Jan. 17, 1950 C. D. TUCKER 2,495,038

METAL DISINTEGRATING DEVICE

Filed March 20, 1946 2 Sheets-Sheet 1

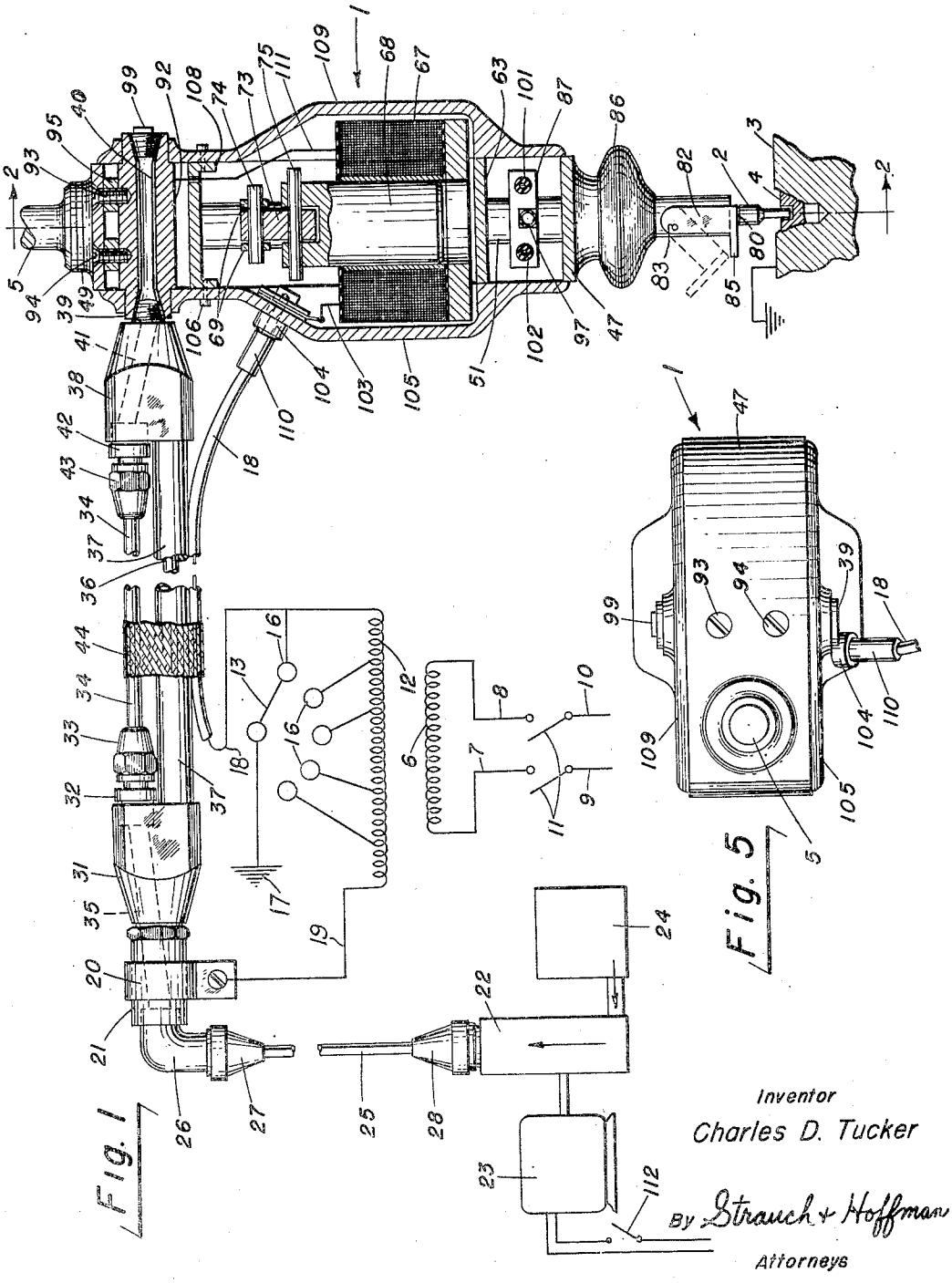


Fig. 1

Fig. 5

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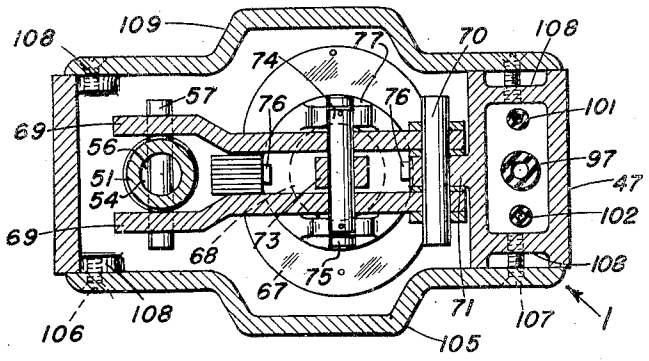


Fig. 3

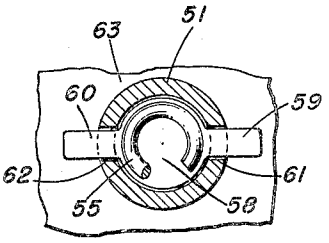


Fig. 4

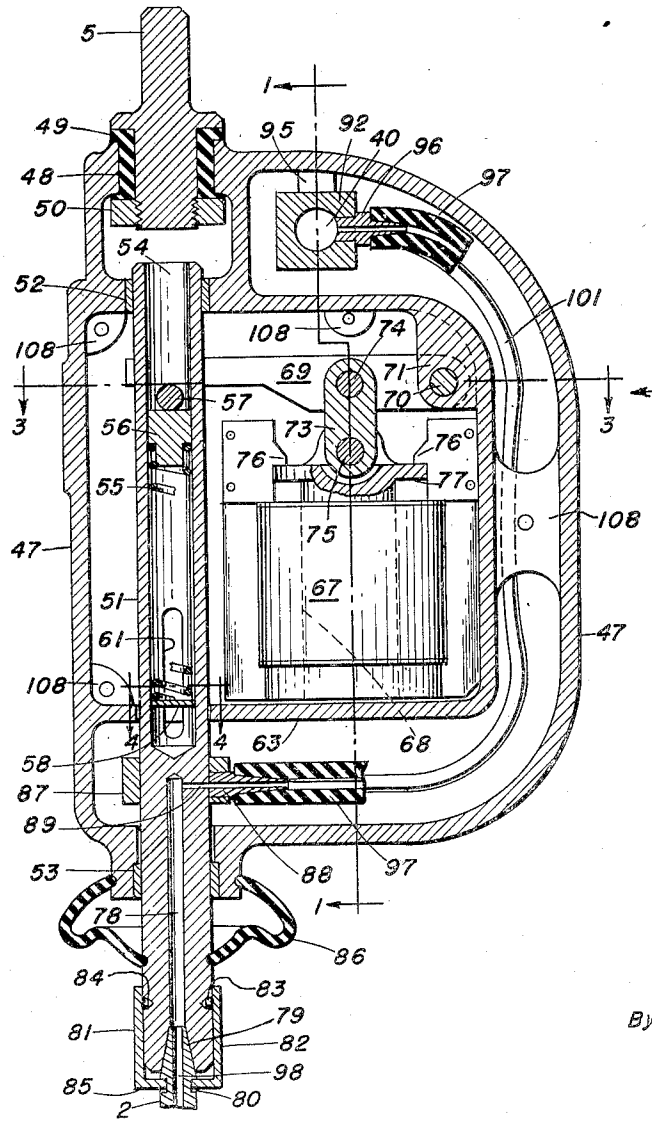


Fig. 2

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2,495,038

METAL DISINTEGRATING DEVICE

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5 Claims. (Cl. 219—15)

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This invention relates to metal disintegrators particularly of the type for removing metal studs, broken tools, and other metal objects from work pieces.

It is a major object of this invention to provide an improved apparatus for actuating a vibrating electrode tool for disintegrating metal parts.

Another important object of the invention is to provide an improved holder and actuator for a vibrating electrode and for supplying electric current and cooling fluids thereto.

Another object of the invention is the provision of an improved support for the reciprocating electrode in a metal disintegrator.

Another important object of the invention is the provision of an improved reciprocating metal disintegrator of novel construction and requiring a minimum of care and servicing.

Another specific object of the invention is the provision of a solenoid actuated drive for the reciprocating tool of a metal disintegrator wherein a spring normally urges the tool away from the work and the solenoid when actuated overcomes the resistance of the spring.

Other objects will become apparent as the description progresses in connection with the accompanying drawings wherein:

Figure 1 is a more or less diagrammatic view of the assembled device, with the drive head or actuating mechanism itself shown in detailed section along the line taken substantially along line 1—1 of Figure 2;

Figure 2 is a sectional view of the drive head or actuating mechanism taken substantially along the line 2—2 of Figure 1;

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 2;

Figure 4 is a sectional view taken substantially along the line 4—4 of Figure 2;

Figure 5 is a top plan view of the actuating device itself.

As shown in Figure 1 the mechanism comprises a drive head or actuating mechanism 1 which holds and applies an electrode 2 to a work piece or the like 3 which has a metallic tool particle 4 or the like broken off therein. The drive head is adapted to be mounted in any position by means of a support pin 5 which extends from the top thereof and is adapted to be inserted into the chuck of a drill press or any other device which will provide longitudinal axial travel and the spindle of which is adapted to be locked against rotation. Electric power for the operation of the device is connected to the primary 6 of a step down transformer by means of leads 7 and 8

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which are connected to the power line 9 and 10 by means of a double pole switch or the like 11. The transformer secondary 12 is tapped as shown so that the voltage applied to the electrode 2 in the drive head may be varied by shifting the contact arm 13 along the taps 16. The contact arm 13 on the transformer secondary is grounded at 17. The other end of the transformer secondary is connected by a lead 19 to a clamp 20 on a metallic nipple 21. A lead 18 which furnishes current to the solenoid 67, is connected to the highest voltage terminal 16 on the transformer secondary. A pump 22, driven by a motor 23, pumps cooling fluid from a supply tank 24 to the nipple 21 by means of a non-conducting tubing 25 which may be of plastic, connected at one end to an elbow 26 by a fitting 27 and to the pump 22 by a fitting 28. The elbow 26 is threaded into the nipple 21.

The metallic nipple 21 has an enlarged portion 31 which receives a nipple 32 having a fitting 33 to clamp a flexible conduit 34 to the nipple 32. A passage 35 within the nipple 21 and the enlarged portion 31 connects the elbow fitting 26 with the nipple 32 so that cooling fluid from the pump 22 is delivered to the flexible conduit 34. An electric conduit 36 of high current capacity is electrically connected to the enlarged portion 31. The conduit 36 may have an insulating covering 37. A second metallic nipple 38 is threadedly received at its smaller end in a block 92 which is also of conducting material, and has a central passageway 40 therethrough. The nipple 38 has a passageway 41 which communicates at one end with the passageway 40 and at the other end with a nipple 42 to which the other end of the flexible conduit 34 is connected by a fitting 43. A protective flexible covering 44 of fabric braid or the like encloses and confines the lead 18, the flexible conduit 34, and the electric conduit 36 between the nipples 21 and 38 since the distance between these nipples is usually in the order of several feet.

That part of the mechanism which has been described above serves to furnish electric power and cooling fluid to the drive head 1 which will now be described.

The drive head 1, which is indicated generally by the reference number 1, comprises a frame 47 which is substantially D-shaped as best shown in Figure 2. The frame 47 is a casting of aluminum, plastic or other suitable material. The support pin 5 passes through an opening 48 in the top of the frame 47 and is electrically insulated therefrom by insulation 49 so that the drive head 1 is electrically insulated from the drill press or other mechanism upon which it is normally

mounted when in use. The lower end of the support pin 5 is threaded to receive a nut 50 which nut securely fastens the support pin to the frame. The frame is bored coaxially with the support pin 5 to receive a spindle 51 which is mounted in upper and lower bearings 52 and 53 for longitudinal reciprocation within the frame 47. The upper end of the spindle 51 has a central bore 54 which houses a compression spring 55. The upper end of the spring engages a retainer 56 which is held against upward movement within bore 54 by a pin 57 which passes completely through the spindle 51 as best shown in Figure 3 and is retained in position by suitable means. The lower end of the spring 55 bears against a retainer 58 which has a central disk shaped portion received within the bore 54 and has diametrically opposed wings 59 and 60 which extend through slots 61 and 62 respectively in the tubular walls of the spindle near the bottom of the bore 54. The wings 59 and 60 rest upon the top of a horizontally disposed portion 63 of the frame 47. These slots 61 and 62 are elongated longitudinally of the spindle 51 so that the retainer 58 can remain stationary and be supported by the portion 63 as the spindle 51 is reciprocated longitudinally. Thus downward movement of the spindle 51 compresses the spring 55 between the retainers 56 and 58.

The solenoid 67 is mounted within the frame 47 so that its armature 68 is movable in a vertical direction and parallel to the axis of the spindle 51. A rocker arm 69 of integral forked construction as indicated in Figure 3 is pivotally connected to the frame 47 by means of a pin 70 which passes through the end of the rocker arm and through a lug 71 which is integral with the frame. A link 73 which is coaxial with the armature 68, is pivotally connected to the two portions of the rocker arm 69 by a pin 74 and at its lower end is pivotally connected to the armature 68 by a pin 75, so that movement of the armature 68 will cause the rocker arm 69 to move counterclockwise about its pivot 70, as viewed in Figure 2, when the solenoid is actuated. The end of the arm 69 remote from its pivotal support at 70 spans the spindle 51 just above the pin 57. Upward movement of the armature 68 of the solenoid is limited by lugs 76 (Fig. 2) which engage the guide elements 77 at the upper end of the armature. Thus the upward movement of spindle 51 is limited through pin 57 by the limit of the upward movement of the rocker arm 69 which is connected to the armature. The lower end of the spindle has a central coolant bore 78 which terminates at the bottom in a conical seat 79 to receive the electrode 2. The electrode has an annular recess 80 adjacent the bottom of the spindle. A substantially U-shaped retainer has its legs 81 and 82 pivotally attached to the bottom portion of the spindle 51 by means of pins 83 and 84. The bottom 85 of the retainer is slotted so that when the retainer is swung down into the position shown in Figure 1, the walls of the slot in the bottom 85 engage the groove 80 in the electrode to force the electrode upward and hold it in the conical seat 79. The electrode 2 is thus inserted or removed by swinging the retainer into the retracted position shown in dotted lines, Figure 1 where it is disengaged from the groove in the electrode. Thus the electrode is held in the bottom of the spindle so that it makes good electrical contact and will not fall out during operation of the device.

A rubber boot 86 surrounds the spindle and

the bottom of the frame 47, being secured to each, and preventing the entrance of dirt and cooling fluid, etc., into the bearing 53.

At a point adjacent the top of the coolant bore 78 the spindle 51 is provided with a power connection 87 which is fixedly secured thereto in any suitable manner to form an enlargement on the spindle. A nipple 88 is threaded into the connection 87 and has communication with the bore 78 through a hole 89.

Adjacent the top of the frame 47 a rectangular metallic block 92 extends transversely of the frame and is fastened thereto by means of screws 93 and 94, there being separating washers 95 between the frame 47 and the block 92. The nipple 38 is threaded into the block and communicates with the central axial bore 40 therein as described before. A flexible tube 97 is connected at its ends to the nipples 38 and 96. Thus cooling fluid from tank 24 which is delivered to the passageway 40 during operation of the device passes through the tube 97, hole 89 and bore 78 to be delivered to the tool particle 4 by means of the central bore 78 within the electrode.

A pair of conducting wires 101 and 102 are each electrically connected at their lower ends to the power connection 87 on the spindle 51 as best indicated in Figure 1. The wires 101 and 102 pass through the frame adjacent its outer curved portion and substantially paralleling the flexible tube 97 being electrically connected at their upper ends to the block 92 in a manner similar to the connection to the power connection 87. The wires 101 and 102 have a large carrying capacity in order to furnish sufficient power to the electrode 2 to generate the arc required to do the work. In view of the fact that the lower ends of the wires are reciprocated up and down at high speed with the spindle, while the upper ends of the wires are fixed to the immovable block 92, two wires are used instead of one in order to provide sufficient flexibility. The loop in these wires between their connections to the connector 87 and to the block 92 further adds to their flexibility and permits them to be subjected to the rapid vibration without fatigue breakage. The coil of the solenoid 67 is connected by a wire 103 (Figure 1) to a jack 104 which is mounted on but electrically insulated from a side wall 105, which is secured to the frame 47 by means of screws 106 and 107, etc. (Figure 3), which have threaded engagement with lugs 108, integral with the frame 47. A similar side wall 109 is attached to the frame 47 on the other side. The block 92 has integral circular end portions 39 which pass through holes in the side walls 105 and 109. The end remote from nipple 38 is closed by a threaded plug 99. The lead 18 has a plug 110 which is inserted into the jack 104. The other electrical connection to the solenoid 67 comprises a wire 111 (Figure 1) which is connected to the block 92. The leads 103 and 111 and the lead 18, all of which furnish power to the solenoid are of much smaller current carrying capacity than the conducting rods 101 and 102, which are of course in parallel, and the conduit 36.

The normal position for the spindle 51 when no power is applied to the device is in the extreme upward position shown in Figure 2, towards which it is urged by the spring 55.

As soon as the head 1 has been lowered so that the electrode 2 is at the proper elevation with respect to the tool particle 4 which is to be removed, electrical power may be applied to the

head by closing the switch 11. This actuates solenoid 67 and forces spindle 51 to the bottom of its stroke. The power supplied to the motor 23 is controlled by independent means such as switch 112, which may be connected to the same power line 9 and 10 of the switch 11. As the head 1 is lowered by the drill press or other suitable means and with switch 11 closed, the electrode 2 will contact the work, represented by the tool particle 4. When the electrode contacts the work 4, a circuit is completed between the ground connection to the work piece 3 on the one hand and through the electrode 2, the spindle 51, the conducting wires 101 and 102, block 92, nipple 38, conduit 36, nipple 21, and lead 19 to the transformer. The spindle 51 will remain in the lowermost position until the electrode 2 engages the tool particle 4. The resistance of the above described circuit is very low because of the ample dimensions of the conducting elements. The wiring from both sides of the solenoid 67 and the circuit including this wiring is of very much greater resistance and impedance than that of the circuit to the electrode 2. The result is that when the electrode 2 is brought into contact with the work the resistance of the power circuit to the electrode is so low as compared to that of the solenoid circuit that the solenoid circuit is effectively shunted out of action to render it ineffective. Thus the spring 55 raises the spindle 51 to disengage the electrode from the work piece. This of course immediately breaks the power circuit to the electrode and allows the control circuit to the solenoid to become operative again and to force the spindle to the bottom of its stroke again. This entire cycle is repeated several times each second and results in the disintegration of the work piece wherever contacted by the electrode 2.

While the device has been described as a disintegrator which causes the breaking up of a metal article by rapid heating and cooling of a portion thereof it is to be understood that it is not restricted to such use since it may be used for hammering, chiseling or riveting, etc.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A machine for working or disintegrating metals or the like comprising a frame; a projecting spindle mounted for longitudinal reciprocative movement in said frame and adapted to hold an electrode; resilient means operative to urge said spindle towards said frame; electromagnetic means operative to move said spindle outwardly from said frame; and an electrical circuit for energizing said electrode and said electromagnetic means, said circuit including means operative to render said electromagnetic means ineffective upon the energization of said electrode.

2. A metal working or disintegrating machine comprising a hollow metallic electrode; means to deliver cooling fluid through said electrode; electromagnetic means operable to urge said electrode towards the work; second means operable to urge said electrode away from said work; and an electric circuit operable to energize said electromagnetic means and to energize said electrode upon contact with said work, said circuit including means operative to render said electromagnetic means ineffective in response to contact of said electrode with the work.

3. A metal working or disintegrating machine comprising a metallic electrode; electromagnetic means operable to urge said electrode towards the work; second means operable to urge said electrode away from said work, said second means being weaker than said first means; and an electric circuit of low resistance and including said electrode, operative to be closed when said electrode engages the work, said electric circuit including a high resistance shunt including said electromagnetic means in parallel with said electrode, whereby said electromagnetic means is rendered ineffective upon engagement of said electrode with the work.

4. In a device for working or disintegrating metals, a drive head; a spindle mounted in said drive head for reciprocating movement, said spindle being adapted to support an electrode; electromagnetic means within said drive head for imparting a reciprocating movement to said spindle; means in said drive head for delivering cooling fluid to said spindle and an electrode held thereby; cooling fluid and electric supply means; a flexible conduit connecting said fluid current and electric supply means to said drive head, said conduit including a pair of leads for actuating said electromagnetic means and one of said leads being connected to said spindle; and additional means operative to connect said electrical supply means to said spindle.

5. A metal working or disintegrating machine comprising a metallic electrode; first means operable to urge said electrode towards a work piece; second means operable to urge said electrode away from the work piece; and an electric circuit operable to energize said first means and to energize said electrode upon contact with the work, said circuit including an electromagnet means for energizing said first means, said electromagnet means being in parallel with and of much higher impedance than that portion of the circuit for energizing said electrode, whereby said electromagnetic means is ineffective upon contact of said electrode with the work piece.

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