May 16, 1944. H. R. FISCHER 2,349,156

OFFSET DRILLING ATTACHMENT

Filed March 13, 1942 2 Sheets-Sheet 1

Fig. 1.

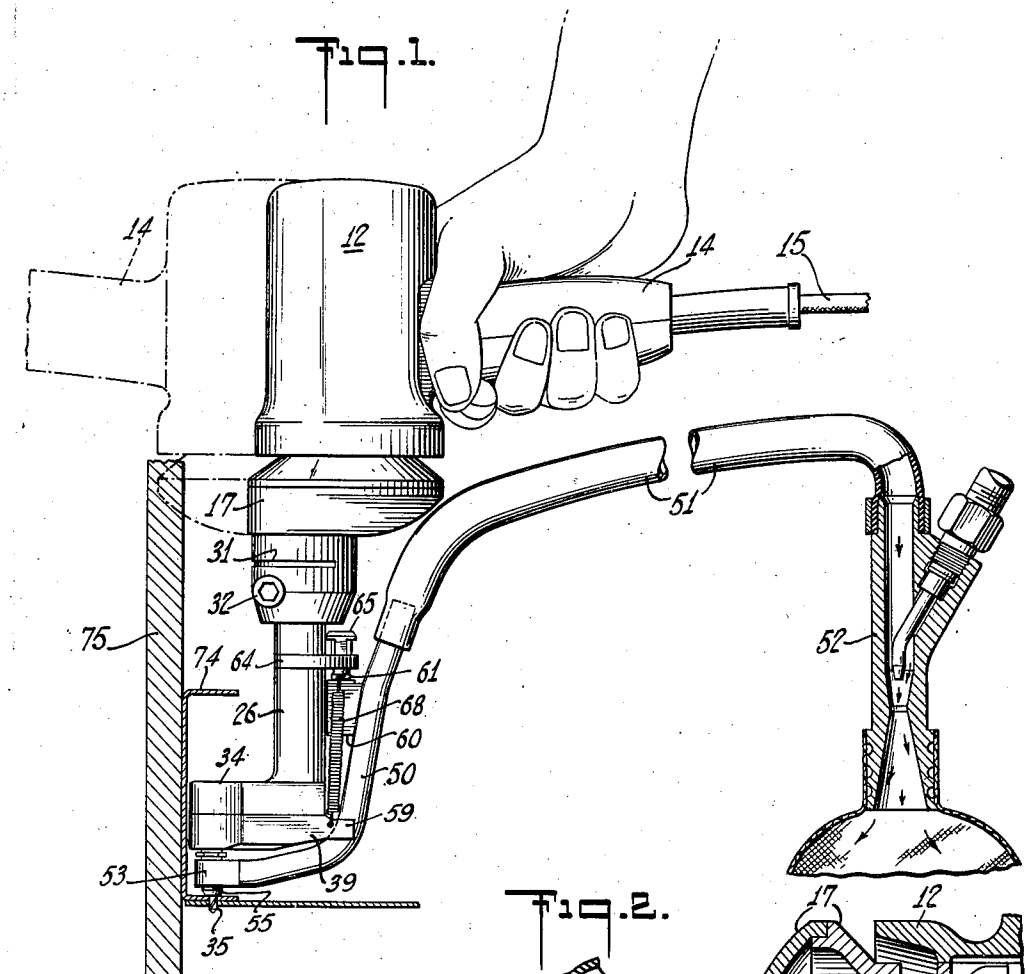
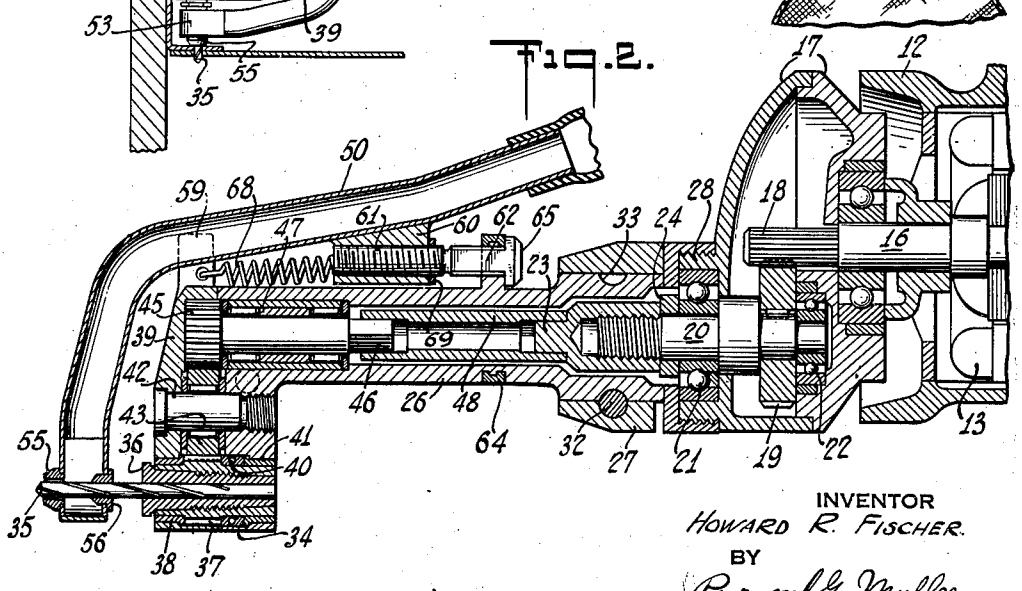


Fig. 2.



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Filed March 13, 1942 2 Sheets-Sheet 2

Fig. 3.

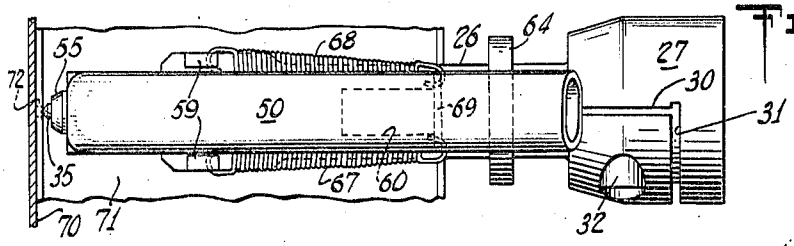


Fig. 4.

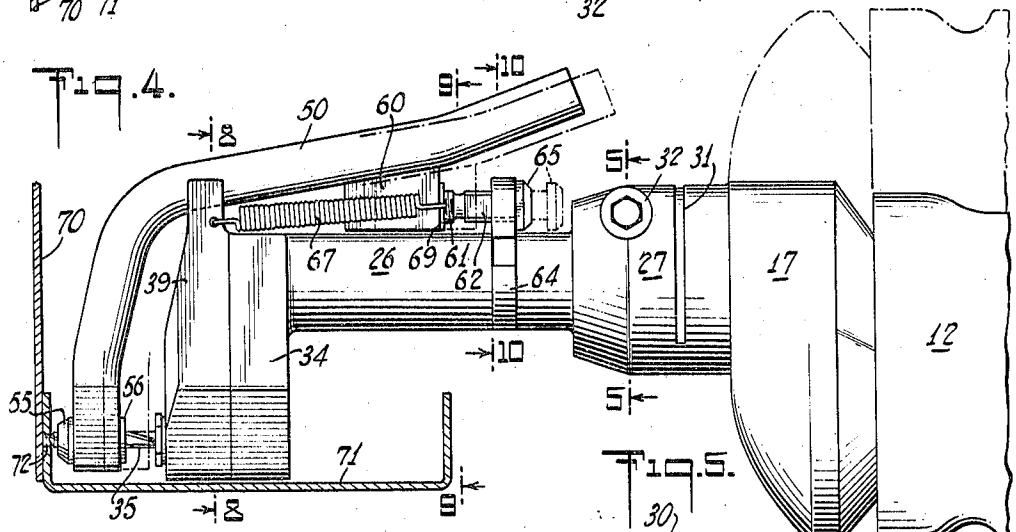


Fig. 5.

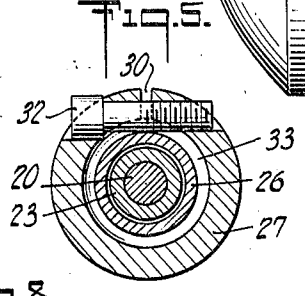


Fig. 6.

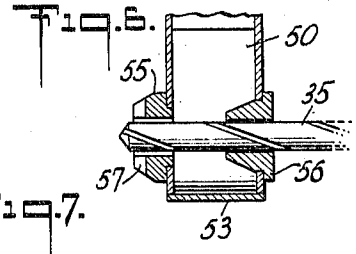


Fig. 7.

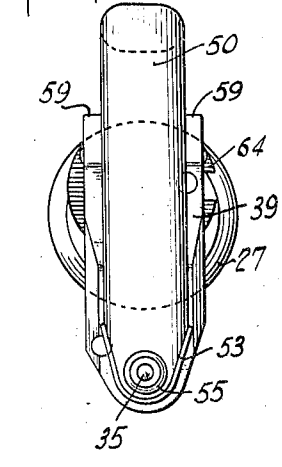


Fig. 8.

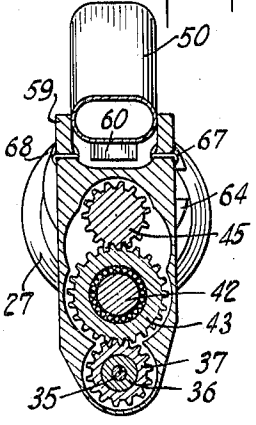


Fig. 9.

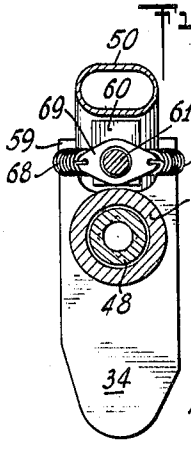
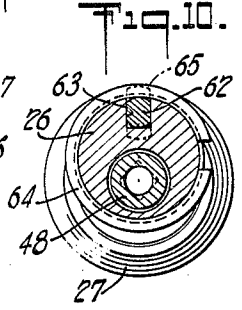


Fig. 10.



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UNITED STATES PATENT OFFICE

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OFFSET DRILLING ATTACHMENT

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Application March 13, 1942, Serial No. 434,511

8 Claims. (Cl. 77—55)

This invention relates to portable tools for drilling, reaming, and the like and more particularly to a drill attachment designed for operation in close quarters. The invention has a special, though not limited, application in aircraft construction for drilling holes in an aluminum skin member and its supporting channel member in preparation for a riveting operation.

An object of the invention is the provision of a drill attachment or extension for holding the bit in a position offset from the axis of the drill spindle, thereby permitting the drilling of a channel member by inserting the bit between the flanges thereof.

Another object is to enable the drill motor and handle to be swiveled relative to the attachment, whereby the handle may be offset from the attachment body on the same side as the bit or may extend in a different direction.

A further object is the provision of an improved mounting for a suction tube whose function is to remove the dust particles and chips resulting from the drilling operation and also to serve as a hold-down device for maintaining two adjacent sheets of metal in firm engagement while they are being drilled.

A still further object is to permit quick adjustment of the attachment relative to the drill, and of the suction tube relative to the attachment.

Other objects and features of the invention will appear more clearly from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a side elevation of a portable drill equipped with an attachment of the invention and held in a vertical position, a portion of the dust disposal apparatus being shown in longitudinal section;

Fig. 2 is a longitudinal section of the drilling attachment and part of the motor shown in Fig. 1, held in a horizontal position and viewed in a different direction;

Fig. 3 is an elevational plan view of the drilling attachment;

Fig. 4 is a side elevation of the attachment, a portion of the drill being illustrated in two alternative positions of adjustment relative to the attachment;

Fig. 5 is a cross section through the swivel connection as indicated by the arrows 5 in Fig. 4;

Fig. 6 is a longitudinal section of the front end of the suction tube and illustrates the bushings surrounding the bit;

Fig. 7 is an end elevation looking from the left in Fig. 4;

Fig. 8 is a cross section through the transmission gears as indicated by the arrows 8 in Fig. 4;

Fig. 9 is a cross section through the spring mounting for the suction tube, as indicated by the arrows 9 in Fig. 4; and

Fig. 10 is a cross section as indicated by the arrows 10 in Fig. 4.

Fig. 1 is on a smaller scale, and Fig. 6 on a larger scale, than the remaining figures.

The invention is disclosed as an attachment to a portable drill of a type commonly used in the aircraft industry to drill holes in adjacent metal sheets preparatory to riveting. Referring to Figs. 1, 2 and 4, the drill comprises a main housing 12 enclosing an electric motor 13, and a grip handle 14 from which extends an electric cable 15. The electric motor drives a shaft 16 which projects from the housing 12 into a transmission case 17, which is rigidly bolted to the front of the housing. The front end of the shaft 16 is formed as a toothed pinion 18 and meshes constantly with a gear 19 fixed to a spindle 20. The spindle extends parallel to the motor shaft 16 and is rotatably mounted in bearings 21 and 22 within the case 17. The spindle extends forwardly through an opening in the transmission case 17 and has screw-threaded engagement with a driving key 23. A washer 24 is interposed between the driving key and the bearing 21 to sustain the axial thrust of the key.

The attachment of the present invention comprises a body member 26 swivelly connected to the gear case 17 by means of an adapter 27. The rear end of the adapter is internally threaded to receive a threaded projection 28 on the gear case 17. Referring to Figs. 3, 4 and 5, the front end of the adapter is provided with a longitudinal slot 30 communicating with a circumferential slot 31. An adjusting screw 32 extends across slot 30 and is arranged tangent to an annular groove 33 in the body 26 to provide a swivel connection between said body and the adapter 27. By tightening the screw, the slotted portion of the adapter is clamped securely around the body 26 to lock it frictionally in adjusted position.

The body member 26 of the attachment has an angular extension 34 in which the drill bit 35 is supported. The drill bit is permanently secured, as by soldering, within a driven bushing 36 which is screwed in a driven gear 37. The periphery of the gear has a toothed portion intermediate a forward and a rearward bearing

portion. The forward bearing portion is mounted within a friction bushing 38 supported by a cover plate 39. The rearward bearing portion is mounted within a thrust bushing 40 and a friction bushing 41, the latter being fitted within a bore in the body extension 34. The bushings cooperate to hold the gear 37 against axial movement while permitting rotation thereof. Cover plate 39 is secured to the body 26 by means of a screw 42. It is recessed to provide a space between the plate and the body. Within the recess are positioned the driven gear 37, an idler gear 43 surrounding the screw 42 and meshing with gear 37, and a driving gear 45 for imparting rotation to the idler. Driving gear 45 has a toothed portion at its front end, a square portion 46 at its rear extremity and an intermediate cylindrical portion. The cylindrical portion is mounted in a needle bearing assembly 47 comprising rollers and spacers arranged within a counterbore in the attachment body 26. A drive shaft 48 mounted in the bore of the body 26 transmits torque from the driving key 23 to the driving gear 45 and has square sockets at its ends for cooperation with correspondingly shaped ends on the driving key and driving gear. From the foregoing description it is apparent that rotation of the motor is imparted through the reduction gears 18 and 19, spindle 20, driving key 23, drive shaft 48, driving gear 45, idler 43, driven gear 37, driving bushing 36, and bit 35. This driving transmission is not interrupted when the motor housing 12 is swiveled relative to the attachment body 26.

The chip collector of the present invention comprises an elongated suction tube 50 of angular shape. One arm extends alongside the attachment body 26 and the other in front of the extension 34. The rear end of the tube is attached to a flexible hose 51 leading to an air jet device 52 which is arranged to maintain a partial vacuum in the suction tube. The front end of the tube 50 is closed by a cover plate 53 secured to the tube by welding. The tube is provided with aligned apertures to receive the bit 35 and a pair of hardened steel bushings 55 and 56 which are secured to the tube by brazing. As shown in Fig. 6, rear bushing 56 surrounds the bit 35 with only a slight clearance. Front bushing 55 has a bore of sufficient diameter to permit the entry of dust and metal particles into the suction tube, the particles being arranged to travel along the flutes of the bit, being entrained with the air sucked into the tube. A set of radial grooves 57 insure the passage of an adequate volume of air when the bushing is pressed tight against the metal sheets being drilled. The pressure of the front bushing 55 against the drilled sheets holds the sheets together and prevents the formation of burrs therebetween.

An important feature of the invention resides in a novel support for the suction tube which permits limited movement thereof lengthwise of the body 26 and yieldingly holds the tube in its foremost position. In accordance with this invention, the suction tube is guided for such movement by the bit 35 and by a pair of lugs 59 extending from the cover plate 39. Also cooperating with the guiding means is a block 60 welded to the suction tube 50 and receiving a screw 61. As shown in Fig. 10, the screw has a flattened portion 62 slidably mounted in a slot 63 formed in a flanged portion of the body member 26. A split ring 64 circumscribes the flanged portion to lock the screw in the slot. A narrow head 65 on screw 61 is adapted to abut against ring 64 and the flanged portion of body 26 to limit the forward movement of the screw with the associated block 60 and suction tube 50. The screw head may be passed through the slot 63 when the suction tube is being assembled or disassembled. The suction tube is constantly urged toward its forward limit position by a pair of extension springs 67 and 68 on opposite sides of the block 60 and extending from the lugs 59 to an apertured plate 69 which rests against the front face of the block 60, as shown in Fig. 9. The limit to the forward movement of the suction tube may be adjusted by turning the screw 61 while the suction tube is removed from the attachment body 26.

To change the bit 35 for resharpening, it is necessary to turn the split retaining ring 64 until the space between the ends of the ring is aligned with the adjusting screw 61, whereupon the complete suction tube assembly including the adjusting screw may be removed in a forward direction.

Fig. 4 illustrates the use of the invention for drilling a pair of aligned holes in an aluminum skin member or sheet 70 and an aluminum supporting rib or channel 71 in preparation for a riveting operation in aircraft construction. The channel 71 is first drilled with small holes 72 indicating the position where the rivets are to be located, and the channel member thereby serves as a template for locating the bit 35. The operator grasps the suction tube 50 and withdraws it to the position outlined in broken lines in Fig. 4 to expose the point of the bit 35. The drill and attachment are moved to insert the bit into the pilot hole 72. The rearward flange on the channel member does not prevent the attachment from being moved into, or held in, operative position, due to the fact that the bit axis is offset from the main part of the attachment body 26. The operator releases the suction tube to permit the springs 67 and 68 to act through the tube 50 to press the front bushing 55 against the channel member 71. A backing element, such as a jig, not shown, is provided to resist movement of the sheet 70 in the same direction. With the sheet and channel member thus held firmly together, the operator closes the electric switch and starts the drill motor which drives the bit 35 as hereinbefore described. The bit enlarges the pilot hole 72 and drills a hole in the sheet 70. The dust particles and loose metal chips are removed with the air that is sucked along the flutes of the bit into the suction tube 50. From the tube, the air with the fine metal particles suspended therein is discharged through the hose 51 to the jet device 52. As the bit penetrates the sheet, the entire attachment and drill advance as a unit, with the exception of the suction tube 50 which is urged forwardly by the springs 67 and 68, but which is prevented from moving by the engagement of the bushing 55 against the channel member 71. By holding the drilled sheets together and by exhausting the chips resulting from the drilling operation, it is possible to drill smooth clean holes without leaving rough surfaces or burrs around the edges of the holes.

Fig. 1 shows the use of the invention in drilling alongside the bulkhead of a ship or airplane where there is a channel member 74 providing close quarters for the front end of the drilling attachment, and in addition an obstruction to the handle of the drill. The dotted lines in Fig.

1 illustrate the usual position of the handle 14 relative to the attachment body 26, the handle being offset on the same side as the extension 34. With such an adjustment of the swivel connection, the bulkhead 75 would obstruct the handle and prevent the bit 35 from being held in a vertical position close to the bulkhead. To remove this interference, the swivel screw 32 is loosened, thereby permitting the drill proper including handle 14 to be turned to the full line position in Fig. 1, after which the screw is again tightened.

While the feature of the invention which resides in the suction tube assembly has been described with reference to an offset drilling attachment, it should be understood that this feature is also applicable to a drill in which the driving spindle is aligned with the bit.

What is claimed is:

1. A tool for drilling and the like comprising a motor housing, a transmission case secured to the front end thereof, an attachment body secured to the front end of the transmission case, a driving spindle projecting from the transmission case into the attachment body, said body having an elongated portion in line with said spindle and an offset portion at its front end at right angles thereto, a bit supported in the offset portion for rotation about an axis parallel to the axis of the spindle and projecting beyond the front end of the attachment body, transmission means between the spindle and bit, a bushing surrounding the bit and normally positioned at the front end of the bit, a support on which the bushing is carried, said support and bushing being movable rearwardly to expose the front end of the bit, and resilient means urging the support and bushing forwardly toward normal position, whereby said bushing may be pressed against the work.

2. An attachment for drilling and like tools comprising a body member having an elongated portion adapted to be secured to the front end of the tool and having an offset portion extending at right angles to the front end of the elongated portion, a bit supported in the offset portion for rotation about an axis parallel to the elongated portion and projecting beyond the front end of the offset portion, a suction tube having an inlet adjacent the bit for collecting dust particles and chips, and means for mounting said tube, said mounting means comprising a pair of guide members at the front end of the elongated portion of the body member, one or more springs interposed between the body and the tube for urging the latter forwardly, and an adjustable stop device between the body and the tube for limiting the forward movement thereof.

3. An attachment for drilling and like tools comprising an elongated body member adapted to be secured at its rear extremity to a drill, a rotatable bit projecting from the front extremity of the body member, a suction tube having an inlet adjacent the bit for collecting dust particles and chips, said tube being movable rearwardly during assembly and forwardly during the disassembly of the tube relative to the bit and attachment body, a retaining ring for the tube rotatably mounted in an annular groove surrounding the attachment body, a rod adjustably connected at its front end to the suction tube and having a head at its rear extremity, said retaining ring having a recess arranged to permit passage of the head through the ring in one position of adjustment of the latter and to restrain the head and thereby limit forward movement of the second tube in another position, and spring means for urging the suction tube forwardly.

4. A drill attachment comprising a body member, a bit projecting from the front end thereof, a suction tube, a bushing carried by the tube and surrounding the bit and arranged to be pressed against the work to admit dust and chip particles into the tube, means for maintaining a partial vacuum in the suction tube, and means for supporting the suction tube on the body member, characterized in that said supporting means comprises one or more springs urging the suction tube forwardly, a stationary projection on one side of the body member, and a rod secured to the suction tube and having a head engaging the rear end of the stationary projection to limit forward movement of the suction tube.

5. A drill attachment according to claim 4 in which the rod is adjustable relative to the suction tube.

6. A drill attachment according to claim 4 in which the rod is screw threaded into a block welded to the suction tube.

7. A drill attachment according to claim 4 in which the body member has a pair of projecting ears engageable with offset sides of the tube to support and guide the latter.

8. A chip collector adapted for attachment to a drill having a projecting bit, said chip collector comprising a pair of spaced bushings adapted to surround the bit near the front end thereof, a suction tube in which said bushings are mounted, said tube providing a partial vacuum near the bit and within the space between said bushings, the front end of the tube extending radially relative to the bit and an intermediate portion of the tube being bent to extend alongside a stationary projection on the drill, resilient means urging the tube forwardly, and means for limiting such forward movement, said limiting means comprising a threaded rod extending parallel to the bit and having a head providing engagement between the suction tube and the stationary projection.

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