March 26, 1929. H. W. SCHATZ ET AL 1,706,824

RADIAL DRILLING MACHINE

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Fig. 1.

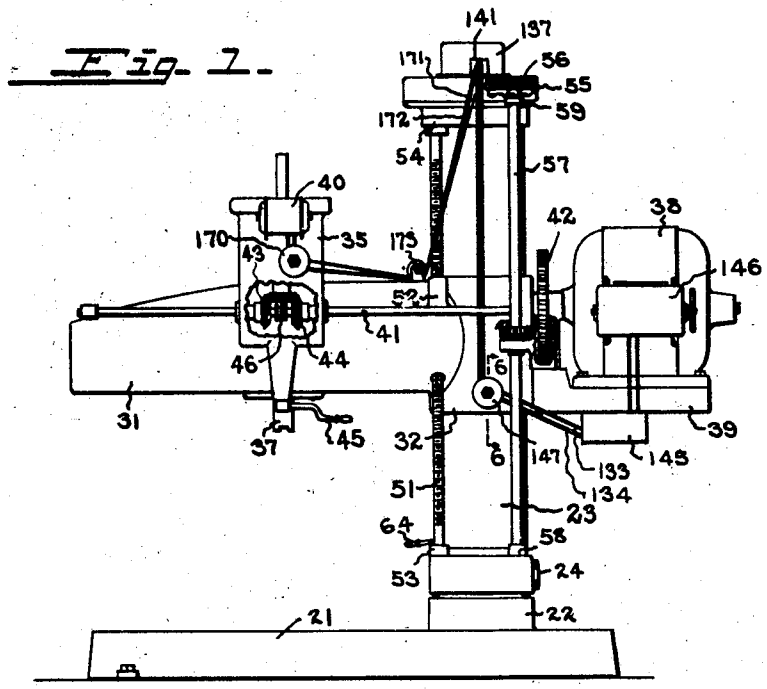
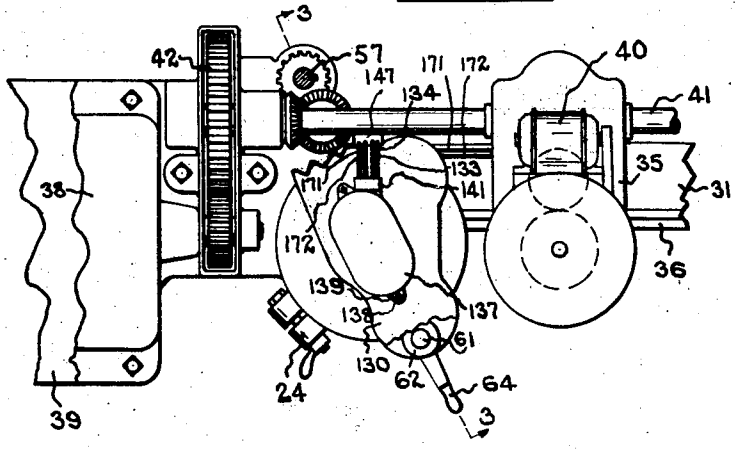


Fig. 2.



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RADIAL DRILLING MACHINE

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Fig. 3.

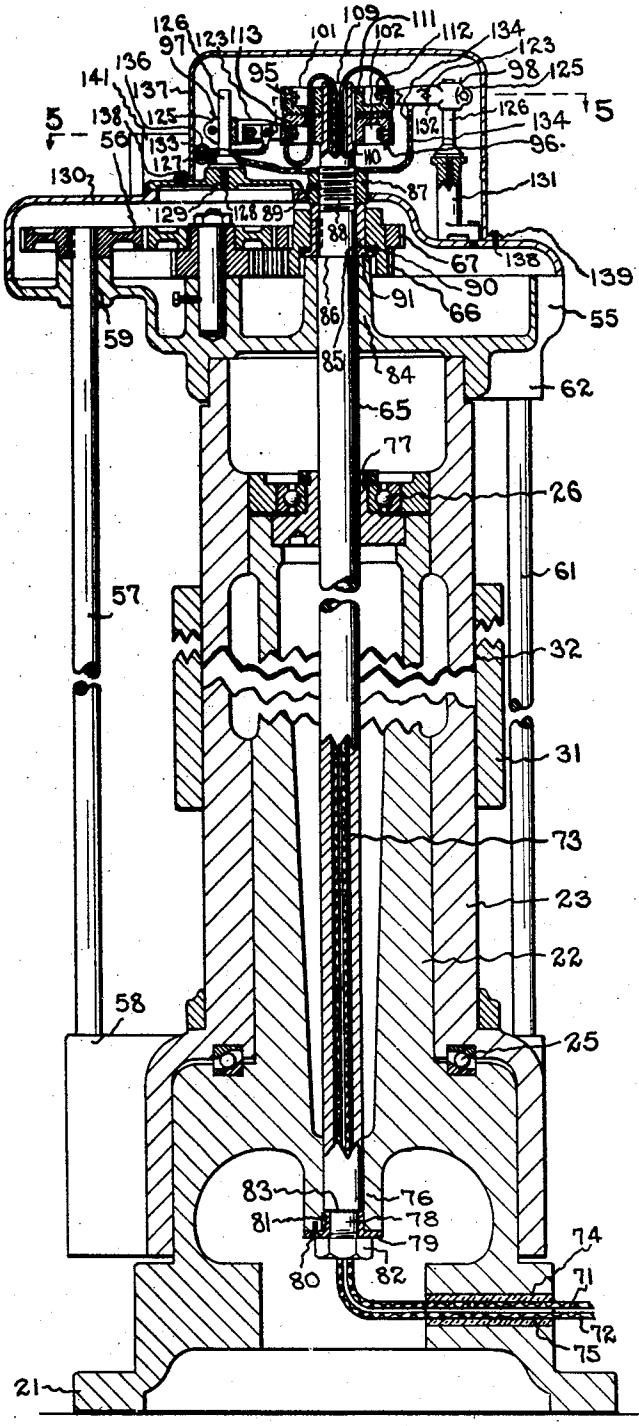
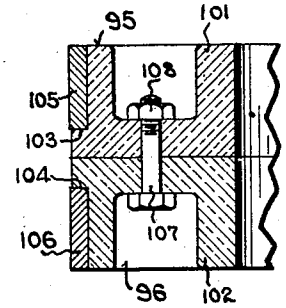


Fig. 4.



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March 26, 1929. H. W. SCHATZ ET AL 1,706,824

RADIAL DRILLING MACHINE

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Fig. 5.

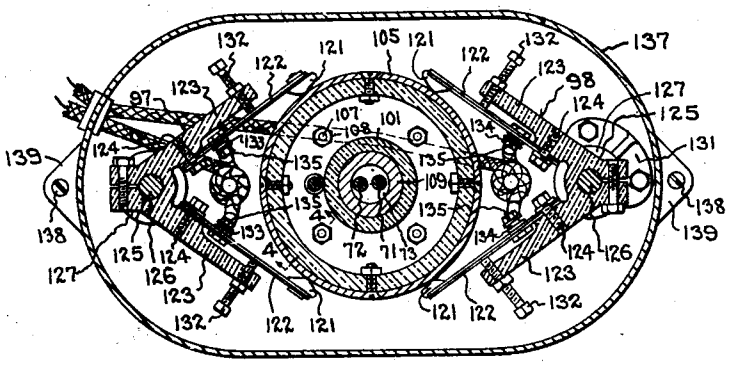


Fig. 6.

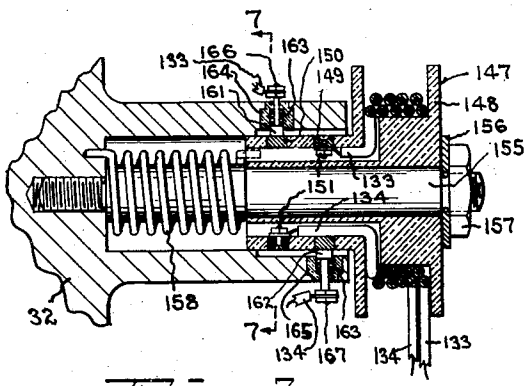


Fig. 8.

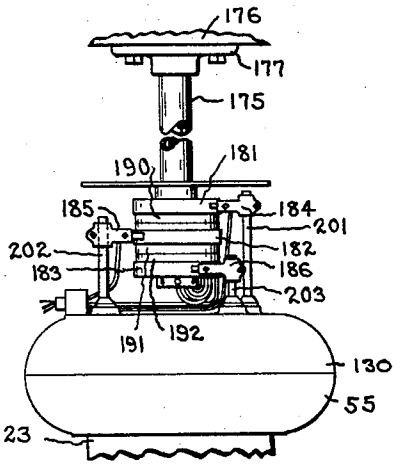
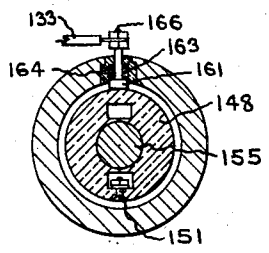


Fig. 7.



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RADIAL DRILLING MACHINE

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Fig. 9.

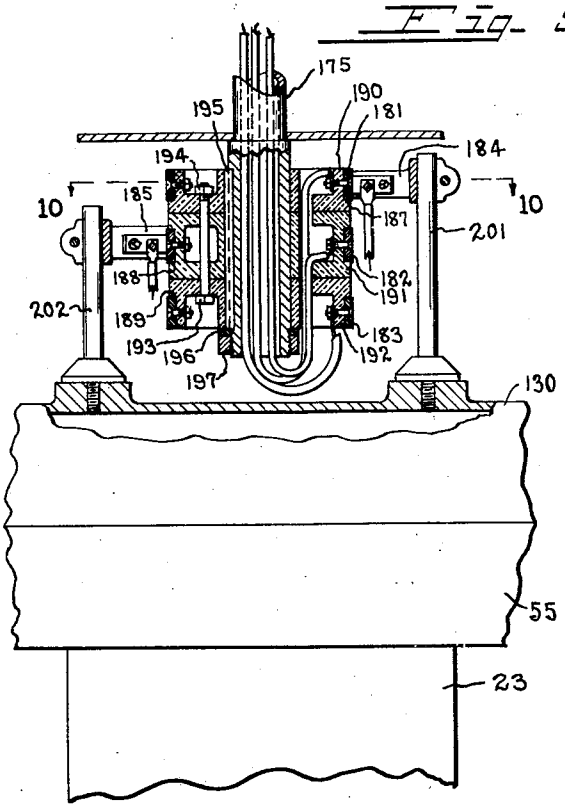
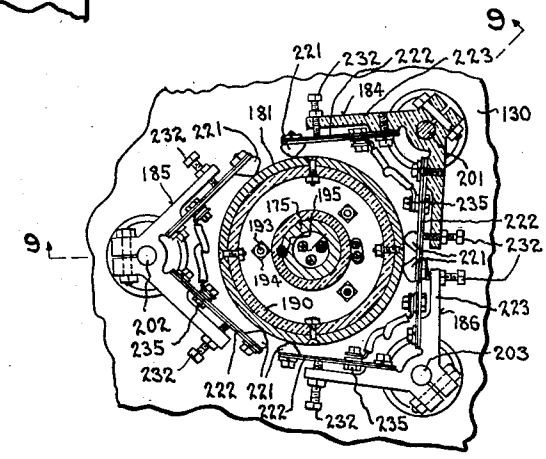


Fig. 10.



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Patented Mar. 26, 1929. 1,706,824

UNITED STATES PATENT OFFICE.

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RADIAL DRILLING MACHINE.

Application filed July 12, 1926. Serial No. 121,855.

In radial drilling machines there is a drill-arm which is rotatably adjustable into various radial positions and is also adjustable to elevation, for adjusting the tool with relation to the work, the tool being on a drill-head which is adjustable lengthwise of the drill-arm.

An electric motor or electric motors are in some types of radial drilling machines supported by and movable with a rotatably adjustable part, for providing power for effecting a vertical adjustment of the drill-arm, for a lateral adjustment of the drill-head, or for rotation of the drill-spindle, or one or more of these or other duties. The electric motor is movable with the movable part on which it is located, with the result that the electric conducting wires, to and from the electric motor, have one of their ends movable with the shiftable part or shiftable electric motor, while the other of their ends is stationary, resulting in twisting disarrangement, buckling and entangling of the wires, and having wires in the way of operative movements of the machine or of the operator.

An example of radial drilling machine in which the electric motor for driving the drill-spindle and for causing elevation of the drill-arm is mounted on a rotatable part, is shown and described in the Schatz and Sosa Patent No. 1,413,790, dated April 25, 1922, for drilling machine.

It is the object of our invention to so improve drilling machines of the character mentioned as to dispense with the twisting, disarrangement, buckling and entangling of electric conductors, due to the swinging movements of the drill-arm or rotatable movements of the column, which swinging or rotatable movements are in practice in certain machines of this character described throughout complete circles; further, to provide a relatively stationary electric conducting means for a drilling machine substantially in line with the axis of rotation of the rotatable member on which the electric motor is mounted, with which a rotatable elecrtic conducting means coacts to transfer the electric energy from one to the other and convey the same so as to operate the movable electric motor; further, to provide means whereby to support a member of an electric transmission couple centrally with relation to the rotatable or swinging member of the drilling machine, and to mount a coacting member of said transmission couple so as to move substantially with the rotatable or swingable member of the drilling machine; and, further, to provide take-up means for flexible electric conductors having connection with said electric couple and with the electric motor or motors.

The invention will be further readily understood from the following description and claims, and from the drawings, in which latter:

Fig. 1 represents a rear elevation of a radial drilling machine embodying our invention, partly broken away, for better illustration of parts.

Fig. 2 is a plan view of the same, partly broken away.

Fig. 3 is a central vertical section of the same, partly broken away, taken in the plane of the line 3—3 of Fig. 2.

Fig. 4 is a detail section of the securing means for the spools, taken on the line 4—4 of Fig. 5.

Fig. 5 is a horizontal cross-section of the same, taken in the plane of the irregular line 5—5 of Fig. 3.

Fig. 6 is a vertical section, taken on the line 6—6 of Fig. 1, showing the automatic take-up means for the flexible electric connections.

Fig. 7 is a vertical cross-section of the same, taken on the line 7—7 of Fig. 6.

Fig. 8 is a front elevation of a modification of our improved device, partly broken away, showing our invention adapted for a three-phase electric circuit.

Fig. 9 is a vertical axial section of the same, taken in the plane of the line 9—9 of Fig. 10; and,

Fig. 10 is a horizontal section of the same, taken on the line 10—10 of Fig. 9.

In the exemplification of radial drilling machine which we have preferred to show, there is a base 21, from which a post 22 extends vertically, a column 23, shown as a rotary column or sleeve, being rotatable about the relatively stationary post in usual or suitable manner, and arranged to be clamped in adjusted positions with relation to the base by means of a usual clamp, instanced at 24, so as to fix the column and post together in adjusted positions. There may be suitable

bearings 25, 26, between the relatively stationary post and the column.

A drill-arm 31 has a bearing 32 about the column, the bearing being arranged to be raised and lowered to suitable elevation on the column for positioning the drill-arm at suitable elevation, for proper operation of the drill with relation to the work, which latter is arranged to be supported on the base 21, although the work may be supported alongside of the base, or at other suitable points on the floor within range of the drill-arm, the drill-arm in this example of drilling machine being rotatable for complete circles about the post. The bearing 32 is arranged to be clamped about the column, when the same has been adjusted, for instance by means of a usual clamp.

A drill-slide 35 is adjustable laterally on the drill-arm on suitable guideways 36 on the arm, the lateral movements of the slide being accomplished in any well-known manner. The slide has a usual drill-spindle 37 journaled therein.

An electric motor 38 is supported by and fixed to a bracket 39, which extends from the drill-arm, and an electric motor 40 is shown mounted on the drill-slide. The bracket and motors are movable rotatably and to elevation with the drill-arm.

The electric motor 38 is in the present instance intended for supplying the motive power for rotating the drill-spindle, and for causing ascending and descending of the drill-arm. It transmits power to an operating shaft 41 by means of suitable gearing, shown generally at 42, which transmits motion from the rotor of the electric motor to said operating shaft, as more fully described in said patent.

Suitable operating means for driving and feeding the drill-spindle are mounted on the tool-slide and have operative connections with the operating shaft. These operating means may be of any usual or ordinary construction, and may include a pair of bevel gears 43, 44, having suitable spline groove and key connection with the operating shaft. Suitable clutches, operated by a shifting lever 45, are arranged to operatively connect a bevel gear 46 selectively through either of the bevel gears 43, 44, with the operating shaft, for selectively rotating the bevel gear 46 in reverse directions, the latter being connected by suitable trains of gearing in usual manner for driving and feeding the drill-spindle.

The means for raising and lowering the drill-arm on the column are exemplified as a screw-rod 51, extending lengthwise of the column, with which a nut 52, fixed in the drill-arm, has threaded engagement in usual manner. The lower end of the screw-rod is journaled in a bearing 53 in the lower part of the column, and the upper end of the screw-rod is journaled in a bearing 54 on a cap 55, secured to the upper end of the column, these bearings and cap being rotatable with the column. Suitable trains of gearing, indicated generally by the reference numeral 56, are located in the gear cap 55, for transmitting rotation in reverse directions to the screw-rod 51, from an upright shaft 57, which extends lengthwise of the column, and is journaled at its lower end in a bearing 58 on the rotatable column and at its upper end in a bearing 59 in the cap 55.

One of the gears of the train of gears 42, has spline groove and key connection with the upright shaft 57, for rotating said upright shaft throughout the range of adjustments to elevation of the drill-arm.

A rock-shaft 61 extending lengthwise of the column is journaled at its upper end in a bearing 62 in the cap 55, and at its lower end in a suitable bearing adjacent to the lower end of the column. The rock-shaft is provided with a handle 64, by means of which it is rocked, the rock-shaft communicating with shiftable gears in the train of gears 56 for arranging the gearing in the gear-cap 55 for rotating the screw-rod 51 in reverse directions, for elevational adjustment of the drill-arm.

The construction of the radial drill exemplified, and the trains of gearings, and the constructions and arrangements of the parts hereinbefore mentioned and indicated, are more clearly shown and described in the aforesaid Schatz and Sosa patent. It is to be understood, however, that our invention is applicable to other types and structures of radial drilling machines.

In the preferred form of our invention, the relatively stationary parts of the electric connections are preferably supported from a stationary part of the radial drilling machine, exemplified as the post. This is accomplished in the preferred form of our invention by leading the relatively stationary electric conductors past the train of gearing 56 at the top of the column, as by providing a hollow shaft 65 about which the gears 66, 67, of said train rotate. Electric conductors, exemplified at 71, 72, extend through the bore 73 of the hollow shaft or tube.

These electric conductors may be of suitable number, depending upon the character of electric current employed, and may be suitably insulated, and are exemplified in Figs. 1 to 7 inclusive as flexible electric conductors of a direct current motor. The flexible insulated electric conductors may extend into the post at a point below the rotatable column, being led from a suitable source of electric energy, for instance, through an opening 74 in the base, in which an insulating sleeve 75 may be located.

The tube 65 is secured to the post, as by

being fixed in a bearing 76 in the lower end of the post and laterally supported in a bearing 77 in the upper end of the post. The tube is shown clamped in the bearing 76 by being provided with a reduced threaded end 78 received through a gland 79 fixed to the bearing by bolts 80 and to the tube by a key 81. A nut 82 received over said reduced threaded end clamps an annular shoulder 83 of the tube against said gland.

The upper end of the tube is received through a bearing 84 in the cap 55, rotatable about the tube. A sleeve 85 is received about the reduced upper end of the tube, the lower end of the sleeve being received upon a shoulder 86 on said tube, permitting the bearing 84 thereunder to rotate. A nut 87 is adjustable about the upper screw-threaded portion 88 of the tube, and held in adjusted positions by a bolt 89, for locating said sleeve with relation to said shoulder. An anti-friction washer 90 is located between the combined gears 66, 67, and a flange 91 of said sleeve.

An electro-conductive couple is located at the top of the column, and is exemplified as comprising relatively stationary members 95, 96, and relatively movable coacting members 97, 98.

The relatively stationary members are exemplified as comprising spools 101, 102, of insulating material, provided with annular rabbets 103, 104, in which rings 105, 106, of electro-conductive material are located. The spools are secured together by means of bolts 107 and nuts 108. The connected spools are received about an upward extension 109 of said tube, downward movement of the spools being limited by an annular shoulder 110 on said upward extension, and rotation of the spools about the tube is prevented by means of spline groove and key connection 111 between said spools and said extension. One of the electric conductors is secured to the ring 105, as by means of a binding-post 112. The other electric conductor is secured to the ring 106, as by means of a suitable binding post 113. The electric source of energy is thereby communicated to said respective rings. These rings are exemplified as the relatively stationary members of the electric transmitting couple and the number of rings may vary, dependent on the character of electricity employed.

The other members of the electro-conductive couple are exemplified as rotatable members. These members are similarly constructed, and description of one will suffice for all. Each of the rotatable members comprises contacts 121, shown in pairs. One of the pairs of contacts coacts with one of the rings, and the other of the pairs of electric contacts coacts with the other of the rings. It is obvious that either of said sets of members may form the relatively stationary member and the other of said sets of members form the relatively movable member of said electro-conductive couple, within the spirit of our invention and the scope of the appended claims.

The electric contacts 121 are fixed to electro-conductive spring strips 122, shown fixed to arms 123, by means of clamp bolts 124. The arms are mounted on a rotatable part, exemplified as the cap 55. This is accomplished, in the present instance, by providing each of the arms with a bearing 125, shown as a clamp bearing, arranged to be clamped in adjusted positions to a stem 126. The stem is provided with a flange 127, and a screw-threaded end 128, which is threaded into a threaded socket 129, the flange coacting with the upper end of the wall of the socket for clampingly holding the stem in position. One of the stems is shown threaded direct to the top plate 130 of the cap, whilst the other stem is shown threaded to a pedestal 131 secured to said top-plate.

Adjusting screws 132 are threaded in the arms 123, and are arranged to urge the contacts 121 toward their coacting rings, for insuring electric transmission between said contacts and their coacting rings. Electric conductors 133, 134, may terminate in branches which are secured to the electric-conductive strips 122, as by means of binding posts 135. The arms 123 and the bearing 125 are preferably of non-conducting material to insulate the electric current from the body of the drilling machine. The electric contacts 121 of the respective sets act counter to each other.

The electric conductors 133, 134, are exemplified as flexible insulated electric conductors, received through an insulating thimble 136 in a hood 137 protectingly received over the electro-transmitting couple. The hood is shown secured to the cover 130 of the gear cap 55 by means of screws 138 received through flanges 139 of said cover and threaded into said cap.

The flexible electric conductors 133, 134, are received and secured in a suitable terminal box 141, and are continued therefrom as flexible electric conductors, which lead to the drill-arm, in the present exemplification, for instance, to a suitable electric translating device 145, shown as a switch, for supplying electric current to the electric motor, preferably through a rheostat 146, as more fully described in said Schatz and Sosa patent.

In order to compensate for the various elevational positions of the drill-arm, we provide the electric conductors 133, 134, with automatic take-up means 147. This automatic take-up means is exemplified as a spool 148 provided with electro-conductive contact rings 149, 150, with which said elec-

tric conductors are connected by binding posts 151, 152. The spool is preferably of insulating material.

The spool rotates about a stud-shaft 155, fixed at a suitable point either to a column part or a drill-arm part, and is shown threaded to the bearing 32 of the drill-arm. The spool is held endwise to the stud-shaft by a washer 156 and a nut 157 received about the threaded reduced end of the stud-shaft. A spiral spring 158 is received about the stud-shaft, one end thereof being received in a hole in the drill-arm and the other end being received in a hole in the spool. Electric contacts 161, 162, urged by springs 163, coact with the rings on the spool, and are received in insulating blocks 164, 165, and have binding posts 166, 167, to which the continuations of the electric conductors 133, 134, are secured. The spring 158 automatically takes up the slack which may be in the electric conductors 133, 134, between the top of the column and the drill-arm, as the drill-arm is raised or lowered.

When an electric motor is mounted on the drill-slide, we prefer to lead flexible insulated electric conductors 171, 172, from the electric conductors 133, 134, in the terminal box 141, and to interpose an automatic take-up 170 in said flexible electric conductors, similar to the automatic take-up 147, to which reference is made for details of structure. The automatic take-up 170 is mounted on the drill-slide 35. The flexible electric conductors 171, 172, are preferably received about a sheave 173, journaled on the drill-arm in the angle between the rotatable column and the drill-arm. The automatic take-up 170 may be mounted either on the column or on the drill-slide, and is exemplified as mounted on the drill-slide. It automatically takes up any slack there may be in the flexible electric conductors 171, 172, due to lateral shifting of the drill-slide on the drill-arm or to vertical adjustment of the drill-arm on the column.

The electric motor 40 mounted on the drill-slide is provided with suitable controls, or it may be a reversible motor, depending on the duties it is to perform. It may for instance be employed to drive a usual pinion in reverse directions, the pinion meshing with the usual rack extending lengthwise of the drill-arm, for adjusting the drill-slide in oposite directions lengthwise of the drill-arm.

We have in Figs. 8 to 10 inclusive exemplified a modified form of our invention adapted for a three-phase circuit of electric transmission for the electric motor or motors, and as showing the relatively stationary members of the electric transmission couples supported from above, and as showing the relatively movable members of the electric transmitting couples supported by the rotatable column. This manner of mounting the electric transmitting couples is especially applicable where the leading of electric conductors from the source of electric energy through a stationary post or similar support is inadvisable, as in such characters of radial drilling machines in which the power is transmitted to the operated parts of the drilling machine by means of a rotating power shaft extending upwardly centrally through the post.

In this modified form of our invention, a tube 175 depends from above, as from the ceiling, indicated at 176, being rigidly fastened to the upper support or ceiling by means of a flange 177 to which said tube is secured.

Three electro-conductive couples are exemplified, shown comprising relatively stationary members 181, 182, 183, and relatively movable coacting members 184, 185, 186. These members are constructed, mounted and connected similarly to the corresponding members 95, 96 and 97, 98, hereinbefore described.

The electro-conductive rings 181, 182, 183, are respectively received in annular grooves 187, 188, 189, of spools 190, 191, 192, clamped together by means of bolts 193 and nuts 194, and suitably held stationary on the tube 175, as by means of spline groove and key connection 195, the spools being held on the tube by means of a washer 196, and a nut 197 threaded to the lower end of the tube.

The relatively rotatable contacts coact with the relatively stationary contacts or rings. The relatively rotatable contacts are mounted on stems 201, 202, 203, similar to the stems 126, extending upwardly from and fixed to the cover 130 of the cap 55, in manner similar to the stems 126. The electric contacts and the means for mounting and adjusting the same are similar to the similar parts described in connection with the preferred form of our invention, the parts not hereinbefore designated being designated by similar reference numerals raised to the series 200.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is:

1. In a radial drilling machine, the combination of a base, a stationary post extending upwardly therefrom, a column rotatable about said post, a radial drill-arm mounted on and rotatable with said column, an electric motor mounted on and movable with said drill-arm, means including gearing for adjusting said radial drill-arm up and down on said column, a gear-cap at the top of said column in which said gearing is located, said gear-cap including a bearing, an upright tube coincident with the axis of said post extending through said bearing, a removable upright journal-sleeve supported by said

bearing about said tube, said gearing including gearing rotatable about and supported by said journal-sleeve and relatively to said cap, stationary electric contact means supported by said tube, complemental rotary electric contact means mounted on said gear-cap and rotatable with said column, electric conductors extending through said tube having electric connections with said first-named contact means, electric conductors for said electric motor having electric connections with said second-named contact means, and a hood on said cap inclosing said electric contact means.

2. In a radial drilling machine, the combination of a base, a stationary post extending upwardly therefrom, a column rotatable about said post, a radial drill-arm mounted on and rotatable with said column, a drill-slide, means for laterally adjusting said drill-slide on said drill-arm including an electric motor for said drill-slide, a drill-spindle on said drill-slide, an electric motor for rotating said drill-spindle mounted on and movable with said drill-arm, means including gearing for adjusting said radial drill-arm up and down on said column, a gear-cap at the top of said column in which said gearing is located, a tube coincident with the axis of said post, said gearing including gearing rotatable about the axis of said tube and relatively to said cap, stationary electric contact means supported by said tube, complemental rotary electric contact means mounted on said gear-cap and rotatable with said column, electric conductors extending through said tube having electric connections with said first-named contact means, flexible electric conductors for said respective electric motors having electric connections with said second-named contact means, automatic take-up means for said respective flexible electric conductors, and an inclosing hood on said gear-cap about said electric contact means.

3. In a radial drilling machine, the combination of a stationary post extending upwardly, a column rotatable about said post, a radial drill-arm mounted on and rotatable with said column, a drill-slide, means for laterally adjusting said drill-slide on said drill-arm including an electric motor on said drill-slide, a drill-spindle on said drill-slide, an electric motor for rotating said drill-spindle mounted on and movable with said drill-arm, means including gearing for adjusting said radial drill-arm up and down on said column, a tube coincident with the axis of said post, stationary electric contact means supported by said tube, complemental rotary electric contact means rotatable with said column, electric conductors extending through said tube having electric connections with said first-named contact means, flexible electric conductors for said first-named electric motor, flexible electric conductors for said second-named electric motor, said respective flexible electric conductors for said respective electric motors having electric connections with said second-named contact means, and automatic take-up means for said respective flexible electric conductors, and constructed and arranged for simultaneous raising and lowering of both said electric motors and for adjustment of said first-named electric motor toward and from said second-named electric motor in any of the radial positions of said drill-arm and maintenance of electric connections in said respective automatic take-up means throughout said adjustments.

In testimony whereof, we have hereunto signed our names.

HERMAN W. SCHATZ,
STANLEY M. RATLIFF.