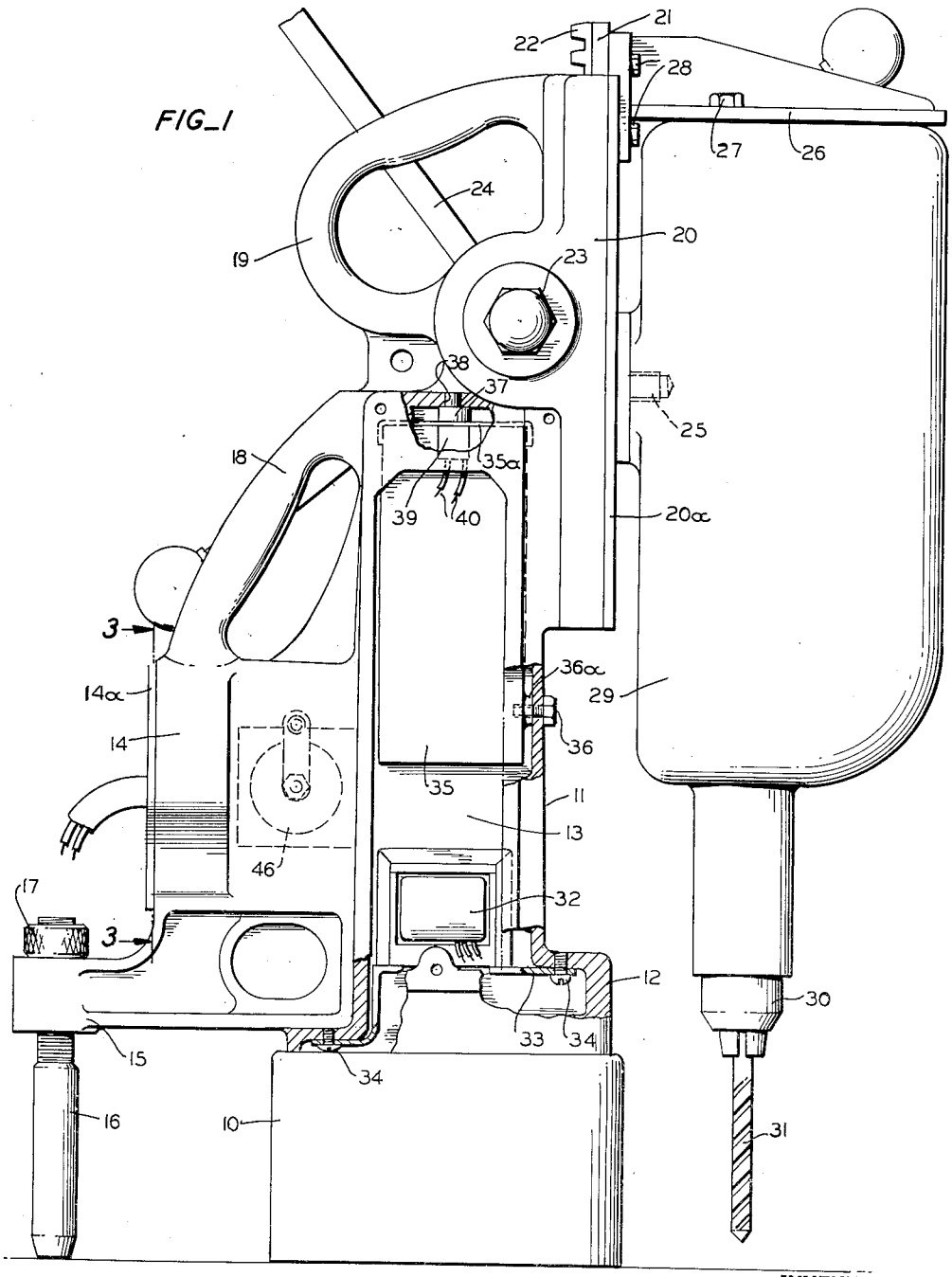
April 4, 1961 E. W. BUCK 2,977,825

ELECTROMAGNETIC DRILL SUPPORT WITH AUXILIARY POWER SUPPLY

Filed Aug. 20, 1958 2 Sheets-Sheet 1

FIG_1



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ELECTROMAGNETIC DRILL SUPPORT WITH AUXILIARY POWER SUPPLY

Filed Aug. 20, 1958 2 Sheets-Sheet 2

FIG_2

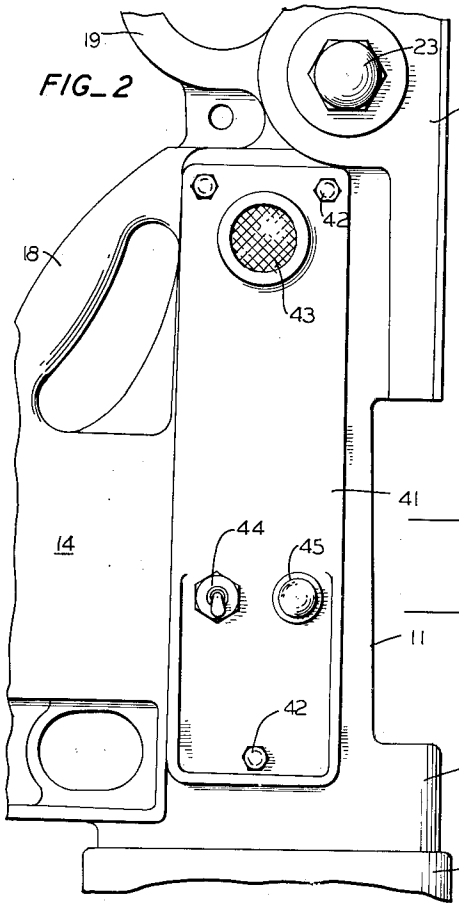


FIG_3

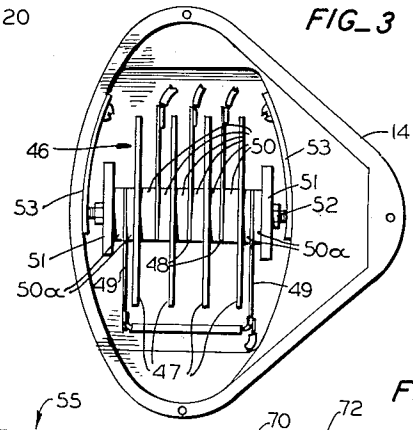
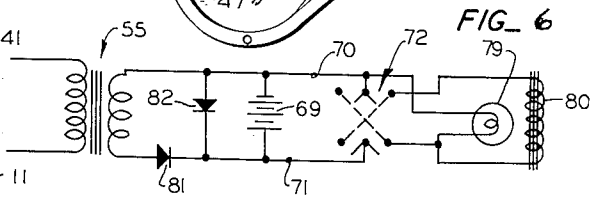


FIG_6



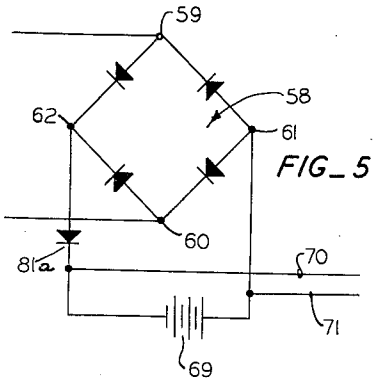
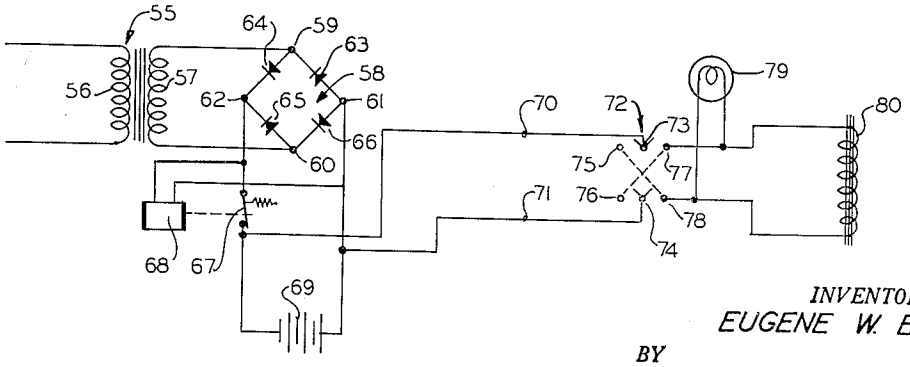


FIG_5

FIG_4



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ELECTROMAGNETIC DRILL SUPPORT WITH AUXILIARY POWER SUPPLY

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Filed Aug. 20, 1958, Ser. No. 756,227

12 Claims. (Cl. 77—7)

This invention relates to an electromagnetic tool support stand which is adapted to be battery operated in case of failure of the main current supply.

An object of this invention is to provide an improved electromagnetic tool support which is provided with a chargeable battery to energize the winding of the electromagnet in case of failure of the main current supply.

Another object of this invention is to provide an improved electromagnetic support for tools which includes a self-contained source of current supply that functions as a "floating" current supply while the main current supply is functioning and is adapted to energize the electromagnetic support in case of power failure of the main source of current supply, said self-contained source being connected to the winding of the electromagnet at all times when the tool support is in use.

Still another object of this invention is to provide an improved arrangement for energizing the electromagnetic support of tools and the like in which a self-contained chargeable source of current supply for the electromagnet functions to smooth out the rectified current to the electromagnet in addition to insuring the operation of the electromagnet in case of power failure of the main current supply.

A further object of this invention is to provide an improved magnetically supported tool stand such as is employed for supporting electric drills, said stand including a chargeable type of battery that is connected to the electromagnet at all times that the tool stand is in use so that said battery is charged from the main current supply and is ready for immediate use in case of failure of the main current supply.

Still another object of this invention is to provide an electromagnetically operated drill stand with an auxiliary self-contained source of current supply for energizing the electromagnet of the stand when the main source of current supply is interrupted, the main source of current supply being connected to the electromagnet through a rectifier and the circuit between the rectifier and the auxiliary source being such as to prevent or minimize current leakage from the auxiliary source through the rectifier in case of power failure of the main source.

Other and further objects of this invention will be apparent to those skilled in the art to which it relates from the following specification, claims and drawing.

In accordance with this invention there is provided a magnetic tool support or stand of improved construction having incorporated therein certain safety features for the purpose of preventing or minimizing accidents that might occur in case of power failure. These accidents may be especially serious in cases where the tool support or stand is used in overhead positions and where the workmen have failed to attach the safety chain or cable to prevent the tool support from falling down in case of power failure.

This apparatus is provided with an electromagnetic base that is adapted to support the tool on a magnetic surface while the tool is brought into engagement with a

work piece. This electromagnetic base is adapted to be energized from a remote power source such as the 110 v. lighting circuit and for this purpose this apparatus is provided with a connection to such source as well as a rectifier for rectifying the alternating current supplied by this remote source. Frequently this apparatus is employed on a vertical wall or an overhead wall and it is supported on such wall by the electromagnetic base. This arrangement is very satisfactory and convenient as long as there is no power failure or power interruption to the apparatus. Upon occurrance of such power interruption the electromagnetic base is of course de-energized and the apparatus loses its magnetic grip. No serious accidents will result if the operator attached the apparatus by means of an emergency support such a cable or chain that is provided thereto. However, sometimes it is inconvenient to use such emergency support because of a lack of suitable means with which to attach it to the wall structure.

In accordance with this invention this apparatus is provided with a self-contained source of current supply that is connected to the electromagnet of the base and this self-contained source of current supply is arranged to energize the electromagnet sufficiently to prevent the apparatus from losing its magnetic grip on the wall structure in case of interruption of the remote source of power.

The self-contained source of current supply is preferably a re-chargeable type battery and it is adapted to be charged by the rectified alternating current supply that normally energizes the winding of the electromagnetic base. Thus the rectifying apparatus employed in this device maintains the self-contained chargeable source of current supply fully charged so that current therefrom is available during any interruption or diminishing of power supplied from the remote source. Thus the current from the self-contained source is available to the electromagnet at all times while the device is in use, even though the power from the remote source is not interrupted completely.

Further details of this invention will be set forth in the following specification, claims and drawing in which briefly:

Figure 1 is a view in side elevation of an embodiment of this invention in which portions of the apparatus are shown in partial section;

Figure 2 is a fragmentary view in side elevation showing this apparatus with the cover plate enclosing the battery and transformer attached to the main frame thereof;

Figure 3 is a sectional view taken along the line 3—3 of Figure 1 showing the rectifier mounted in a cavity formed in the frame of this apparatus;

Figure 4 is a schematic diagram of connections employed on this apparatus;

Figure 5 is a schematic diagram of connections of a modified circuit; and

Figure 6 is a schematic diagram of connections of another modified circuit.

Referring to the drawing in detail there is illustrated a tool support arranged as a drill stand for supporting an electric drill to be employed for drilling through a work piece and this tool support is provided with an electromagnetic base **10** inside of which is positioned a winding or coil that is adapted to be energized for the purpose of setting up a magnetic field which grips the work piece and supports the stand thereon. This base **10** is attached to the flange member **12** that is provided to the bottom of the frame **11** and suitable bolts (not shown) are employed for this purpose. The frame **11** is provided with a cavity **13**, the purpose of which will be described hereinafter.

A rearwardly extending portion **14** is provided to the frame and this portion also has a cavity formed therein which is covered by a cover plate **14a**. A frame member

15 that extends to the back of the flange 12 and is integral therewith, is provided with a threaded hole for receiving the adjustable foot 16 which is adapted to be threaded into said hole and which is provided with a nut 17 threaded to the top thereof for the purpose of maintaining the foot 16 in a preset adjustment. A handle 18 that is integral with the top of the member 14 and the frame 11 is provided for the purpose of facilitating handling of this apparatus. Another handle 19 is made integral with the top of the frame 11; thus the workman may employ both hands in transporting or positioning of this apparatus. A pair of side members, such as the member 20, is provided to the top of the frame 11 and the slide member 21 which is adapted to be moved between the members 20 is retained therebetween by the retaining members 20*a*. This structure is shown in more detail in my co-pending application, Serial No. 618,935, filed October 29, 1956, now U.S. Patent No. 2,932,194, issued April 12, 1960. The slide member 21 is provided with a rack 22 which engages a pinion (not shown) that is rotatable by means of the shaft attached to the member 23 by use of handles 24 so that the slide 21 may be moved upward or downward by manipulating the handles 24.

The electric drill 29 is adapted to be attached to the slide 21 by means of the bolt 25 which is threaded into the housing of the electric drill. A bracket 26 that is attached to the top of the electric drill housing by the bolt 27 extends across the back of the electric drill and is attached to the slide 21 by the bolts 28. Thus the electric drill is supported on the slide 21 by the bolt 25 and the bracket 26 and this arrangement provides a firm and positive support when the drill bit 31 that is supported in the chuck 30 of the drill is urged into the work piece by manipulation of the handles 24.

The cavity 13 in the frame 11 is provided with an opening through which the battery case 35 is adapted to be inserted. This case 35 is provided with a threaded boss 36*a* that is attached to the lower portion thereof and is in alignment with a hole in the frame 11 through which the bolt 36 is inserted for the purpose of engaging the nut 36*a* and retaining the battery case 35 firmly in the cavity. The battery case 35 is provided with a cover 35*a* to which the stud 37 is attached and this stud is provided with an upper portion that is adapted to fit into the hole 38 formed in the frame at the top of the cavity. Thus when the battery case 35 is inserted into the cavity 13 so that the bolt 36 engages the nut 36*a*, the stud 37 is positioned in the hole 38. This structure forms a simple and convenient arrangement for holding the battery case in the frame 11 from which the battery case may be removed simply by removing one bolt 36 which is easily accessible. A plug arrangement 39 is provided in the top of the battery case 35 for the purpose of making electrical connections to the battery positioned in the case and a pair of leads 40 is provided to this plug arrangement for connecting the battery to the circuit as shown in Figures 4 and 5.

The transformer 32 is positioned in the cavity 13 in the lower part thereof and this transformer is provided with a bracket 33 having two end portions that are shaped to fit into the frame flange 12. These end portions are attached to the inner walls of this flange by the screws 34. The cavity 13 is provided with a cover plate 41 as shown in Figure 2 and this cover plate is attached to the frame 11 by the screws 42. A hole 43 is provided in the upper portion of the cover plate 41 and a similar hole may be provided in the lower portion thereof to permit air circulation through the cavity 13 if desired. The switch 44 and pilot light 45 are also supported by the cover plate 41.

The rectifier 46 which is of the dry disc type is supported in the cavity formed in the member 14. This rectifier is made up of a plurality of discs 47 which may be coated with selenium or other material as is well known in dry disc rectifier construction. These discs are separated from each other by a plurality of washers 50 of conducting material and said washers contact the members 48 which are provided for the purpose of making electrical connection to the rectifier discs. Additional washers 50*a* are provided at the end portions of the rectifier and these additional washers engage the contact members 49 which are connected together to connect the rectifier discs 47 into a full wave rectifier arrangement such as shown in the schematic diagram of connections (Figure 4 and 5). Insulating members 51 are provided to the ends of the rectifier and the bolt 52 extends through the entire rectifier assembly for the purpose of holding the assembly together. This bolt is insulated from the rectifier discs 47 and other electrically conducting parts of the rectifier. The bolt 52 engages the bracket members 53 which are attached to the inner walls of the member 14 by means of suitable screws and support the rectifier in the cavity provided in this member.

The diagram of connections employed on this apparatus is shown schematically in Figure 4 in which there is illustrated a transformer 55 of the step-down type which is provided with a primary winding 56 and a secondary 57. The primary winding 56 is connected to a source of current supply such as the 110 v. lighting circuit or other suitable source and the low voltage secondary winding 57 is connected to the terminals 59 and 60 of the full wave rectifier 58. The terminals 61 and 62 of this rectifier form the direct current output terminals thereof which are connected across the current supply battery 69 which may be charged therefrom and they are also connected across the electromagnetic winding 80. The output voltage of the secondary winding 57 is of such magnitude that the rectified output of the rectifier 58 has a voltage that is higher than the terminal voltage of the battery 69, at least during a part of the cycle so that during this part of the cycle the battery 69 receives charging current from the rectifier. During this part of the cycle when the output voltage of the rectifier 58 is higher than the terminal voltage of the battery 69, the rectifier will also supply magnetizing current to the electromagnet 80 which is connected to the output of the rectifier by the conductors 70 and 71 and the switch 72. During the portion of the rectified current cycle when the terminal voltage of the rectifier 58 is lower than the terminal voltage of the battery 69 the battery 69 will of course supply magnetizing current to the electromagnet 80. Thus the battery 69 also functions to reduce any ripple in the rectified current fed to the electromagnet 80. In case of power failure of the remote source of current supply, or in case of impairment of the electric circuit thereto, at which time the output voltage of the rectifier 58 may be reduced to zero or to some low value, such as would be insufficient to energize the electromagnet 80 properly, magnetizing current for this electromagnet will be furnished by the battery 69. At such time the output of the rectifier 58 will also be insufficient to energize the winding of the relay 68 so that the contacts 67 thereof will be opened and the circuit to the rectifier 58 from the battery 69 will be interrupted so that current leakage through this rectifier from the battery will be eliminated. This relay however does not interrupt the circuit to the electromagnetic winding 80 from the battery 69 so that energizing current from said battery will flow to this winding without interruption and the base 10 of the apparatus will retain its magnetic grip on the surface even though the remote power supply has failed. The pilot light 79 will also be energized from the battery at this time.

When it is desired to remove the apparatus from a certain work piece to another location the magnetic grip of the winding 80 may be interrupted by opening the circuit of the switch 72 formed between the blades 73 and 74 and the contacts 77 and 78 respectively and momentarily reversing the current through the winding

80 by contacting the blades 73 and 74 on the contacts 75 and 76 respectively. This momentary reversal of the current through the winding 80 is provided for the purpose of neutralizing any residual magnetism that may exist in the magnetic circuit of the winding 80. The residual magnetic field may be quite intense in certain cases and prevent the workmen from readily moving the tool support; however, by momentarily reversing the current to the winding this difficulty is overcome.

The transformer 55 shown in the wiring diagram Figure 4 may occupy the space in the lower part of the cavity 13 occupied by the transformer 32 which corresponds thereto and the battery 69 is positioned in the case 35. The switch 72 is attached to the cover plate 41 in the position occupied by the switch 44 and the rectifier 58 is positioned in the cavity 14 in the manner shown in Figure 3.

The battery 69 may be of the rechargeable hermetically sealed nickel cadmium type that is manufactured by the Gould National Batteries, Inc.

Instead of employing a relay 68 for breaking the circuit between the rectifier 58 and the battery 69, it may be desirable to provide a diode rectifier 81*a* in this circuit as shown in Figure 5 and this diode will prevent the flow of leakage current from the battery into and through the rectifier 61. The diode rectifier 81*a* is polarized so that it permits current to flow into the battery 69 from output of the rectifier 58 but prevents current of substantial magnitude from flowing from the battery 69 through the rectifier 58 in case of failure of the power supply feeding said rectifier.

Where it is desired to supply a battery 69 of high enough voltage so that it may be charged or employed with a rectifier 58 that is connected with its input directly to the 110 v. lighting circuit, then the step-down transformer 55 may be eliminated. Such an arrangement would of course also require that a larger number of turns be provided to the winding 80 of the electromagnetic base so that this winding could also utilize the higher voltage supplied thereto under such circumstances and wire of smaller size could be employed for such a winding. The number of turns having been increased, the current of lower intensity would provide an equivalent magnetizing force. Where it is desired to provide a smaller battery having a terminal voltage that is substantially smaller than the terminal voltage of the rectifier, for use to energize the winding 80 in case of failure of the remote power supply, such a battery may be connected to the output of the rectifier through a suitable voltage reducing resistor or choke so that the battery of lower voltage may be charged from the higher voltage rectifier. This resistor or choke may be short circuited by additional contacts controlled by the relay 68 when the rectifier terminal voltage drops so that this resistor or choke would be short circuited when the battery is supplying current to the winding 80 to enable this winding to develop sufficient magnetic grip to support the apparatus.

In Figure 6 there is shown another modified circuit that may be employed in accordance with this invention and this circuit is provided with a diode rectifier 81 which functions as a half wave rectifier as distinguished from the full wave rectifier 58 shown in Figures 4 and 5. Both of these rectifiers 58 and 81 furnish a pulsating output current to the battery 69 and to the electromagnet 80 with the frequency of the current pulsations from the full wave rectifier being twice that of the current pulsations from the half wave rectifier. The no load peak voltage of this rectified current is substantially higher than the terminal voltage of the battery 69 so that this battery will be charged during a part of each pulse of the rectified current whereby the battery will have stored energy so that it can furnish current to the electromagnet during the intervals when the voltage of the current pulses drops below the voltage of the battery. This is important particularly in the arrangement in which only half wave rectification is employed. In both circuits, that is, the full wave and half wave rectifier circuits, the battery functions to smooth out the current supplied to the electromagnet so that the electromagnet is energized by a substantially uniform current. This is important not only because the magnetic field developed by the electromagnet is constant but also because no periodic counter E.M.F. is produced in the winding of the electromagnet as is the case when a pulsating magnetizing current is supplied to the winding.

The battery 69 therefore functions to provide magnetizing current to the winding 80 when the alternating current supply fails either partially or completely and in addition it also functions to smooth out the current to this winding when the rectifier is functioning.

Another diode rectifier 82 may be connected across the battery 69 polarized to be opposed to the battery so that current from the battery will not flow therethrough. This diode however will reduce or eliminate excessive voltages of opposing polarity from being applied to the battery 69 if such voltages should be developed in the winding 80 or during the making or breaking of the connections to this winding by the switch.

While I have shown a preferred embodiment of the invention it will be understood that the invention is capable of variation and modification from the form shown so that its scope should be limited only by the scope of the claims appended hereto.

What I claim is:

1. An electromagnetic support for tools and the like comprising a base having an electromagnet adapted to support the tool on various work surfaces including overhead surfaces and vertical walls, a hollow frame attached to said base for supporting a tool thereon, means for connecting said electromagnet to a remote source of current supply, a self-contained source of current supply, means for supporting said self-contained source of current supply in said hollow frame, means for connecting said self-contained source of current supply in parallel with said remote source of current supply and across said electromagnet so that said self-contained source is charged from said remote source and both of said sources energize said electromagnet depending upon which of said sources has the higher voltage at a particular moment, said self-contained source being adapted to energize said electromagnet in case of failure of said remote source so that said electromagnet is adapted to support the tool on overhead surfaces or vertical walls even if said remote source fails, and means for disconnecting said electromagnet from both of said sources.

2. In an electromagnetically supported tool the combination of a base having an electromagnet for magnetically gripping a magnetic surface for supporting the tool on a work piece, said electromagnet being adapted to support the tool on various surfaces including overhead surfaces and vertical walls, a hollow frame member attached to said base, means for connecting said electromagnet to a remote source of alternating current supply for energizing said electromagnet, said means including a dry disc rectifier for rectifying said alternating current, connections for supplying the rectified current to said electromagnet, a self-contained chargeable source of current supply, means for supporting said last mentioned source in said hollow frame member, means for connecting said self-contained source to said rectifier so that said self-contained source receives charging current from said rectifier when the output voltage of said rectifier exceeds the voltage of said self-contained source and connections for connecting

said self-contained source of current supply to said electromagnet so that said electromagnet is energized from said self-contained source when the voltage of said rectifier is lower than that of said self-contained source or when said rectifier output is impaired and said electromagnet is adapted to support the tool on overhead surfaces or vertical walls even if the output voltage of said rectifier is low or its output is impaired.

3. In an electromagnetically supported tool the combination of a base having an electromagnet for magnetically gripping a magnetic surface for supporting the tool on a work piece, said electromagnet being adapted to support the tool on various surfaces including overhead surfaces and vertical walls, a hollow frame member attached to said base, means for connecting said electromagnet to a remote source of alternating current supply for energizing said electromagnet, said means including a dry disc rectifier for rectifying said alternating current and for supplying the rectified current to said electromagnet, a self-contained chargeable source of current supply, means for supporting said last mentioned source in said hollow frame member, connections for connecting said self-contained source so that said electromagnet is energized from said self-contained source when said rectified output fails and said electromagnet is adapted to support the tool on overhead surfaces or vertical walls even if said rectifier output fails, means for connecting said self-contained source to the output of said rectifier so that said self-contained source receives charging current from said rectifier, and means for interrupting said last mentioned connecting means upon the failure of the output voltage of said rectifier.

4. An electromagnetic support for tools and the like comprising a base having an electromagnet adapted to support the tool on various work surfaces including overhead surfaces and vertical walls, a hollow frame attached to said base for supporting a tool thereon, means for connecting said electromagnet to a remote source of current supply for energizing said electromagnet sufficiently so that said electromagnet will magnetically grip a magnetic surface, a self-contained source of current supply, means for supporting said self-contained source of current supply in said hollow frame, means for connecting said self-contained source of current supply in parallel with said remote source of current supply so that said self-contained source is charged from said remote source during intervals when the voltage of said remote source exceeds that of said self-contained source, means for connecting said remote source and said self-contained source to energize said electromagnet so that said self-contained source energizes said electromagnet when said remote source fails or when its voltage falls below that of said self-contained source, and means for disconnecting said electromagnet from both of said sources.

5. In an electromagnetically supported tool the combination as set forth in claim 2, further providing means for fastening the self-contained source in said frame comprising a container for said self-contained source, said container having a threaded member attached thereto and being adapted to receive another threaded member supported by said frame, and a stud attached to said container, said stud being adapted to be positioned in a recess formed in said frame when said threaded members are in engagement to immobilize said container in said frame.

6. In an electromagnetically supported tool the combination as set forth in claim 3, further characterized in that the means for interrupting the connections between the rectifier and the self-contained source comprises a relay having a winding connected to the output of said rectifier, said relay being connected to maintain the circuit between said self-contained source and said rectifier as long as the output of said rectifier is unimpaired.

7. In an electromagnetically supported tool the combination as set forth in claim 2, further characterized in that there is provided means for substantially preventing current from flowing from said self-contained source of current supply through said rectifier upon failure of said remote source.

8. In an electromagnetically supported tool the combination as set forth in claim 7, further characterized in that the means for substantially preventing current flow from said self-contained source through said rectifier comprises a diode rectifier.

9. In an eletromagnetically supported tool the combination as set forth in claim 2, further characterized in that there is provided means for momentarily reversing the current flow through said electromagnet when it is desired to remove the electromagnetically supported tool from the magnetic surface.

10. An electromagnetic support for tools and the like comprising a base having an electromagnet adapted to support the tool on various work surfaces including overhead surfaces and vertical walls, a hollow frame attached to said base for supporting a tool thereon, means for connecting said electromagnet to a remote source of current supply, a self contained source of direct current supply, means for supporting said self-contained source of current supply in said frame, means for connecting said self-contained source of current supply to said remote source of current and across said electromagnet, a diode rectifier for rectifying alternating current supplied by said remote source to said self-contained direct current source and to said electromagnet, the rectified current derived from said rectifier being in the form of a pulsating current having a peak voltage substantially higher than the voltage of said self-contained source so that said self-contained source receives charging current during the intervals of higher voltage and said self-contained source supplies current to said electromagnet during intervals when the voltage of said rectified current drops below the voltage of said self-contained source.

11. In an electromagnetically supported tool the combination as set forth in claim 10, further characterized in that there is provided a switch for momentarily reversing the current through said electromagnet when it is desired to break the magnetic grip of said electromagnet on a work piece.

12. In an electromagnetically supported tool the combination as set forth in claim 11, further characterized in that there is provided an auxiliary diode connected across said self-contained source of current supply to reduce voltages resulting from the breaking of the circuit through said electromagnet, said auxiliary diode being polarized so that current from said self-contained source of current supply does not flow therethrough.

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