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DISINTEGRATOR DRILLING DEVICE

Edward J. Dobie and Aloise F. Raymond,
Robbinsdale, Minn.

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2 Claims. (Cl. 219—15)

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Our invention relates to a device for removing broken drills, taps, reamers, and the like, from machined metal parts, and has for its primary object the construction of a device of this type which is more efficient than any device heretofore built.

Another object of our invention is the provision of a machine of this type which can be operated with a minimum of skill and training and which is durable and fool-proof.

Another object of our invention is the construction of such a device which is clean in operation and which operates on the work with greater speed than any such device heretofore constructed.

Another object of our invention is the provision of such a device at a minimum cost.

More specifically our invention is a drilling machine of the electric arc disintegrator type wherein a reciprocating electrode, upon periodic contacts with the metal, causes sparks to fly and oxidize out almost molecular-size particles of metal. In our particular device these particles are carried away by a stream of fluid, preferably air, which also has the important function of dissipating the heat from the work.

The above and other objects will become apparent from the following detailed description and attached drawings wherein like characters indicate like parts throughout the several views:

Referring to the drawings:

Fig. 1 is a side elevation of our novel construction, some parts being broken away and shown in vertical axial section;

Fig. 2 is a top plan view of the device shown in Fig. 1;

Fig. 3 is an end elevation of the device shown in Fig. 1 looking from left to right;

Fig. 4 is an enlarged fragmentary view of the air motor;

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary view of the modified form of air motor, some parts being broken away;

Fig. 7 is a vertical axial section taken on the line 7—7 of Fig. 6; and

Fig. 8 is an enlarged fragmentary view taken on the line 8—8 of Fig. 1.

The letter A indicates a machined metallic part or work into which the end of a broken tap, or the like B, has become lodged.

The numeral 1 indicates a work receiving base or bed through which projects an upright supporting member 2. Bed 1 is insulated from sup-

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porting member 2 at 4, for a purpose which will hereinafter become apparent. Supporting post 2 is shown as being round in cross section. Loosely journaled on supporting post 2 for rotary and up and down movements is a sleeve 5 which may be secured in any desired position on the shaft by means of a thumb screw or the like 6.

Shown as projecting laterally from sleeve 5 is an arm 7 on the outer end of which is another tubular sleeve 8 which, as shown, is substantially vertical and parallel to sleeve 5. The upper and lower ends of tubular member 8 are provided with spaced bearings 9 and 10 which have concentric, but restricted openings therein, which communicate with the interior of the tubular member 8.

A tubular tool carrying head 11 projects snugly through upper and lower bearings 9 and 10 and loosely through the enlarged portion of tubular member 8 so as to provide an air chamber 12 between said bearings 9 and 10. It will be noted that tubular tool carrying head 11 is mounted in bearings 9 and 10 of tubular sleeve 8 for compound rotary and axial oscillatory movements.

A disintegrator electrode, shown as being in the form of a tubular nozzle 13 is rigidly secured to the bottom end of tubular head 11 by means of a knurled collar or the like 14 which makes screw-threaded engagement with tubular head 11.

Shown as being mounted on the opposite or upper end of tubular member 11 is a housing 15 having a removable front cover plate 16. Encased in housing 15 are a pair of horizontally disposed loosely meshing gears 17. Gears 17 are eccentrically weighted at 18 and are journaled on pins 19 which extend from back to front through housing 15 so as to keep removable cover 16 in place. As will be seen, pins 19 are provided with enlarged heads 20 at the back, and with screw-threaded burrs 21 at the front. The teeth of gear 17 are identified by the numeral 17a.

It will be observed that housing 15 is mounted on tubular tool carrying head 11 in a manner, as shown in Fig. 4, so that the port 22 communicating therebetween is immediately below the point of meshing engagement with the gears 17. The amount of air entering the interior of housing 15 through port 22 is regulated by thumb screw 22a. Cover plate 16 is shown as provided with an opening 23 which communicates with the interior of the housing and exhausts to the atmosphere at a point radially spaced from the axis of the head.

Referring now to the modified structure shown in Figs. 6 and 7, it will be noted that a housing 38 is rigidly secured to the top end of tubular

tool carrying head 11. Housing 38 is equipped on one face thereof with a removable, vertically disposed cover plate 39, which is held in place by a pair of laterally disposed threaded bolts 49 which make engagement with a pair of outwardly projecting, integrally formed ears 41 on either side of the housing 38. Mounted in housing 38 is a gear 42 which is counterweighted at 43. Gear 42 has teeth 44 and is mounted for rotation on a shaft 45 which extends through the opening in the center of the gear. A reduced end 46 of shaft 45 extends through an opening in the back of housing 38 and is secured fast in a boss 47. Bearings 48 may be utilized to facilitate rotation of the gear 42.

A diagonally extending passage way 49 connects tubular tool carrying head 11 and interior of housing 38. The volume of air passing through port 49 is controlled by a headed screw 50. An exhaust port 51 is provided in the removable cover plate 39.

Shown as being connected to sleeve 5 by means of a clip 24, or the like, is an air hose 25 which connects to a source of air pressure not shown. Air tube 25 communicates with chamber 12 in sleeve 8 by means of a port 26 after passing through a valve 27 which controls the volume of air passing therethrough by means of a needle valve or the like 28, having an enlarged thumb nut 29 at its exterior end. It will be noted that tubular tool carrying head 11 has a centrally located port 30 which communicates between the air chamber 12 and the interior of the tubular head 11.

Arcing current may be supplied from any suitable source such as a step down transformer T, the low voltage winding of which is indicated by a. In accordance with the present example, one end of the secondary a of the transformer T is connected to the electrode 13, through the head 11 a brush b and a cable lead c; and the broken tap B is connected at the other end of the transformer winding a through the work A, the work bed 1 and ground connections indicated at d and e, respectively.

As indicated, brush b is kept in constant frictional contact with reciprocating tubular head 11 by means of a coil spring, or the like 31, interposed between the bottom side of arm 7 and a laterally projecting finger 32, which carries brush b in a collar 33. As shown, brush b is held secure in collar 33 by a set screw 34. Arm 32 is pivoted at 35 to a depending bracket 36, which in turn, is secured to the bottom of arm 7 by means of threaded bolts 37, or the like.

Operation

When a tap, drill or the like, indicated at B, becomes broken off in a machined part A, the part A is placed upon the work receiving bed 1 in a manner so that tubular tool carrying head 11 and disintegrator nozzle 13 are axially aligned with the hole in which the broken tap B is lodged. Air tube 25 is then connected to a source of fluid pressure, preferably air pressure, and needle valve 28 is opened by the turning of thumb nut 29 so as to allow the desired amount of air pressure to enter chamber 12. The air in chamber 12 enters tubular tool carrying head 11 through port 30 and expands both upward and downward therethrough. The air that goes upward through tubular head 11 enters the gear housing 15 through restricted port 22 so that the stream of air, which is still under considerable pressure, impinges upon the intermeshing teeth 17a of

gears 17. Thus, gears 17 are rotated in opposite directions as indicated by the arrows in Fig. 4. Rotation of gears 17 causes a reciprocation of the housing 15, the tubular tool carrying head 11 and the disintegrator nozzle 13 because of the counterweights 18.

At this point it is believed important to point out that the speed of rotation of gears 17, and hence the speed of reciprocation of the housing 15, head 11 and nozzle 13, all of which are tied together, may be varied, as above pointed out, by adjustment of the needle valve 28.

The air stream which enters gear housing 15 through port 22, after imparting a rotary motion to the gears 17, finally exhausts to atmosphere through port 23. In view of the fact that this exhaust port 23 is located at a point radially spaced from the axis of the head 11, a fluid pressure motor is produced which imparts a constant rotary motion of the housing 15, tubular head 11 and disintegrator nozzle 13.

The air under pressure which takes a downward course through tubular head 11 after entering the same through port 30, discharges to atmosphere through tubular disintegrator nozzle 13.

It will thus be seen that when an arcing current is supplied, as above described, periodic arcings will be produced as the reciprocating nozzle 13 contacts the broken tap, or the like B. The flying bits of white hot metal which result from each arcing are quickly blown away by the stream of air exhausting through the nozzle 13. Furthermore, the constant stream of air exhausting through nozzle 13 keeps the end of the nozzle cool as well as preventing the broken tap B from becoming so hot as to damage machined piece A into which tap B has become lodged.

The constant rotary motion of the nozzle we have found to be very much of an aid in the preventing of red hot portions of metal becoming secured to the nozzle 13. Also, we have found that this rotary motion of the nozzle prevents uneven burning of the nozzle.

The operation of the modified air motor and reciprocating device shown in Figs. 6 and 7, is very similar to that above described, namely: air under pressure goes upward through tubular head 11, through the angularly disposed passageway 49 and comes to bear upon the teeth 44 of the gear 42 in a manner to cause the same to be rotated in a counterclockwise direction. Counterweight 43 obviously imparts axial reciprocal movements to the tubular head 11, housing 38 and disintegrator nozzle 13 as gear 42 rotates. The air then exhausts to atmosphere through port 51 in removable cover plate 39. Port 51, like port 23 in housing 15, is radially spaced from the axis of the tubular head 11 so that the air exhausting therethrough produces a rotary motion of the housing 38, tubular head 11 and disintegrator nozzle 13.

What we claim is:

1. In a drilling machine of the electric arc disintegrator type, a supporting structure, a tool carrying head mounted on the supporting structure for compound rotary and axial reciprocating movements, a tool in the nature of a disintegrating electrode carried by the head, a vibrator weight journaled on said head to produce axial reciprocation of the head upon rotation of the weight, and a fluid pressure motor mounted on said head and driving said vibrator weight, said fluid pressure operated motor having a fluid passage exhausting to atmosphere at a point radial-

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ly offset from the axis of the head and in a direction to produce rotary motion of the head.

2. In a drilling machine of the electric arc disintegrator type, a supporting body having spaced bearings and a chamber intermediate said bearings, a tubular tool carrying head projecting through said chamber and bearings and guided by the latter for compound rotary and axial reciprocating movements, a tool in the nature of a tubular disintegrator electrode carried by said head and internally communicating with the interior of the tubular head, a vibrator weight journaled on said head and producing axial reciprocation of the head upon rotation of the weight, a fluid passage leading from the chamber of said head and adapted to be connected to a source of fluid pressure, and a fluid pressure motor mounted on said head and said vibrator weight,

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said fluid pressure operated motor involving a passage communicating with the interior of said head at one end and exhausting to atmosphere at its other end at a point radially spaced from the axis of the head and in a direction to produce rotary motion of the head.

EDWARD J. DOBIE.
ALOISE F. RAYMOND.

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