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ELECTRICALLY DRIVEN PERCUSSION DRILL, PARTICULARLY FOR DRILLING ROCK, EARTH AND SYNTHETIC SUBSTANCES

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Fig. 1

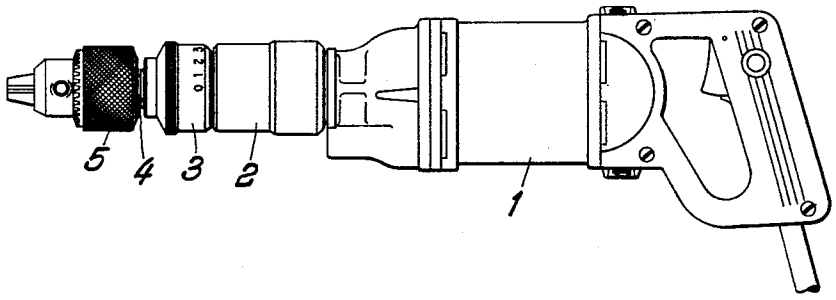
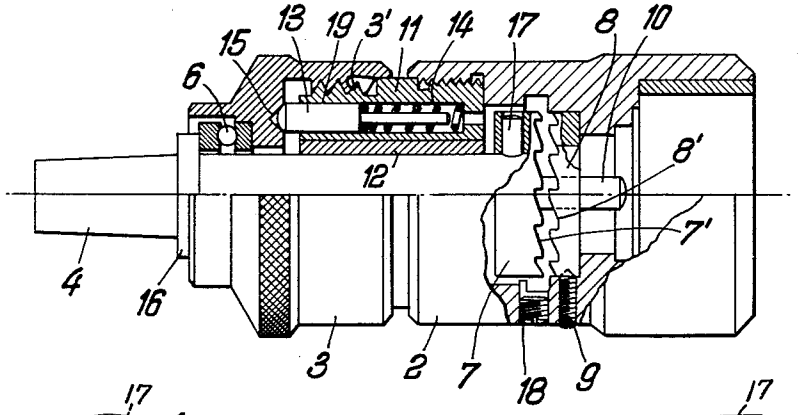


Fig. 2



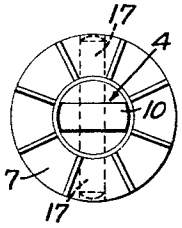


Fig. 4

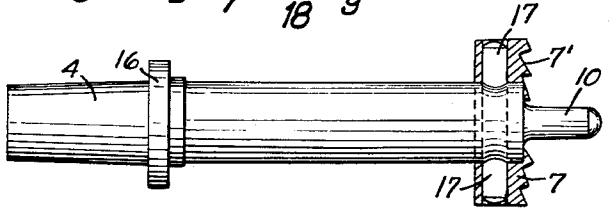


Fig. 3

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ELECTRICALLY DRIVEN PERCUSSION DRILL, PARTICULARLY FOR DRILLING ROCK, EARTH, AND SYNTHETIC SUBSTANCES

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In the construction industry, percussion drills are needed, for example in order to be able to drill through walls, masonry, door-posts etc. in the shortest possible time to lay gas, water and electric conduits. Such machines work with a drill spindle to which axial percussion movements are imparted during the drilling operation. These percussion movements may be produced by two discs which are axially toothed or provided with cam-like surfaces, and one of which remains stationary while the other rotates with the drill spindle. If the two opposed discs with tooth-like or cam-like projections are subjected to a spring pressure or the pressure exerted on the drill by the operator, which urges the discs together, then the axially displaceable toothed or cam disc, which is rigidly connected to the drill spindle, performs percussion-like movements, the frequency of which depends on the number of teeth or cam-surfaces sliding over one another and on the speed imparted to the drill spindle.

It is the object of the invention to develop percussion drills of the type described above in the sense of a constructional simplification and by providing a device for regulating the percussion amplitude which can be adjusted easily while the percussion drill is in service.

According to the invention, this problem is solved by the fact that the distance between the teeth on the rotating notched disc and the teeth on the stationary noched disc, through the middle of which projects the driving pin for the drill spindle, can be varied by means of a percussion adjusting nut which is mounted coaxial with the drill spindle, and between the end of which facing the drill chuck and a collar on the drill spindle there is mounted a thrust bearing which takes up the thrust of the percussion drill. The thrust bearing is rigidly connected to the percussion adjusting nut and by turning the latter, the former is adjustable in its axial position in relation to the stationary notched disc at various main stops, each of which is fixed by a resilient detent pin, in such a manner that at the stop 0 the teeth of the two notched discs do not touch one another, at another stop the teeth are fully engaged and at the remaining stops contact between the teeth takes place to a varying degree in each case.

Screwed into the housing portion surrounding the two notched discs and coaxial therewith is a cylindrical hollow body and fixed to its inner diameter is a liner for the drill spindle. The end of this hollow body which projects from the aforesaid housing portion is provided externally with a thread, for screwing on the percussion adjusting nut. Mounted for longitudinal displacement in a bore in the wall of the cylindrical hollow body and parallel to the axis thereof, is a detent pin which is subject to the pressure of a spring and which engages in depressions in the percussion adjusting nut. In this manner, assurance is provided that the engaged position of the percussion adjusting nut remains unaltered by the vibrations of the percussion drill operation, until the operator of the percussion drill has changed the percussion amplitude setting to another stop.

The various stop positions are preferably indicated by figures on the outer periphery of the percussion adjusting nut so that it is possible to see which stage of the percussion amplitude the drill spindle is performing in operation. If the mark is opposite the figure 0, this means that the teeth of the notched discs are not in engagement with one another, that is to say that no percussion movements are being imparted to the drill spindle.

One embodiment is illustrated by way of example in the accompanying drawings, wherein:

Fig. 1 is an elevational view of a percussion mechanism of the invention with a portable drill attached;

Fig. 2 is a large scale elevational view partly in section, of the percussion mechanism;

Fig. 3 is an elevational view, partly in section, of the drill spindle and driving pin and a notched disc secured to the drill spindle; and

Fig. 4 is an end view thereof.

Figure 1 shows that the percussion drill consists of a motor portion 1, a housing portion 2, surrounding cam and cam follower means such as the notched discs 7 and 8 (Fig. 2), the percussion adjusting nut 3, the drill spindle 4 and the drill chuck 5. Only the mechanism which imparts a precussion movement to the drill spindle 4 and by means of which the percussion amplitude can be varied will be described below.

Fixed in the end of the percussion adjusting nut 3 facing the drill chuck 5 is a thrust bearing 6 which takes up the percussion drill thrust. The notched disc 7 is rigidly connected to the drill spindle 4 by means of a pin 17. The teeth 7' of the notched disc 7 have the same profile as the teeth 8' of the notched disc 8 which is rigidly connected to the housing 2 by means of the grub screw 9. The driving pin 10 for the drill spindle 4 is integral therewith, as best shown in Fig. 3, and is flattened on two opposite sides as shown in Fig. 4 and projects through a bore in the notched disc 8. This driving pin 10 is coupled in known manner with the shaft which projects from the motor portion 1 and which is not illustrated in Figures 1 and 2.

Screwed into the housing portion 2 is a cylindrical hollow body 11 to the inner diameter of which is fixed a liner 12 for the drill spindle 4. The end of the hollow body 11 which projects from the housing portion 2 is provided with a thread 3' on which the percussion adjusting nut 3 is screwed. Mounted for longitudinal displacement in a bore 19, the axis of which runs parallel to the axis of the hollow body 11, is a detent pin 13 which is urged by the pressure of a spring 14 into a depression 15 in the percussion adjusting nut 3. A plurality of represions 15 are arranged in a circle round the inner end of the percussion adjusting nut 3. Each of these depressions corresponds to a stop position of the percussion adjusting nut 3. Since in the example illustrated in Figures 1 and 2, there are four stop positions for the percussion adjusting nut 3, namely the stops 0, 1, 2 and 3, there must be four depressions 15 present altogether, in which the same detent pin 13 engages one after the other.

The percussion drill spindle 4 is provided with a collar 16 against which, during operation of the percussion drill, rests the thrust bearing 6 which is located in the end of the percussion adjusting nut 3 facing the drill chuck 5.

In Figure 2, the reference numeral 18 represents a ball oiler by means of which the flanks of the teeth 7' and 8' of the notched discs 7 and 8, which slide over one another, can be oiled.

The position of the notched discs 7 and 8 shown in Figure 2 corresponds to the zero setting of the percussion adjusting nut 3. In this position, the teeth 7' and 8' of the aforesaid notched discs are not in contact with one another. The machine therefore operates as a drilling

machine without any percussion movement of the drill spindle. If the percussion adjusting nut 3 is in the stop position 3, however, then the oblique flanks of the teeth 7' and 8' rest on one another. With the shape of the teeth illustrated, the notched disc 7 would be driven in clockwise direction. On rotation of the drill spindle 4, its teeth 7' run on the oblique flanks of the teeth 8' of the notched disc 8 which is stationary in the housing 2 and repeatedly engage in the gaps between the teeth 8' under the influence of the pressure exerted on the drill spindle 4 by the operator. In this manner, axial percussion movements are imparted to the drill spindle 4.

When the apparatus is applied by an operator to a wall surface, the drill spindle 4 will be axially stationary—except for penetration into the wall as the drilling progresses. During rotation of the drill spindle 4, the cam action between the discs 7 and 8 will intermittently push the disc 8 and therewith the housing 2 outwardly away from the wall and towards the operator, and release the disc 8 and the housing 2 during the intervals between the outward thrusts. The operator will continue throughout to exert pressure onto the housing 2, so that during these intervals the discs 7 and 8 will be interengaged and the bearing 6 make impact with the collar 16 of the drill spindle.

When the percussion adjusting nut 3 is in the stop position 2, the flanks of the teeth 7' and 8' are somewhat apart from one another. This spacing apart is further increased in the stop position 1. In both stop positions, however, the teeth still slide over one another and impart percussion movements of a smaller amplitude in comparison with stop position 3, to the spindle 4.

When the percussion adjusting nut 3 is turned in such a manner that it moves on the threading 3' of the hollow body 11 screwed into the housing 2, towards the motor portion 1, then it takes the thrust bearing 6 with it because the latter is rigidly connected to the percussion adjusting nut 3. The collar 16 of the percussion drill spindle 4 always rests against the thrust bearing 6 when the drill is in operation, because of the pressure exerted on the spindle 4 by the operator, so that the distance between the teeth 7' and 8' of the notched discs 7 and 8 which has been set by the percussion adjusting nut 3 cannot be affected by this pressure.

The percussion frequency is normally varied by varying the speed of the driving motor of the percussion drill.

I claim:

1. A percussion drill mechanism, for use in connection with an electric motor, comprising a housing, a drill spindle journalled in said housing for rotation and guided in said housing for axial relative movement between said spindle and said housing and adapted to be driven by said electric motor and to carry at its forward end a drill, a revoluble disc disposed inside said housing and secured to said spindle for rotation therewith, a stationary disc secured in said drill housing adjacent and coaxial with said revoluble disc, teeth arranged around the periphery of each of said discs and including oblique surfaces, the teeth of each disc being opposite to and facing those of the other and the oblique surfaces of the teeth of the revoluble disc being operable to slide on those of the teeth of the stationary disc to impart during operation to the housing an axial rearward thrust movement when the spindle rotates, for subsequent forward thrust movement of the housing under manual force applied to the housing by an operator in the intervals between the rearward thrusts, and means operable for varying the distance between said discs to regulate the thrust amplitude comprising a nut threaded with relation to said housing and surrounding said spindle coaxially and moving axially of said spindle when turned for threading, a thrust bearing mounted on said nut and movable therewith axially of the spindle, and a thrust collar secured to said spindle and disposed adjacent the exterior of said thrust bearing, whereby the threading movement of the nut relative to the housing will adjustably position the thrust bearing relative to the thrust collar on the spindle, and the force exerted by the operator against the housing will cause abutment between the thrust bearing and the thrust collar of the spindle as the drill of the spindle rests on the material to be drilled, thus varying the distance the housing can move relative to the spindle before the bearing contacts the thrust collar.

2. A percussion drill mechanism, for use with an electric motor for the drilling of material, comprising a housing, a drill spindle journalled for rotation and guided in said housing for axial relative movement between said spindle and said housing and adapted to be driven by said electric motor and adapted to carry near its forward end a drill, cam and cam follower means between said spindle and said housing disposed on the interior of said housing and operable upon inter-engagement to cause repeated axial rearward thrusts of said housing when said spindle revolves, for subsequent forward thrust movement of the housing under manual force applied to the housing by an operator in the intervals between the rearward thrusts, and means for varying the distance between said cam and cam follower means comprising a nut supported in threaded engagement by said housing and surrounding coaxially said spindle and being movable axially of said spindle when turned relative to said housing in threading engagement, a thrust bearing mounted on said nut and being movable therewith axially of said spindle, and a collar secured to the forward end of said drill spindle near the forward exterior of said thrust bearing, whereby the threading movement of the nut relative to the housing will adjustably position the thrust bearing relative to the thrust collar on the spindle, and the force exerted by the operator against the housing will cause abutment between the thrust bearing and the thrust collar of the spindle as the drill of the spindle rests on the material to be drilled, thus varying the distance the housing can move relative to the spindle before the bearing contacts the thrust collar.

3. In a percussion drill mechanism, as claimed in claim 2, together with means for releasably locking said nut relative to said housing in various positions comprising a spring biased detent pin mounted in the housing relative to which the nut is movable, said nut having a series of notches each adapted to be engaged by said pin for latching of the nut.

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