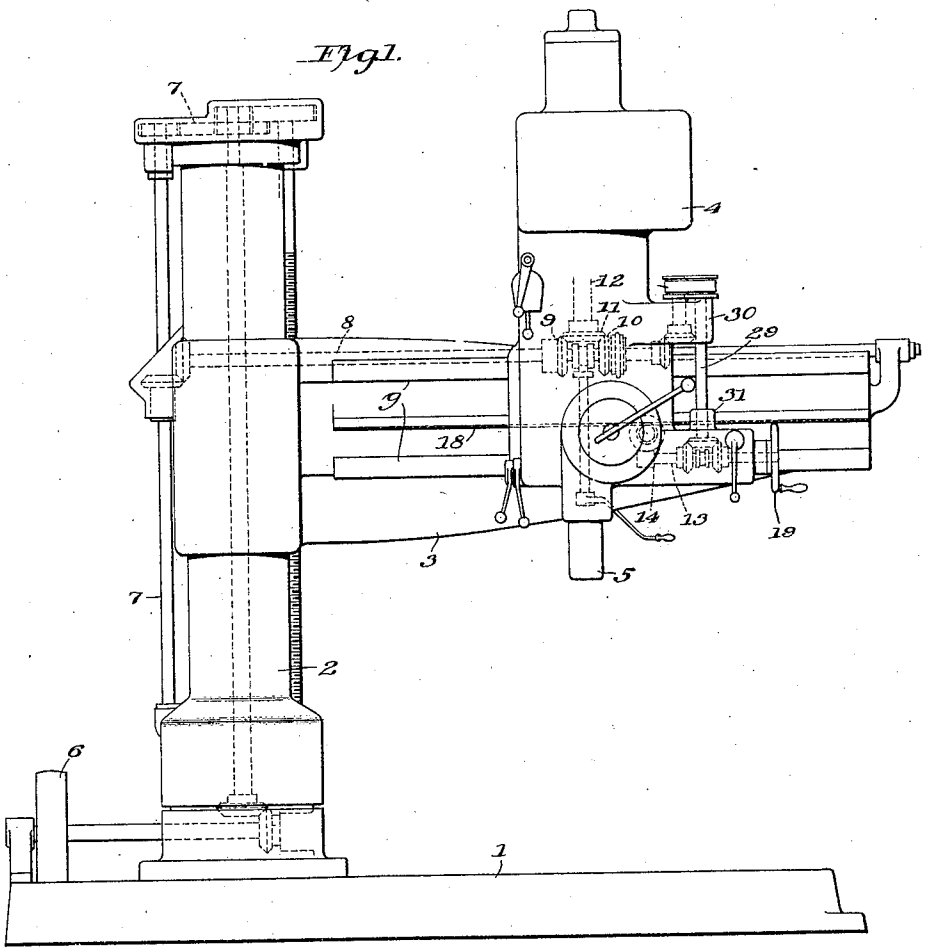
Oct. 15, 1929. D. C. KLAUSMEYER 1,731,466

HEAD TRANSLATING MECHANISM FOR RADIAL DRILLS

Filed March 23, 1925 2 Sheets-Sheet 1

Fig. 1.



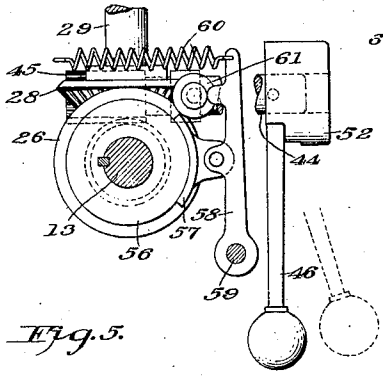


Fig. 5.

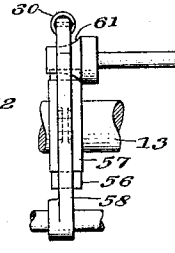
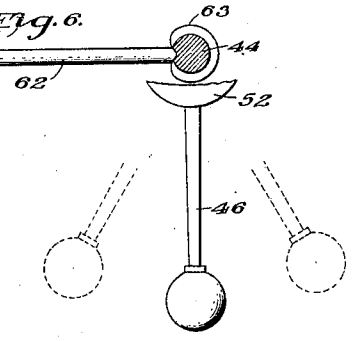


Fig. 6.



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HEAD TRANSLATING MECHANISM FOR RADIAL DRILLS

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Fig. 3.

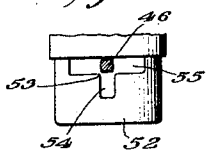
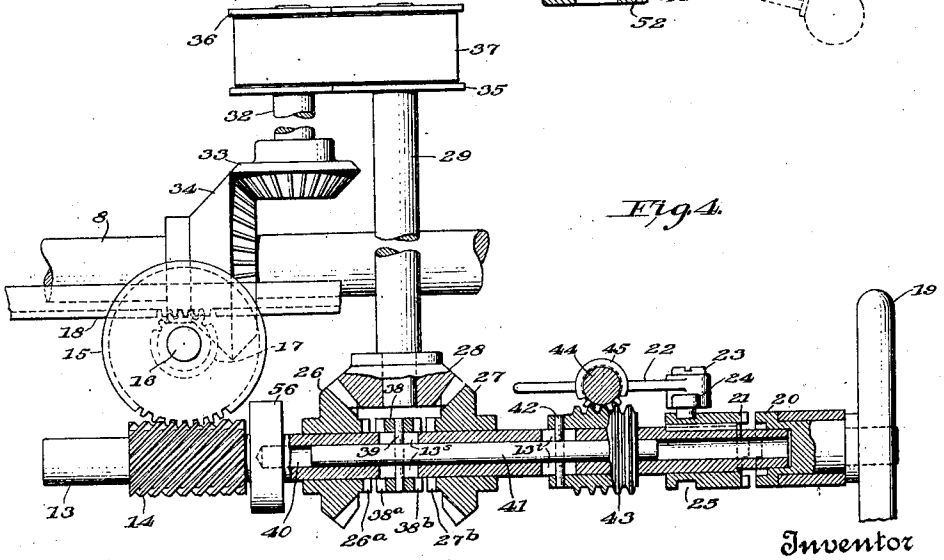


Fig. 2.

Fig 4.



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UNITED STATES PATENT OFFICE

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HEAD-TRANSLATING MECHANISM FOR RADIAL DRILLS

Application filed March 23, 1925. Serial No. 17,606.

This invention relates to radial drills and it deals more particularly with means for translating the drill-head on the radial arm and to means for overcoming the momentum of the drill-head and its translating mechanism when the translating mechanism is rendered ineffective. The invention is adapted particularly to that type of radial drills in which power is transmitted to the drill-head by means of a constant speed power transmission from a suitable single speed prime mover, and including a shaft extending lengthwise of the radial arm but it is to be understood that it is also adaptable to various other types of radial drills.

An object of this invention is to provide means carried wholly by the drill-head and actuated by a suitable power shaft to translate the drill-head on the radial arm at a constant rapid rate.

Another object of this invention is to provide an improved power traverse for radial drill heads, to combine therewith manual means to actuate the traverse and so to coordinate and control the two drives that they both may not be effective at the same time.

Still another object of the invention is to provide a brake mechanism which will become effective simultaneously with the disconnection of the power from the drill-head translating mechanism to overcome the momentum of the drill-head and said mechanism.

These objects have been attained by embodying within a drill-head a translating mechanism adapted to cooperate with a rack carried by the radial arm and by so connecting the mechanism with the arm shaft that it is operative in all of the positions of the drill-head on the radial arm. The translating mechanism preferably includes an auxiliary shaft journaled in the drill-head and operatively connected to rotate one of two mating elements (such for example as a rack and pinion) of which one is carried by the radial arm and the other of which is carried by the drill-head, whereby rotation of the auxiliary shaft effects movement of the drill-head. Means also is provided for reversing the direction of translation without reversing the direction of rotation of the power shaft.

To bring the parts to rest instantly when the translating mechanism is disconnected from the power shaft, there is carried by the driving mechanism (preferably secured to the auxiliary shaft) a brake drum upon which a suitable brake-shoe is adapted to bear. This brake-shoe is maintained out of contact with the brake drum when the power traverse is effective and is automatically applied thereto when the power drive is discontinued. The pinion which acts upon the rack to translate the head is preferably driven from the auxiliary shaft by means of a reversible driving connection, that is, one through which power may flow in either direction, as distinguished from a single thread worm and worm-wheel through which power may flow in one direction only, the worm necessarily being the driver.

It will readily be perceived that the momentum of the driving mechanism and the momentum of the rapidly moving drill-head may not in all instances be equal, that is to say, the momentum in one may be expended before the momentum in the other, and therefore the one having the greater momentum will tend to drive the other after the power drive has been disconnected. The reversible driving connection between the auxiliary shaft and the pinion permits the momentum of the drill-head to flow backwardly through said connection to the auxiliary shaft where it is overcome by the brake mechanism without exerting undue strain on the driving connection.

Other objects and advantages will be in part indicated in the following description and in part rendered apparent therefrom in connection with the annexed drawings.

To enable others skilled in the art so fully to apprehend the underlying features hereof that they may embody the same in the various ways contemplated by this invention, drawings depicting a preferred typical construction have been annexed as a part of this disclosure and, in such drawings, like characters of reference denote corresponding parts throughout all the views, of which:—

Fig. 1 is a side elevation of a radial drill embodying the present invention. Fig. 2 is a

plan of the drill-head translating mechanism and the brake mechanism for overcoming the momentum of the parts when the power drive is rendered ineffective, the controlling lever for the power drive and for the brake mechanism being shown swung upwardly about 90° from its normal position, more clearly to show its connection with the rest of the mechanism. Fig. 3 is a detail view showing a T-guide for the controlling lever. Fig. 4 is a section on the line 4—4 of Fig. 2. Fig. 5 is a section on the line 5—5 of Fig. 2. Fig. 6 is a side elevation of the parts shown in Fig. 5.

Referring more particularly to the drawings, the invention is disclosed as embodied in a radial drill comprising a base 1, column 2, radial arm 3, and a drill-head 4 slidably mounted on guides *g* provided by the radial arm. Rotatably and translatably journaled in the head 4 is a spindle 5 which is adapted to carry the tools usually used in this type of machine tools. Power to rotate the tool spindle may be supplied by a prime mover located at any suitable place, such for example as at 6 in Fig. 1, and power from the prime mover may flow through transmission, indicated generally as 7, to a shaft 8 journaled lengthwise of the arm 3. The shaft 8 is preferably, but not necessarily, rotated at a constant speed and power is taken from this shaft by means of gears 9 and 10 carried by the drill head and adapted selectively to be clutched to the shaft. The gears 9 and 10 drive a gear 11 carried by a shaft 12, journaled in the drill-head, from which power may be taken through suitable speed change gear-sets, not shown, to rotate the drill spindle at any one of a plurality of speeds, and in reverse directions, from the single speed in the arm shaft 8. Inasmuch as the means for rotating the drill-spindle forms no part of the present invention, detailed illustration and description thereof is deemed unnecessary.

Within the drill-head is journaled, parallel to the arm shaft, a second shaft 13 forming a part of the drill-head translating mechanism. Fixed to the shaft 13, is a worm 14 which meshes with a worm-wheel 15 secured upon one end of a shaft 16 rotatably journaled in the drill-head 4. The opposite end of the shaft 16 carries a member 17 adapted to engage a member 18 carried by the radial arm parallel to the shaft 8 whereby relative rotation between the two will effect translation of the drill-head. The mating members 17 and 18 are preferably in the form of a pinion and a rack, respectively, but obviously they may consist of a nut and screw or their equivalent. The worm 14 is preferably of the multiple thread type and the angle of the threads of the worm and worm-wheel is such that either may act as a driver for the other for purposes later to be explained.

The shaft 13 may be rotated manually to effect a slow traverse or it may be rotated by power to effect a rapid traverse of the drill-head. The manual means comprises a hand-wheel 19 rotatably journaled in the drill-head with its axis in line with the axis of the shaft 13. The hand-wheel carries a clutch element 20 adapted to be engaged by a clutch member 21 splined to the shaft 13 and normally maintained in engagement with the element 20 by means of a spring-controlled bell-crank lever 22 pivoted at 23 in the drill-head and having its arm 24 engage an annular groove 25 in the clutch element 21.

The shaft 13 may also be rotated by power from the constant speed arm shaft 8 by means now to be described. Loosely journaled on the shaft 13 are two bevel gears 26 and 27, permanently in mesh with, and driven in opposite directions by a similar gear 28 fixed upon one end of a shaft 29 journaled in bearings 30 and 31 provided by the drill-head. Also journaled within the drill head, parallel to the shaft 29, is a short shaft 32 carrying at one end a bevel gear 33 which meshes with and is driven by a similar gear 34 journaled within the drill-head and splined to the arm shaft 8. The upper end of the shafts 29 and 32 carry pulleys 35 and 36, respectively, which are operatively connected by a continuous belt 37. Thus it will be seen that the gears 26 and 27 are rotated continuously in reverse directions in all of the adjusted positions of the drill-head on the arm 3.

Either of the gears 26 or 27 may be caused to rotate the shaft 13 to effect a power traverse of the drill-head, in opposite directions, by means of a clutch element 38 translatably but non-rotatably mounted on the shaft 13 and providing clutch teeth 38^a and 38^b adapted selectively to be engaged with similar clutch teeth 26^a and 27^b on the gears 26 and 27 respectively. The clutch element 38 is held against relative rotation with the shaft 13 by a pin 39 fixed in said element and passing through slots 13^s formed in diametrically opposite sides of the shaft 13. The shaft 13 is formed with a bore 40 within which is slidingly mounted a clutch-shifting rod 41 through which the pin 39 also passes. The rod 41 also carries a pin 42 which projects outwardly through slots 13^t in the shaft 13 and engage a circular rack 43 slidably mounted on the said shaft. Rotatably and translatably journaled in the drill-head 3 is shaft 44 to which is secured a pinion 45 permanently in mesh with the rack 43. A clutch shifting lever 46 is pivoted within a slot 44^s, in the shaft 44, upon a pin 47, and is formed at one end with a ball 48 which tracks a guideway 49 afforded by spaced walls 50 and 51 provided by the drill head and by a guide-block 52 respectively. The guide block 52 is carried by the drill head and is formed with a T-shaped guideway 53 comprising transverse slots 54 and 55 through which the

lever 46 projects. When the lever 46 is moved through the slot 54 the ball 48 engages the wall 50 or 51 and acts as a fulcrum for the lever whereby the shaft 44 and the pinion are shifted axially. When the lever is moved through the slot 55 the ball 48 passes idly through the guideway 49 and the shaft 44 and pinion are rotated, thereby, through the circular rack 43, pin 42, rod 41 and pin 39, shifting the clutch member 38 and engaging either the clutch teeth 38^a and 26^a or 38^b and 27^b dependent upon the direction of movement of the lever from its intermediate position. It is to be noted that the clutch-shifting bell-crank lever 22 bears against the end of the pinion 45 and therefore movement of the lever out of the slot 54 and into the slot 55 causes the lever 22 to be swung about its fulcrum 23 thereby disconnecting the clutch elements 20 and 21 before either of the gears 26 or 27 may be rendered effective to rotate the shaft 13. Movement of the lever 46 back into the slot 54 to disconnect the power traverse moves the pinion 45 away from the lever 22 and permits the spring *s* to return the lever to its initial position to engage the manual drive for the head translating mechanism.

As hereinbefore stated this invention contemplates means to overcome the momentum of the rapidly moving drill-head and the power driving means therefor. This preferably comprises a brake mechanism adapted to act upon the power drive the instant said power drive is rendered ineffective to translate the head. This brake mechanism may conveniently consist of a brake-drum 56 secured upon any suitable rotating part of the power drive, as for example, upon the shaft 13. Cooperating with the brake-drum 56 is a brake-shoe 57 carried by a lever 58 fulcrumed at 59 in the drill-head. Any suitable means may be employed to force the brake-shoe into contact with the brake drum when the power drive is discontinued. A spring 60 having one end connected to the lever and the other end secured to a stationary part of the drill head may be used for this purpose but it is to be understood that this invention also contemplates the use of positively acting means. To permit the parts to rotate when the power drive is connected, a cam element 61 is adapted to act upon the lever 58 to swing it in opposition to the spring 60 thereby to remove the brake-shoe from the brake-drum. This cam element 61 is preferably carried by one end of a bar 62 slidably mounted in the drill-head and having its opposite end in engagement with a cam 63 carried by the shaft 44. It will, therefore, be perceived that when the lever is moved through the slot 55 to rotate the shaft 44 and the pinion 45 to shift the clutch member 38 to either of its driving positions the cam 63 will move the bar 62 lengthwise away from the shaft 44 and the cam 61 will swing the lever 58 and remove the brake-shoe from the brake-drum. Likewise when the shaft 44 is rotated to shift the clutch member to its neutral position, the spring will overcome the pressure of the cam and again apply the brake-shoe to the brake-drum.

As hereinbefore described, the teeth of the worm 14 and the worm-wheel 15 are preferably so cut as to constitute a reversible drive whereby the momentum of the drill-head may flow back through the worm wheel and worm to the shaft 14 where it is overcome by the brake-mechanism. Thus, it will be seen that the single brake-mechanism is adapted to overcome the momentum of both the drill-head and its power translating mechanism without wear or strain on any of the driving mechanism. Also, as the power drive is preferably actuated by a constant speed shaft, the speed of the parts and therefore their momentum will be the same at all times and the brake-mechanism may be constructed and adjusted to a nicety so as to act with a predetermined force upon a predetermined load thereby insuring efficient operation.

Nothing herein is intended to waive any of the patentable features of applicant's copending application, Serial No. 689,649 filed January 31, 1924.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various utilizations by retaining one or more of the features that, from the standpoint of the prior art, fairly constitute essential characteristics of either the generic or specific aspects of this invention and, therefore, such adaptations should be, and are intended to be, comprehended within the meaning and range of equivalency of the following claims.

Having thus revealed this invention, I claim as new and desire to secure the following combinations and elements, or equivalents thereof, by Letters Patent of the United States:—

1. In a radial drill, a column; an arm supported by the column; a drill-head slidably mounted on the arm; a power shaft journaled lengthwise of the arm; a second shaft, journaled in said drill-head; manual means to rotate said second shaft; power means to rotate said second shaft from said power shaft; means actuated from said second shaft to translate said drill-head on said arm; a lever to control said power means; and means actuated by said lever to render said manual means ineffective when said power means is effective to translate said head.

2. In a radial drill the combination of an arm; a drill-head slidably mounted on the arm; a power shaft; a gear splined to said power shaft and movable with said drill-head; a second shaft, journaled in said drill-head; a member carried by said arm; a ro-

tatable element carried by said drill-head and cooperating with said member; and adapted upon rotation of said second shaft to translate said drill head; a driving connection between said second shaft and said rotatable element; a gear fixed to said second shaft; two parallel shafts journaled in said drill-head transverse to said power shaft and said second shaft; a gear on one of said shafts meshing with the gear on said power shaft; a gear on the other shaft meshing with the gear fixed to said second shaft; and a driving connection between said two parallel shafts.

3. The combination set forth in claim 2 characterized by this that the driving connection between the two parallel shafts consists of a pulley fixed to each of said shafts and continuous belt operatively connecting said pulleys.

4. In a radial drill, an arm; a drill-head slidable on the arm; mechanism to translate the drill head on the arm; power means to actuate said translating mechanism; manual means to actuate said translating mechanism; a control lever movable in transverse planes; means actuated by said lever when moved in one plane to render said power means effective; and means actuated by said lever when moved in another plane to render said manual means effective.

5. In a radial drill, an arm; a drill-head slidable on the arm; mechanism to translate the drill-head on the arm; power means to actuate said translating mechanism; manual means to actuate said translating mechanism; a control lever movable in transverse planes; means actuated by said lever when moved in one plane to render said power means effective; means actuated by said lever when moved in another plane to render said manual means effective; and means to prevent said power means and manual means being effective at the same time.

6. In a radial drill the combination of an arm; a drill-head slidable on the arm; a power shaft; a second shaft, journaled in the drill head; two gears loosely journaled on said second shaft; means actuated by said power shaft to rotate said gears in opposite directions; manual means to rotate said second shaft; means actuated by the rotation of said second shaft to translate said drill-head on said arm; means selectively to clutch either of said gears to said second shaft, to effect power translation of said drill head; a lever to control the action of said power translation; and means actuated by said lever to render said manual means ineffective when said power means is effective.

7. The combination set forth in claim 6, characterized by this that the controlling lever extends through a T-shaped guide-way which prevents the simultaneous connection of the manual and power means to rotate the second shaft; and that the manual means is automatically rendered effective when the power drive is disconnected.

8. In a radial drill, an arm; a drill-head slidably mounted on the arm; a source of power; means actuated from said source of power to traverse said drill-head on the arm; means to disconnect said drill-head traversing means from its source of power; and means including a friction brake to arrest the movement of said traversing means when it is disconnected from its source of power.

9. In a radial drill, an arm; a drill-head slidably mounted on the arm; a constant speed power shaft; means actuated from said constant speed power shaft to traverse said drill head on said arm; means to render said traversing mechanism ineffective; and a brake mechanism adapted to arrest the movement of said drill-head when said traversing mechanism is rendered ineffective.

10. In a radial drill, an arm; a drill-head slidably mounted on the arm, a power shaft; mechanism carried wholly by said drill head and actuated from said power shaft to rapidly translate said drill-head on said arm; means to render said translating mechanism ineffective to translate said drill-head; and a brake associated with said drill-head translating mechanism and adapted, when said translating mechanism is rendered ineffective, to overcome the momentum of said translating mechanism.

11. In a radial drill an arm; a drill-head slidably mounted on the arm; a power shaft; a second shaft journaled in said drill-head; a driving connection between said second shaft and said power shaft, mating members carried by said arm and drill-head; means to rotate one of said members from said second shaft to effect translation of said drill-head on said arm; means to interrupt the driving connection between the power shaft and the second shaft; said last-named means including a lever; and a brake mechanism controlled by said lever and adapted to arrest the movement of said drill head when said driving connection is interrupted.

12. In a radial drill, an arm; a drill-head slidably mounted on the arm; a power shaft; a second shaft journaled in said drill-head; a driving connection between said power-shaft and said second shaft; means to interrupt said driving connection; mating elements carried by said arm and drill-head; means including a reversible driving connection to rotate one of said members from said second shaft to effect translation of said drill-head on said arm; and a brake mechanism located between the reversible driving connection and said power shaft and adapted upon the interruption of said driving con-

nection to overcome the momentum of said second shaft and of said drill-head.

13. In a radial drill the combination of an arm; a drill-head slidably mounted on the arm; a power shaft; mating elements carried by said arm and drill-head and adapted upon relative rotation to translate said drill-head on said arm; a driving connection between said power shaft and one of said mating elements; means to render said driving connection ineffective to transmit motion to said one of said mating elements; a brake mechanism adapted to act upon said driving connection to overcome the momentum of said drill-head when said driving connection is rendered ineffective.

14. The combination set forth in claim 13 characterized by this that a single lever controls both the driving connection and the brake mechanism.

15. In a radial drill, an arm; a drill-head slidably mounted on the arm; a power shaft; a second shaft, journaled in said drill-head; a driving connection between said second shaft and said power shaft; a multiple thread worm fixed to said second shaft; a third shaft journaled in said drill-head transverse to said second shaft; a rack carried by the arm; a pinion carried by said third shaft; a worm-wheel carried by said third shaft and operatively connected with said worm; the angle of the threads of said worm and worm-wheel being such that either may serve to drive the other; a brake mechanism adapted to act upon said second shaft; and means to render said driving connection ineffective and to permit said brake mechanism to overcome the momentum of said drill-head.

16. In a radial drill, an arm; a drill-head slidably mounted on the arm; a power shaft; second shaft, journaled in said drill-head; a power drive between said power shaft and said second shaft; means including a lever to interrupt said drive; means actuated by said second shaft to translate said drill-head on said arm; a brake drum carried by said second shaft; a brake-shoe adapted to bear on said brake-drum; and means controlled by said lever to force said brake shoe against said brake-drum when said power drive is interrupted.

17. In a radial drill, an arm; a drill-head slidably mounted on the arm; a power shaft; a second shaft, journaled in said drill-head; a power drive between said power shaft and said second shaft; means including a control lever to render said drive effective or ineffective; means actuated by said second shaft to translate said drill-head on said arm; a brake drum carried by said second shaft, a lever pivoted to said drill-head; a brake-shoe carried by said lever; a spring acting upon said lever to force said brake-shoe into engagement with said brake-drum when said power drive is ineffective; and means actuated by said control lever to withdraw said brake-shoe from said brake-drum when said power drive is rendered effective to transmit power to said second shaft.

18. In a radial drill, an arm; a drill-head slidably mounted on the arm; a power shaft; a second shaft; a power drive between said shafts; means to render said power drive ineffective to rotate said second shaft; a toothed rack carried by said arm; a pinion rotatably journaled in said drill-head and meshing with the teeth of said rack; means to rotate said pinion to effect translation of said drill-head on said arm, said means including a reversible driving connection between said second shaft and said pinion; and a brake-mechanism located between said reversible driving connection and said power drive and adapted, when said power drive is rendered ineffective, to overcome the momentum of said drill-head which exerts a driving power to said second shaft through said reversible driving connection.

In witness whereof, I have hereunto subscribed my name.

DAVID C. KLAUSMEYER.