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[54] **PERCUSSION AND ROTARY DRILLING MACHINE**

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[58] **Field of Search** 173/13, 47, 48; 74/22

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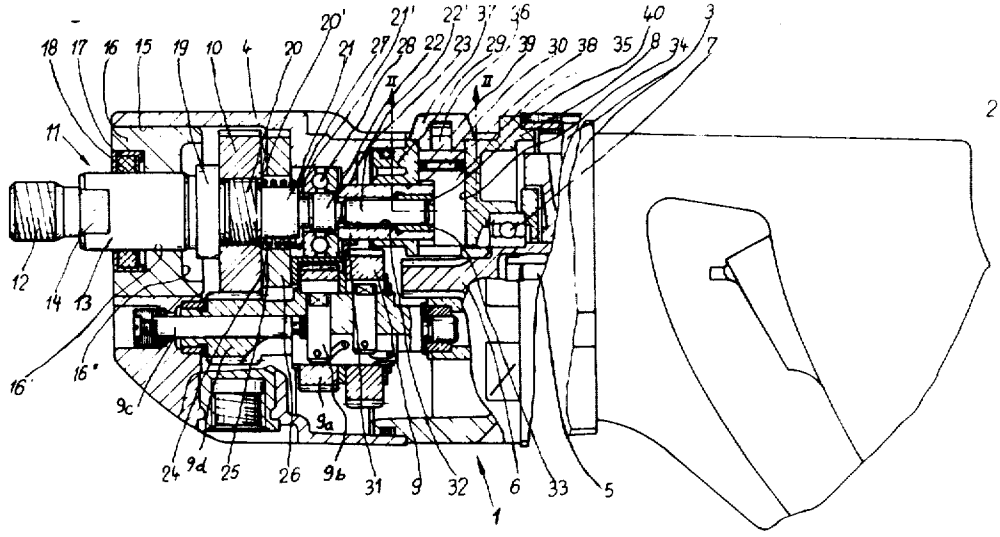
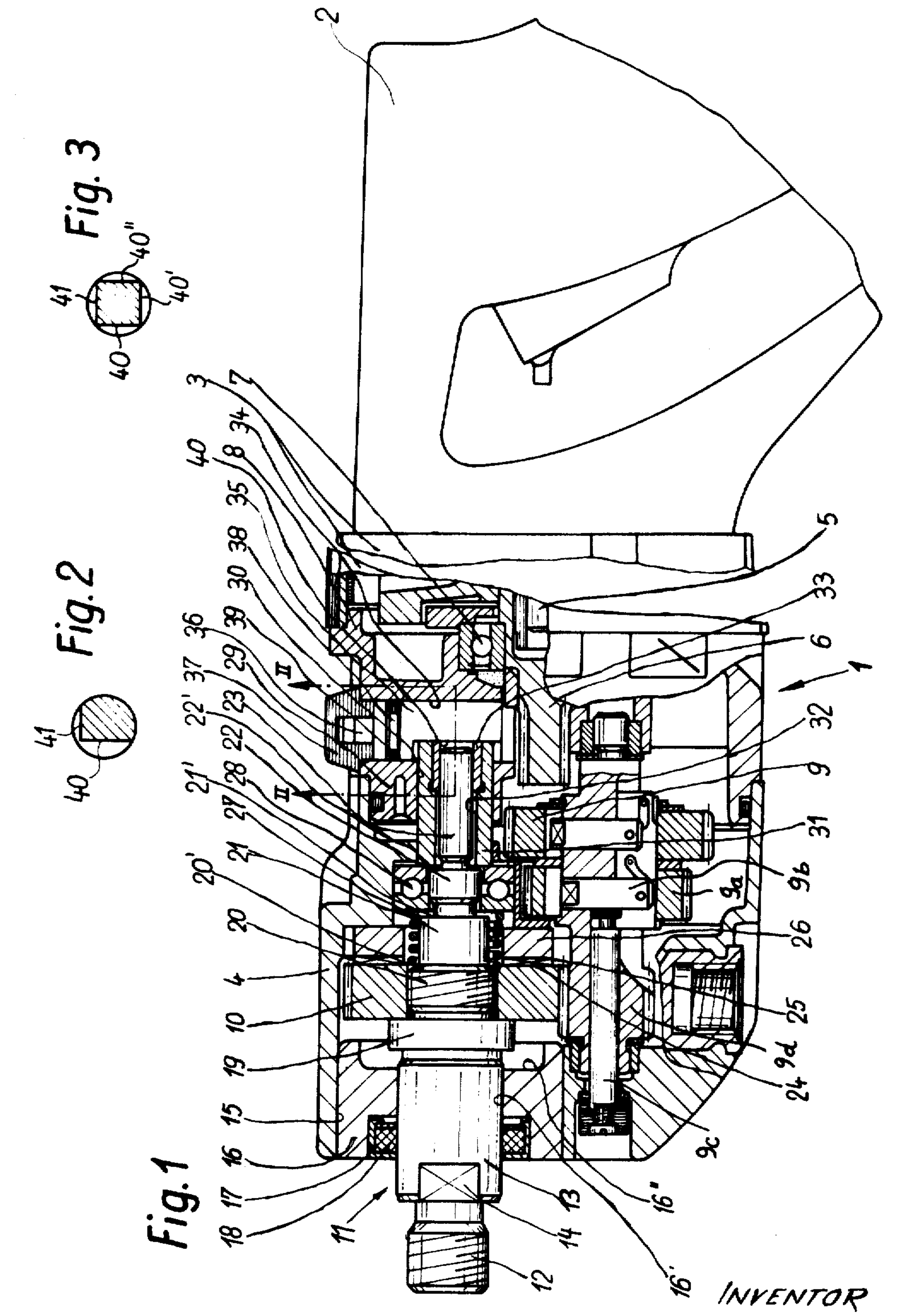
[57] **ABSTRACT**

A drilling machine has a tool holder shaft on which are mounted a spring and a blocking sleeve which abuts one or the other of two eccentric abutment faces of a manually turnable member. In a first position of the manually turnable member, the spring permits movement of the shaft due to pressure against the workpiece to a first axial position in which the shaft is axially reciprocated by suitable displacement means during rotation, and performs a percussion drilling operation. In a second position of the manually turnable member, the blocking sleeve engages the shaft directly, and blocks the same in a second axial position in which the shaft is not reciprocated but only rotated during drilling, irrespective of the pressure applied by the shaft to the workpiece.

11 Claims, 3 Drawing Figures





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PERCUSSION AND ROTARY DRILLING MACHINE

BACKGROUND OF THE INVENTION

The present invention is concerned with a portable percussion drilling machine which has a manually operated means for shifting the machine either to percussion drilling, or to rotary drilling.

In accordance with the prior art, the shaft is biassed by a spring in axial direction, the spring abutting a manually operated sleeve which has a cam track by which it is moved relative to the housing so that the displacement means for axially reciprocating the shaft can be rendered operative or inoperative by turning of the sleeve.

Drilling machines of this type according to the prior art have the disadvantage that the structural parts are complex and expensive to manufacture due to the required geometrical shape. Furthermore, the manually operated control means are sometimes displaced by the vibration produced by the percussion drilling operation. Also, the shifting of the machine between percussion drilling and rotary drilling takes a comparatively long time.

SUMMARY OF THE INVENTION

It is one object of the invention to overcome the disadvantages of percussion drilling machines according to the prior art, and to provide a drilling machine which is shiftable by very simple means between percussion drilling and rotary drilling.

Another object of the invention is to provide manual control means, which remain in the position to which they were set even when the machine is subjected to strong vibrations during percussion drilling operations.

With these objects in view, a manual control means is rotatably mounted in the housing of the machine, and has an abutment face eccentric to its axis. In the position "rotary drilling," the abutment face supports the tool holder spindler against movement in axial direction so that the tool holder shaft cannot assume the "percussion drilling position." A particularly safe arresting and blocking of the selected operational position, can be obtained by providing on the manual control means, two substantially planar faces which are angularly staggered at least 90°, and which have different distances from the axis. Preferably, the manual control means has a first abutment face in which the tool holder shaft can be placed in the percussion drilling position by pressure against the workpiece, while the second abutment face effects blocking of the tool holder shaft in a position in which it cannot be moved by pressure to the axial position in which it is axially reciprocated.

One embodiment of the invention comprises a housing; a tool holder shaft mounted on the housing for rotation about an axis, and for axial movement; first and second displacement means fixedly secured to the shaft and to the housing, respectively, and having an engaged position in which interacting projections and recesses reciprocate the shaft in axial direction during rotation for percussion drilling, and an axially spaced position in which the shaft only rotates for rotary drilling; actuating means including a blocking means movable along the shaft, and a spring; and manually operated means mounted on the housing for angular movement about the second axis and having abutment means eccentric to the second axis.

The actuating means abut the abutment means, which preferably includes two abutment faces of different eccentricity so that in a first position of the manually operable means the shaft is held by the spring in the first axial position in which the first displacement means is spaced from the second displacement means until the shaft is pressed against a workpiece, and the spring yields, whereby the first and second displacement means engage each other and the shaft is axially reciprocated.

In a second position of the manually operated means and abutment means, the blocking means directly engages the shaft and blocks the same and the first displacement means in a second axial direction in which the first and second displacement means remain spaced when pressed against the workpiece so that the shaft performs a rotary drilling operation.

The spring has ends abutting the shaft and the blocking means, respectively, and the blocking means abuts one or the other abutment face. The blocking means includes a bearing sleeve having one end abutting the abutment faces, and a thrust ball bearing mounted on the shaft for axial movement and abutting the other end of the bearing sleeve. The spring abuts the thrust ball bearing in axial direction.

A third abutment face may be provided which is engaged by the blocking means in a third position of the manually operated means, and is spaced from the axis of the manually operated means a distance intermediate the distances which the first and second spaces are spaced from the same. When the blocking means engages the third abutment face, the shaft is blocked against movement due to the pressure against a workpiece in an intermediate position in which the first and second displacement means are partly engaged so that the shaft is reciprocated in shorter percussion strokes than in the first position of the manually operated means. Evidently, a fourth and a fifth abutment face can be provided for selectively blocking the reciprocating shaft in different positions corresponding to strokes of different length during percussion drilling.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary side elevation, partially in longitudinal section;

FIG. 2 is a fragmentary cross-sectional view, illustrating a detail and being taken on line II—II in FIG. 1; and

FIG. 3 is a fragmentary cross-sectional view taken on line II—II in FIG. 1 and illustrating a modification.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The portable percussion drilling machine 1 has a handle 2 secured to a motor housing 3, and a machine housing 4. The motor, not illustrated, drives a motor shaft 5 with a pinion 6 which is mounted in a bearing 7 carried by a partitioning wall 8, by which the motor housing 3 is separated from the machine housing 4.

Motor pinion 6 drives through other gears, not shown, a pair of gears 9 and 9*a* which are rotatably mounted on a shaft 9*c* to which they can be selectively coupled by coupling pins 9*b*, each of which has an operative position projecting into inner teeth of the respective gear, as shown for gear 9, and an inoperative position, shown for gear 9*a*. In this manner, shaft 9*c* can be operated at two different speeds, so that gear 9*d* which is fixed on shaft 9*c*, can drive a gear 10 at different speeds for rotating the tool holder shaft 11 at different speeds. The manner in which the coupling means 9*d* are operated, is not an object of the present invention.

The front end of the tool holder shaft 11 has a threaded portion 12 on which a chuck, not illustrated, can be mounted for supporting a drill. Behind the threaded portion 12, the tool holder shaft 11 has a shaft portion 13 of greater diameter, having two flat faces which can be engaged by a wrench during opening and closing of the chuck, and for holding the shafts against rotation during screwing on and taking off the chuck. The machine housing 4 has an opening 15 at its front end into which a bearing block 16 is pressed. Tool holder shaft 11 is mounted in a bearing bore 16' of bearing block 16 by the cylindrical journal portion 13 in such a manner that shaft 11 can rotate and also move in axial direction. A sealing means 18 in the recess 17 of the bearing block 16 prevents the loss of lubricating oil along the tool holder shaft 11. Shaft 11 has a flange 19 which is followed by a threaded portion 20 of small diameter, rearwardly of which the cylindrical shaft portions 21, 22 and 23 of gradually reduced diameter are provided.

Gear 10 is screwed onto the threaded portion 20 of shaft 11, and abuts the flange 19. On its rear face, gear 10 has a ring of alternating projections and recesses 24, and a corresponding ring of recesses and projections 25 is provided on the front face of a disc or ring 26 which is fixedly secured to housing 4, by screws, not shown.

The threaded portion 20 of the tool holder shaft 11 is separated by a shoulder 20' from the cylindrical shaft portion 21. A coil spring 27 surrounds the cylindrical portion 21 and abuts at one end on shoulder 20'. The cylindrical portion 21 is separated from shaft portion 22 by the shoulder 21'. A thrust bearing 28 is mounted on shaft portion 22, slidable on the same in axial direction. The cylindrical end portions 23 of shaft 11 projects rearward toward partition wall 8. A projecting portion 29 of partition wall 8 has a bore 30 registering with shaft 11, in which a substantially cylindrical sleeve 31 is mounted for longitudinal movement in axial direction. The sleeve 31 has an inner bore 32 which has at its rear end for two-fifth of its length a greater diameter for receiving a bearing bushing 33. The shaft end portion 23 of shaft 11 is rotatable and slidable relative to the bearing bushing 33. Spring 27 abutting shaft 11 and gear 10 at one end, presses at the other end against the thrust bearing 28 urging the same against the front end of the sleeve 31 so that the rear end of the same abuts an abutment face 40 of a manually operated control member 37.

At a right angle to the axis of shaft 11, a bore 34 is provided in the projecting portion 29 of partition wall 8 in which the manually operated means 35 is mounted for turning movement about an axis transverse to the axis of shaft 11. The manually turnable means 35 has an upper portion 36 of small diameter which projects out of bore 34 and carries a knob 37 consisting of a synthetic material. Below the knob 37, an annular groove is provided in the shaft portion 35 in which a sealing ring 39 is located.

The manually turnable means 35 has at the height of sleeve 31, abutment means in the form of two abutment faces 40 and 41, see also FIG. 2, which in the direction of the axis of the manually turnable means 35, are somewhat wider than the sleeve 31, and define an angle of 90° with each other. The abutment face 40 is closer to the axis of the manually turnable means 35, while the abutment face 41 deviates from the circular shape a distance which is substantially a quarter of the radius.

In the inoperative position of the drilling machine, the sleeve 31 abuts abutment face 40, ball bearing 28 abuts sleeve 31 due to the action of spring 27, and shaft 11 is in a position in which the projections and recesses of the displacement means 24, 25 are spaced from each other. When the drive shaft rotates pinion 10, transmission shaft 9*c* is rotated through gears 9 or 9*a*, and gear 10 is driven by gear 9*d* together with tool holder shaft 11 so that the same idly rotates.

When the tool at the front end of tool holder shaft 11 is pressed against the workpiece, the axial pressure compresses spring 27, since the sleeve 31 abuts the abutment means 40. Shaft 11 is placed in a position in which the projections and recesses of the displacement means 24, 25 fully engage each other. Since disc 26 is fixed to the housing, the interacting projections and recesses of the displacement means 24, 25 cause axial reciprocation of shaft 12 so that a percussion drilling operation is carried out. Due to the pressure exerted by the operator on the handle 2, every time one of the projection of displacement means 24 moves over a projection of displacement means 25, the shaft 11 performs a rapid forward stroke, transmitted by flange 19 to shaft 11.

When the manually operated means 35 is turned 90° to a position in which the abutment face 41 is located opposite the end of the sleeve 31, the manually turnable means pushes the sleeve 31 and thrust bearing 28 forward until the thrust bearing 28 engages directly the shoulder 21' of shaft 11 and displaces the same forwardly to a position in which the projections and recesses of the displacement means 24 and 25 are axially spaced from each other. While the edge formed by the abutment faces 40 and 41 engages the sleeve 31, shaft 11 is displaced beyond its normal forward position to a position in which the front edge of flange 19 almost engages the inner surface 16'' of the bearing block 16. When the manually operated member 35 has been further turned, shaft 11 moves rearward due to the manual pressure until sleeve 31 abuts the second abutment face 41. In this position of shaft 11 and gear 10 with the projections and recesses 25, the latter are still axially spaced from the projections and recesses 26. Consequently, during continued rotation of the tool holder shaft 11, the same is not axially reciprocated and forms a rotary drilling operation. The distance between the front edge of flange 19, and the inner face 16'' of bearing block 16, is reduced to a small distance to a degree corresponding to the displacement caused by the edge between abutment faces 40 and 41 to a distance required for rotary drilling.

Due to the additional forward and rearward displacement caused by the edge between the planar abutment faces **40** and **41**, together with the action of spring **27**, the result is obtained that the shaft **11** is reliably arrested in the rotary drilling position as well as in the percussion drilling position, and cannot be shifted to the other condition by vibrations.

In the position shown in FIG. **1**, spring **27** is alternately compressed and expanded while urging the blocking means **28, 31** into engagement with abutment face **40**. In the position in which the other abutment face **41** is operative, blocking means **31** and **28** is displaced forwardly to a position in which the forward race of bearing **28** abuts the shoulder **21'** which is due to the fact that the abutment face **41** is spaced a greater radial distance than abutment face **40** from the axis of bore **34** about which the manually operated means **35** turns. In this manner, shaft **11** through shoulder **21'** is blocked by the blocking means **28, 31** in a position in which no manual pressure can move shaft **11** with the displacement means **24** to a position engaging the displacement means **25**.

When abutment faces **40'**, **40''**, shown in FIG. **3**, which are spaced from the axis of the manually operated member **35**, distances intermediate the distances which the abutment faces **40** and **41** are spaced, are provided, the shaft **11** is blocked in the manner described above, in an intermediate position in which the projections and recesses of displacement means **24, 25** only partly engage each other, whereby the length of the percussion strokes is reduced in accordance with the angular position of the manually turnable member **35** which can be effected by manual operation of knob **37**.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of percussion and rotary drilling machine differing from the types described above.

While the invention has been illustrated and described as embodied in a drilling machine which can be selectively set to percussion drilling and rotary drilling by turning of a manual control means having eccentric abutment faces, it is not intended to be limited to the details shown since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

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

What is claimed as new and desired to be protected by Letters patent is set forth in the appended claims.

I claim

1. Percussion and drilling machine comprising a housing; a tool holder shaft mounted in said housing for rotation about a first axis, and for limited axial movement; first and second displacement rings secured to said housing and said shaft, respectively, and having confronting faces, each face having alternate projecting and recessed portions, said first and second faces having an engaged position in which said shaft reciprocates in axial direction for percussion drilling, and an axially spaced position in which said shaft only rotates for rotary drilling; spring means engaging said shaft for urging said shaft and first displacement ring away from said second displacement ring to said axially spaced position; blocking sleeve means mounted on the rear end of said shaft for axial movement; and manually operated means mounted on said housing for angular movement about a second axis perpendicular to, and intersecting said first axis rearward of said rear end, said manually operated means having at least first and second abutment faces spaced different radial distances from said second axis and cooperating with said blocking sleeve means so that when said first abutment face cooperates with said blocking sleeve means in a first angular position of said manually operated means, and the front end of said shaft is pressed against a workpiece, said spring means yields and said first displacement ring is pressed against said second displacement ring and said faces engage each other, whereby said shaft is axially reciprocated, and so that in said second angular position of said manually operated means said second abutment face blocks said blocking sleeve means whereby, when said front end of said shaft is pressed against the workpiece, said shaft is blocked by said blocking sleeve means and said second abutment face in an axial position in which said displacement rings remain in said axially spaced position so that said shaft performs a rotary drilling operation.

2. Drilling machine as claimed in claim **1**, wherein said manually operated means include a third abutment face angularly spaced from said first and second abutment faces, and cooperating with said blocking sleeve means in a third angular position of said manually operated means; wherein said third abutment face is spaced from said second axis a radial distance greater than said first abutment face and smaller than said second abutment face so that in said third angular position of said manually operated means, when said front end of said shaft is pressed against said workpiece, said shaft is blocked by said blocking sleeve means and said third abutment face in an intermediate position in which said projecting and recessed portions of said faces of said displacement rings partly engage each other so that said shaft is reciprocated in a shorter percussion stroke than in said first angular position of said manually operated means.

3. Percussion and rotary drilling machine comprising a housing; a tool holder shaft mounted in said housing for rotation about first axis, and for axial movement; first and second displacement means fixedly secured to said shaft and said housing, respectively, and having an engaged position in which said shaft reciprocates during rotation for percussion drilling, and an axially spaced position in which said shaft only rotates for rotary drilling; actuating means including a blocking means movable along said shaft, and a spring having ends abutting said shaft and said blocking means, respectively; and manually operated means mounted on said housing for angular movement about a second axis and having abutment means eccentric to said second axis, said blocking means abutting said abutment means so that in a first position of said manually

operated means, said shaft is held by said spring in a first axial position in which said first displacement means is spaced from said second displacement means until said shaft is pressed against a workpiece and said spring yields whereby said first and second displacement means engage each other and said shaft is axially reciprocated, and so that in a second position of said manually operated means and abutment means, said blocking means engages said shaft and blocks said shaft and said first displacement means in a second axial position in which said first and second displacement means remain spaced when pressed against a workpiece so that said shaft performs a rotary drilling operation.

4. Drilling machine as claimed in claim 1 wherein said abutment means includes two abutment faces angularly spaced at least 90° about said second axis and having different distances from said second axis.

5. Drilling machine as claimed in claim 4 wherein said second axis intersects said axis of said shaft; wherein said blocking means abuts one of said abutment faces in said first position of said manually operated means due to the action of said spring; and wherein said shaft has an abutment engaged by said blocking means when the same engages the other abutment face.

6. Drilling machine as claimed in claim 4 wherein said blocking means includes a bearing sleeve having one end abutting said abutment means, and a thrust ball bearing mounted on said shaft for axial movement and abutting the other end of said bearing sleeve, and wherein said spring abuts said thrust ball bearing.

7. Drilling machine as claimed in claim 6 wherein said shaft has a small shaft portion surrounded by said thrust ball bearing, and an adjacent larger portion surrounded by said spring and forming an annular shoulder with said small shaft portion against which said ball bearing abuts in said second position of said manually operated means.

8. Drilling machine as claimed in claim 3 wherein said abutment means include a first abutment face engaged by said blocking means by the action of said spring in said first position of said manually operated means, and a second abutment face spaced a greater distance from said second axis than said first abutment face and engaged by said blocking means in said second position of said manually operated means.

9. Drilling machine as claimed in claim 8 wherein said abutment means includes a third abutment face engaged by said blocking means in a third position of said manually operated means and being spaced from said second axis a distance intermediate the distances which said first and second faces are spaced from said second axis so that said blocking means blocks movement of said shaft due to pressure against a workpiece in an intermediate position in which said first and second displacement means are partly engaged so that said shaft is reciprocated in shorter percussion strokes than in said first position of said manually operated means.

10. Drilling machine as claimed in claim 9 wherein said first and second displacement means are first and second discs respectively secured to said shaft and said housing and having confronting faces, each of which has alternating axially projecting and recessed portions so that in a fully engaged position, said projecting portions said first disc completely enter the recessed portions of said second disc due to said spring, while in the partly engaged position, said projecting portions only partly enter said recesses due to said blocking means abutting said third abutment face and said shaft.

11. Drilling machine as claimed in claim 10 wherein said first disc is fixedly secured to said shaft and forms a shoulder with the same; and wherein said spring abuts said shoulder.

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