F. NOSSAGK.

MULTIPLE DRILL, &c.

APPLICATION FILED JAN. 19, 1914.

1,264,429.

Patented Apr. 30, 1918.

5 SHEETS—SHEET 1.

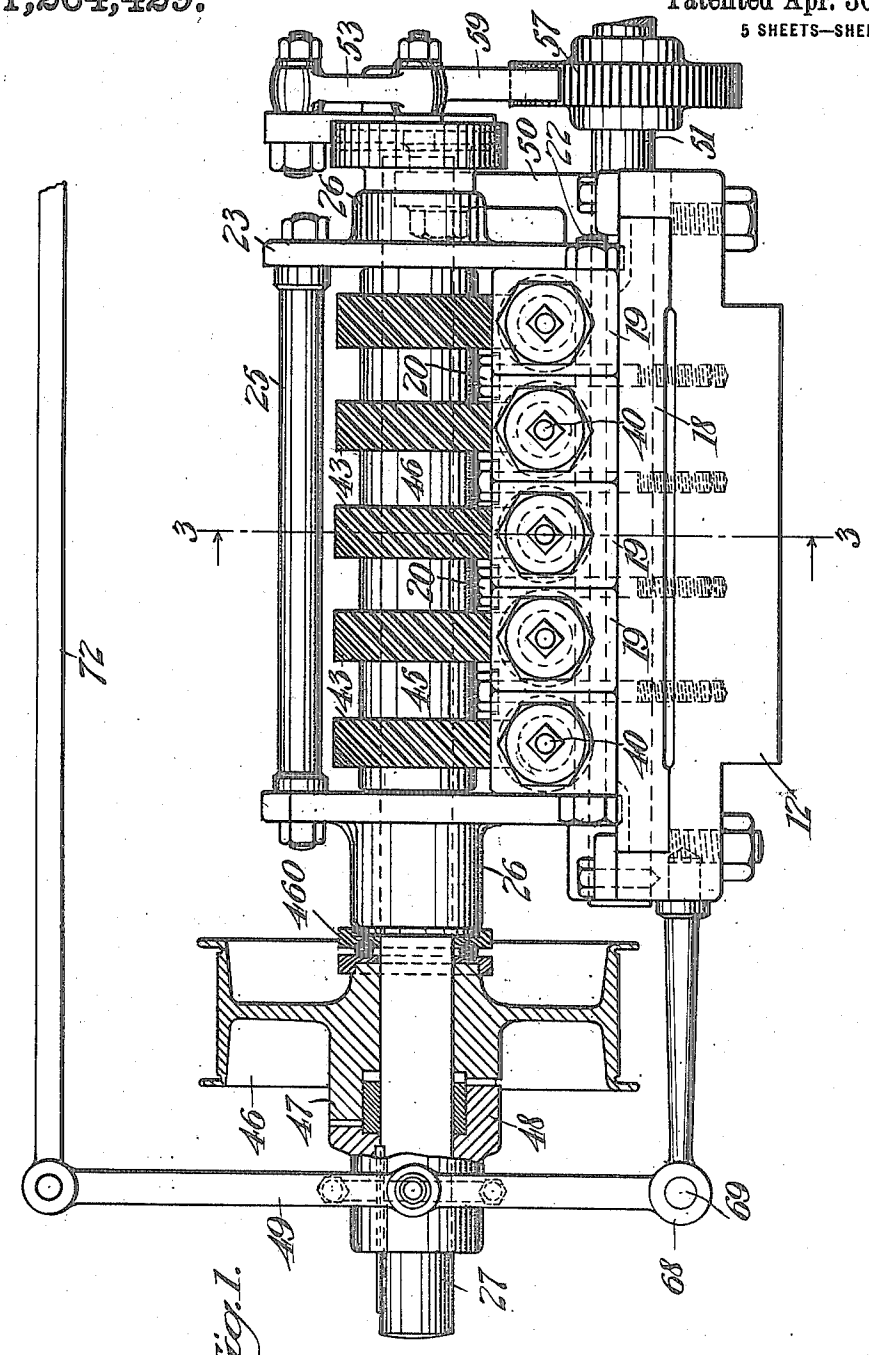


Fig. 1.

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5 SHEETS—SHEET 2.

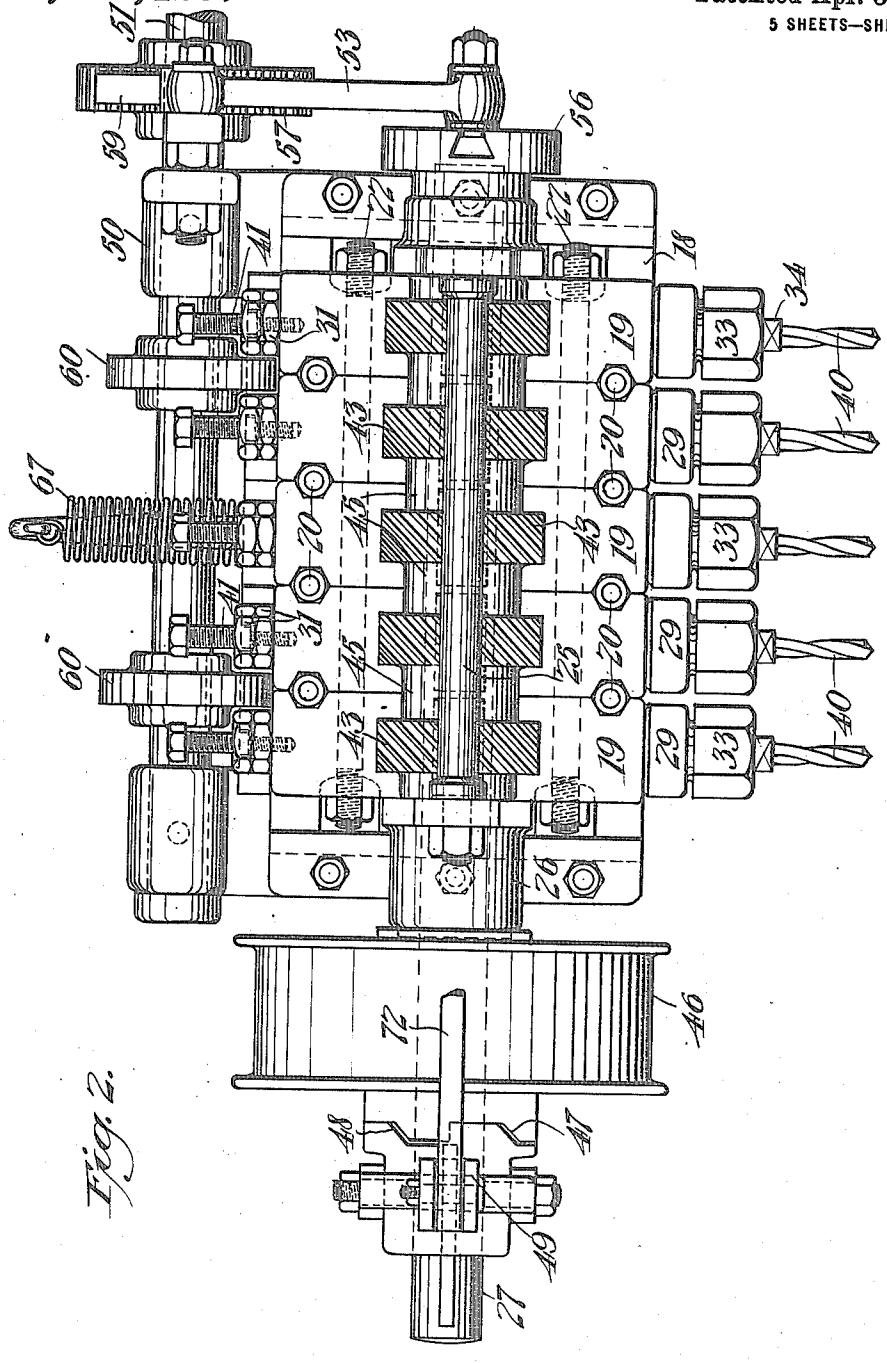


Fig. 2.

Witnesses:
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5 SHEETS—SHEET 3.

Fig. 3.

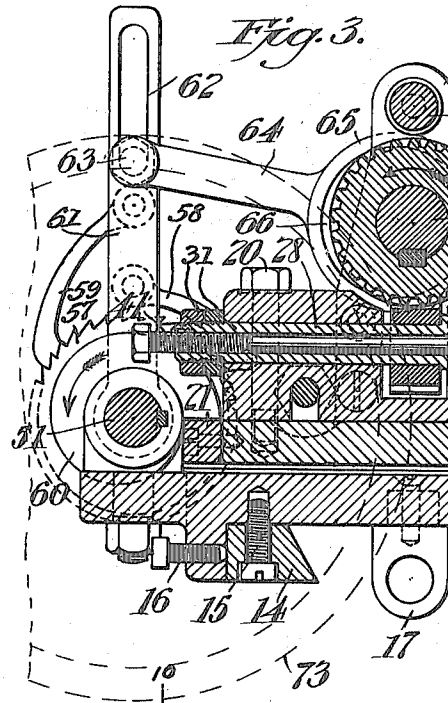


Fig. 5.

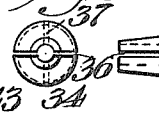


Fig. 4.

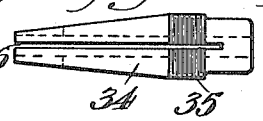


Fig. 6.



Fig. 8.

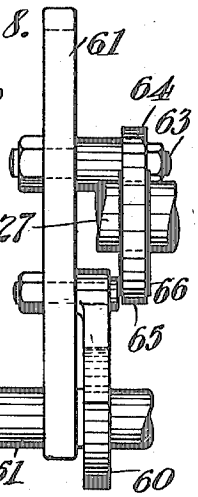
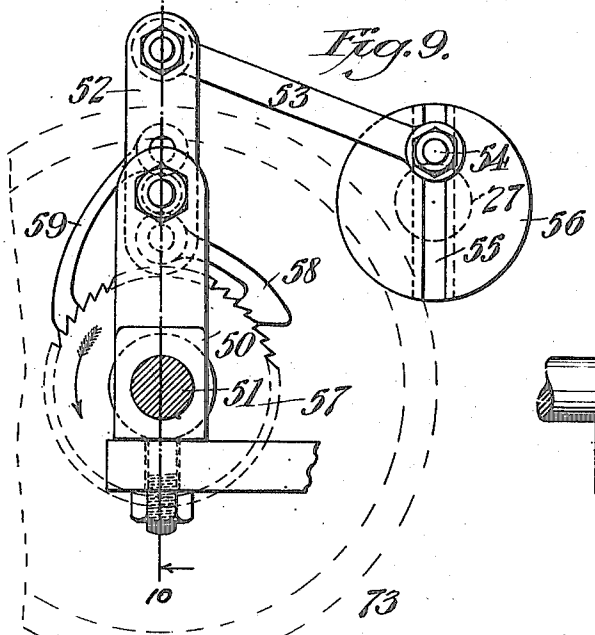


Fig. 7.

Fig. 9.



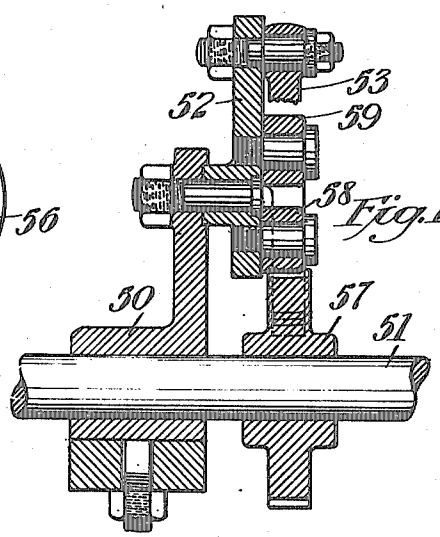


Fig. 10.

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5 SHEETS—SHEET 4.

Fig. 11.



Fig. 12.

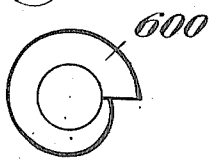
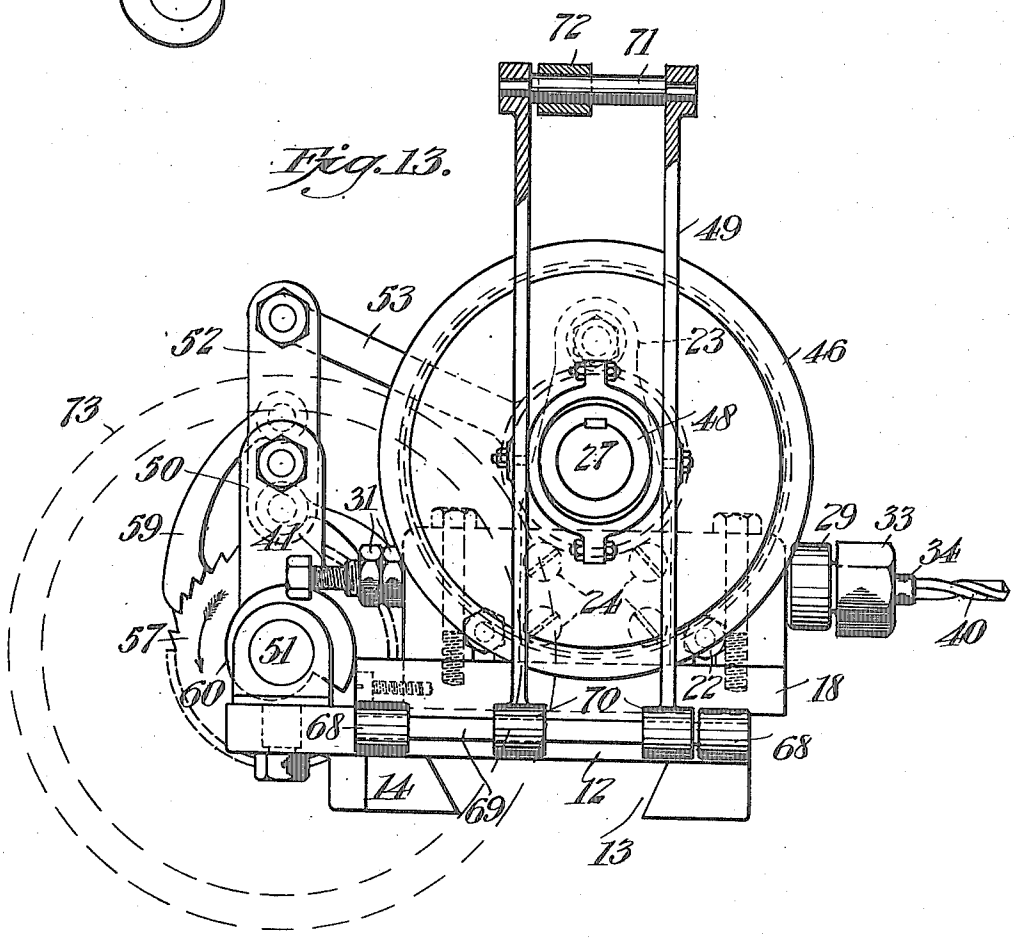


Fig. 13.



Witnesses:

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MULTIPLE DRILL, &c.

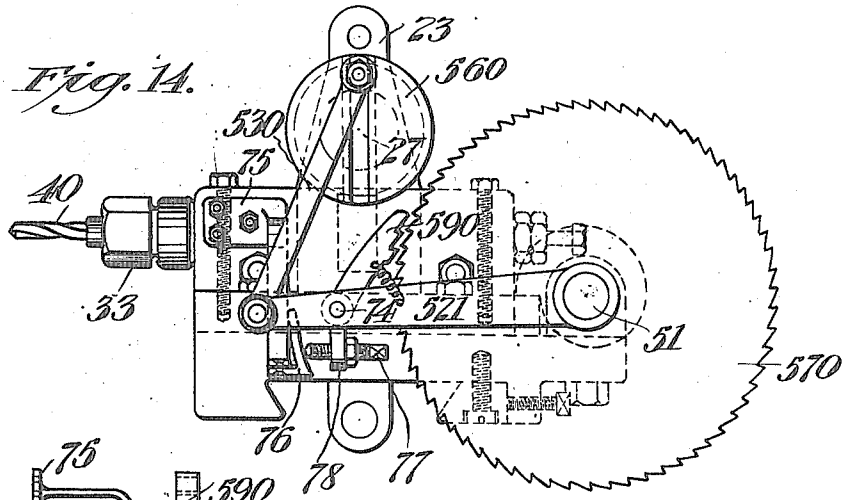
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1,264,429.

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Fig. 14.



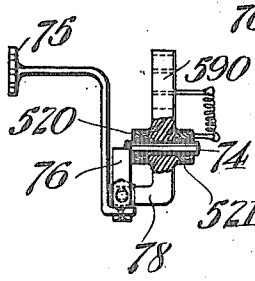
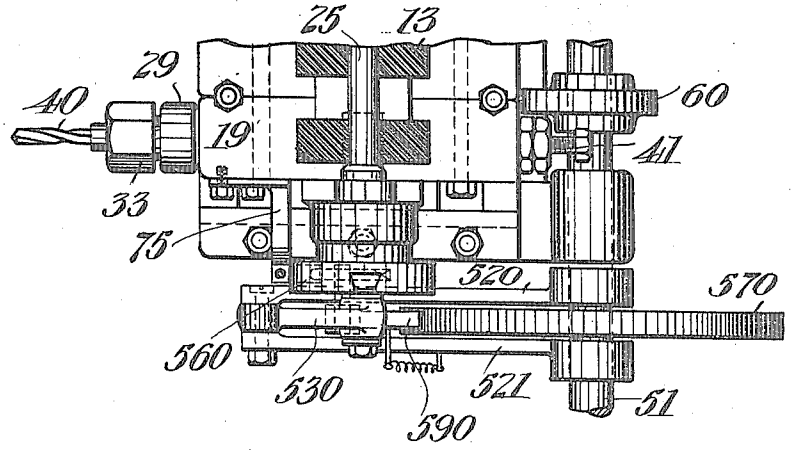


Fig. 15.

Fig. 16.



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UNITED STATES PATENT OFFICE.

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MULTIPLE DRILL, &c.

1,264,429. Specification of Letters Patent. Patented Apr. 30, 1918.

Application filed January 19, 1914. Serial No. 813,094.

To all whom it may concern:

Be it known that I, FRIEDRICH NOSSACK, a subject of the Emperor of Germany, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Multiple Drills, &c.; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an apparatus for drilling, boring, milling or otherwise cutting or working metal or other substances, and especially to a form of multiple drill.

Its object is to provide a machine in which a series of drills or other tools shall be automatically fed forward to the desired distance, in which the gears for the several tools shall operate in unison and shall take up the end-thrust of the operation of the tools, in which the series of tools may be readily separated or assembled, in which the finest adjustment may be given the tools by a chuck-regulating device which permits a closer proximation of the several tools, and in which any practical number of tools may be utilized in unison and equally and automatically adjusted and operated.

For convenience I have illustrated an apparatus carrying a series of drills especially adapted for metal working.

In the drawings, Figure 1, is a front elevation looking at the drill points and showing the main driven pulley and a part of the coupling in section:

Fig. 2 is a plan view:

Fig. 3 is a section on line 3—3 of Fig. 1:

Fig. 4 is a detail view of a conical split nut used in the chuck:

Figs. 5 and 6 are detail views looking in at the adjacent end of Fig. 4:

Fig. 7 is a detail view of the locking nut of the chuck device enlarged to bring out more clearly the differential character of the threads:

Fig. 8 is a detail side elevation of the form of operating devices for the feed mechanism shown in Fig. 3.

Fig. 9 is a detail side view of the drill feed shown in place in Figs. 1, 2, and 13:

Fig. 10 is a section on line 10—10 of Fig. 9:

Fig. 11 is a lay-out and Fig. 12 a side view of a modified cam which may be used in the drill-feed, and indicating how the face of the cam may be varied with the work to be done.

Fig. 13 is an end elevation of Fig. 1 from the right:

Figs. 14 and 16 are respectively, an end and a plan view and Fig. 15 is a detail representing a modified construction of feeding mechanism and an automatic disconnecting device to throw the feed-mechanism out of operation on the return movement.

In the drawings 12 represents a table, with a groove 13 having in one side a separable piece 14 held in place by a screw 15 and adjustable by a screw 16, so that any degree of adjustment may be given the groove to enable it to receive a corresponding dove-tail joint in a supporting bed or bench.

At 17 is shown a depending ear, a familiar shaft or guide-rod bearing, which may be used in adjusting the drill apparatus as a whole.

18 represents a sliding base adapted to reciprocate on the table 12 and carry spindle-bearing blocks 19 secured to the slide-base 18 by bolts 20.

The front of the slide-base 18 bears a wear-plate 21 to receive and transmit force from a series of cams to be described hereinafter.

Passing through the bearing blocks 19, as illustrated especially in Fig. 3, are series of bolts 22, which bind together the several blocks into a compact body.

An upright 23 is secured by screws 24 to each of the end bearing-blocks 19, and the two upright end pieces are bound together by a rod 25. Each end piece carries also a sleeve 26 and the frame thus formed is borne by the slide-base 18 and provides a bearing for the main operating shaft 27.

28 represents a series of hollow spindles, one for each drill and each adapted to turn in a spindle-bearing 19. Each of the hollow spindles has an enlarged bearing-head 29 with a tapered thrust-bearing at 30 and at the opposite end two lock-nuts 31 which hold the spindle in the proper position and prevent it from running loosely at any time. At the fore-end of the spindles there is a threaded portion 32 with which engages a chuck locking-nut 33. Each spindle is supplied with a conical split-nut or chuck 34 exteriorly threaded at 35, that is, at the

outer end. The conical nut is split on two sides as indicated in detail, Figs. 4, 5 and 6. The split 36 extends from the tapered end nearly all the way through the length of the conical nut. The split 37 extends from the base of the conical nut nearly through its length. There is thus left some metal at the sides. By this construction the nut is all in one piece and yet provides four grips on the helical drill it is to hold, that is, four sides of the conical nut grip the drill so that it may be firmly held.

The chuck locking-nut 33 has two threaded portions 38 and 39. The thread 38 is much the coarser.

The finer thread 39 engages the thread 35 on the conical split-nut while the coarser thread 38 engages the corresponding thread on the end 32 of the drill-spindle. This construction enables me to secure a differential effect due to the difference between these threads. When the nut is turned the coarser thread 38 will travel more rapidly than the finer thread 39. The effect will be not only to feed the nut forward but also to draw in upon the conical nut and force its jaws to grip the drill 40 and lock the chuck upon the drill.

In the illustration I have shown five of the drills 40. It will be observed that these are within a close space, as illustrated especially for example in Fig. 2. This arrangement of locking the nut for the chuck enables me to bring the locking-nuts into juxtaposition so that I secure the advantages of the separable construction of bearing-blocks and arrangement of the hollow spindles and also forming all the drills into a compact space.

The drills might, of course, extend throughout the hollow spindle but in the illustration I have shown as a preferred form a series of short drills each placed in one end of the hollow spindles, a screw-rod or head 41 with a filling-rod 42 between the drill and the adjustable screw-head. I am thus enabled to entirely use any drill for it may be readily fed out and again gripped as it is worn down.

This arrangement of the drills also permits me to drill readily articles or parts of articles not in the same plane, for I may adjust the drills to different distances and have them project more or less. I can do this readily because of the ease and rapidity with which the drills may be taken out and readjusted.

The power-shaft 27 extends across the machine and bears a series of left-hand helical gear wheels 43 which mesh with a series of left-hand pinions 44 each of which is secured to a spindle 28.

The gear wheels 43 are separated from each other by collars or sleeves 45 shown as integral therewith and are driven in unison by the shaft 27 which receives its power from a driven pulley 46. The pulley 46 bears at one side a clutch member 47 with which engages a clutch member 48 keyed to the power-shaft 27. At 460 I have shown a thrust-bearing especially useful in a device of this sort with the gears operating as described. The clutch member 48 is operated by means of a yoke 49 in an obvious manner, but with a construction especially adapted for this apparatus and to be hereinafter described.

The parts heretofore described constitute separable drills and drill-spindles and the operating devices therefor. It may be observed before passing to the next stage of the description of the feeding mechanism and adjustable arrangements therefor, that the left-hand gears provide for taking up the end-thrust of the drills 40 when they are at work because the direction of the force is such as to counteract the inward thrust of the drills at work, thus preventing too great a friction at the bearing point 30, and enables the spindles to run rapidly without deterioration. I take up any surplus thrust by means of the thrust-bearing 460.

It is proposed to reciprocate, or to advance, the slide 18 so that the drills shall be fed forward to their work, and at the same time at the end of the work to simultaneously retract all of the drills. It is proposed, also, to regulate the depth to which the drills shall operate and the degree of forward movement which shall be imparted by the regulating mechanism for each advance.

50 represents a bracket carried by a shaft 51 which may be journaled in any obvious manner.

52 represents a vertical arm pivoted, in this instance by stub-shaft, to the bracket 50.

53 represents a connecting arm pivoted to the top of the arm 52 and carrying a pin 54 at the opposite end which may be fixed at any given point in a slot 55 formed in a disk 56 secured upon the power-shaft 27. The effect of the rotation of the disk 56 with the power-shaft 27 is that of an eccentric, or is to impart a link motion to the arm 53 to oscillate the arm 52.

57 represents a ratchet wheel secured upon the shaft 51 and operated from the arm 52 by means of two pawls 58, 59. The result of the oscillation of the arm 52 will be, through the pawls 58, 59, to turn the ratchet wheel 57 in the direction indicated by the arrow and to rotate the shaft 51.

Removably secured upon the shaft 51 are a series of cams 60, shown in this instance as two, though obviously a greater or less number might be employed. The purpose of these cams is to reciprocate the slide-base 18 and the parts it carries by having the face of the cam turn against the wearing-head 21 of the slide. The extent to which the slide-base shall be advanced by

the cam is determined by the size of the cam, there being different sizes for different depths and it being intended that the apparatus shall be adjusted to different depths by the size of the cam secured upon the shaft 51, and that the extent of each feeding movement shall be governed by the position of the pin 54 in the slide 55.

The relation of the cam to the slide is shown for example in Fig. 3, and in that figure I have shown a modified construction for operating the cams. In that figure, the arm 61 corresponds with arm 52 and is slotted at 62. There may be adjusted at any point in this slot the pin 63 operated by the connecting arm 64 having at the end an eccentric strap 65 which takes over an eccentric block 66 on the shaft 27, shown in Figs. 3 and 8.

It will be obvious that by this arrangement, as by the feed device previously described, the rotation of the shaft 27 will impart an oscillating action to the arm 61 so as to rotate the shaft 51 and thus advance in the direction of the arrow the cam 60, to force forward the slide 18 and the drills which it bears. The slide-base 18 is spring-drawn as indicated at 67, so that when the highest dwell of the cam 51 passes the wearing-head 21, the slide-base 18 carrying its parts is snapped back against the reduced portion of the cam as illustrated in Fig. 3.

In Figs. 11 and 12 I have laid out and shown a modified cam 600 by which the feed of the slide may be, for example, rapid at first and then gradual or may vary to have the feed accord with different work, as where plates of different material are drilled at the same time. It will be observed that the slide-base 18 and the operating gears and parts advance under the operation of the cams 600, but that the cams and their shaft 51, journaled in the bed or table, do not advance. The connecting arms and levers which, from the shaft 27 operate the shaft 51, therefore operate as the drills feed, from different angles, because, for example, the lever 53 moves over with the shaft 27, and the top of the arm 52 also moves over while its bottom remains on the same plane. The pawl and ratchet mechanism rotates the shaft in the same manner at whatever angle the operating arms may be, and the action is the same at any stage of feeding.

In Fig. 13, I illustrate the provision by which the clutch operating-yoke may travel with the operating-shaft. At 68 are shown two bearing-sleeves in which is journaled a rod 69. The yoke 49 has at the bottom two sleeves 70 which travel on the rod 69. At the top the yoke is separated by a rod and sleeve 71 which travels upon an operating arm or handle 72 which may be secured at any place desired and which is shown also in Fig. 1. By this construction the clutch operating-yoke travels with the operating mechanism and yet is ready to be in operation at any stage.

In the operation the metal article to be drilled is secured in place opposite the drills 40 or the drilling apparatus itself is adjusted upon a bench or table to bring it into proper position. When the shifting-lever 72 is drawn over to the right, clutch-member 47 engages clutch-member 48. The shaft 27 rotates turning the gears 43 which in turn rotate the pinions 44 and the attached spindles 28 in which are held the drills 40. As the shaft 27 rotates it carries around the disk 56 reciprocating the connecting arm 53 and thereby oscillating the arm 52.

The action of the arm 52 through the pawls 58, 59, rotates the ratchet wheel 57 which turns with it the shaft 51. It will be understood, as described, that the position of the arm 53 may be so adjusted with relation to the pin 54 as to regulate the extent of the movement and the consequent extent of the action of the arm 53 and of the rotation of the ratchet wheel and the shaft 51, so that the degree of advance may be varied in accordance with the character of the material being drilled. The same results, as described, are secured by the action of the modification having the parts 61—66. The shaft 51 rotating carries in the direction of the arrow, the cams 60. As the circumference of these cams presses against the wearing-plate end 21 of the slide-base 18, that slide, the bearing-blocks 19, the inclosed spindles 28 and their drills, the frame 23 and the gear wheels 43, 44 and shaft 27 all travel forward, that is, for example in Fig. 3, to the right, until the rotation of the cams 60 has brought the cams around past the wearing-head 21 into the position illustrated in Fig. 3, whereupon the spring 27 draws back the slide-base 18 and connecting parts into the initial position illustrated, ready for another operation.

The adjustments of the table, and of the nuts which hold the drills in place and regulate their position, have been described hereinbefore, and the manner in which the cams may be removed and different sizes used in accordance to the depth of the drills desired has also been set forth.

I find in the actual operation of this drill apparatus that it is readily assembled or taken apart, that the drills are held in a compact space and easily reached and adjusted, and that the cams on the open side of the machine are readily changed as is also the adjusting device which operates the cams. I find too, that the drills may be given a degree of adjustment precisely adapted to any grade of work thus rendering them especially efficient in such work,

for example, as drilling holes in numerous parts to be used in articles of manufacture or machines.

In the apparatus I have described, when the slide-base 18 and the tools it carries are retracted by the action of the spring 67 the operation of the machine may be stopped through the rod 72 and the connected clutch-operating parts.

As my apparatus is required frequently to work with great rapidity I have provided a device which may be employed to automatically disconnect the drills so that while the power is continuously applied the feeding mechanism is disengaged until it is desired by the operator to have the tools begin another operation. The device for thus disconnecting the feeding mechanism is illustrated in Figs. 14, 15 and 16.

It should be premised that I have provided a hand wheel 73, shown in dotted lines in Figs. 3, 9 and 13, by which the feeding mechanism may be operated if desired and which is especially employed when the disconnecting device about to be described, is used. It should also be premised that the feeding mechanism may be operated by a single pawl if desired and I have so illustrated the operation of a single pawl in Figs. 14 and 16. In those figures the ratchet wheel 57 is replaced by a ratchet wheel, preferably of a larger size, 570 which is secured upon the shaft 51 and is operated by a spring-pressed pawl 590 through the medium of an eccentric 560, a connecting arm 530 and operating arms 520, 521 bearing upon the shaft 51 and to which the pawl 590 is pivoted, as indicated at 74. When the eccentric is operated by the shaft 27 the result will be to reciprocate the pawl 590 and advance step-by-step the ratchet wheel 570, thus rotating the shaft 51 which carries the cams 60 or 600 to advance the slide-base 18 and the tools it carries. It is proposed when the slide-base and its connected parts are retracted by the spring 67 to throw the pawl 590 out of engagement with the ratchet wheel 570. This is done by the device now to be described.

To the end spindle block 19 is secured a bracket 75 whose lower bent arm carries a curved shoe 76 against which strikes a set-screw 77 which passes through an inwardly curved lower extension arm 78 of the pawl 590. The set screw may be arranged so that at the appropriate instant when the slide-base and its parts including the feeding mechanism are retracted the set-screw 77 will strike against the shoe 76 and throw the pawl 590 out of engagement with the ratchet wheel. When the tools are ready to begin another operation the hand-wheel 73 is turned slightly, advancing the mechanism and thus releasing the pawl so that it may engage and operate the ratchet wheel 570 and rotate the slide-base and the tools it carries.

I have illustrated and described this modification as employing a single pawl so that I might at the same time include a showing of an apparatus employing a single pawl. It is obvious that the idea of means and operation is applicable to a device having the pawls and ratchet of Figs. 3, 9 and 10.

I again refer to the statement of invention in the opening of this specification and especially to the statement of the broad application of my idea, covering the employment of various tools of which the drills specifically illustrated and described are merely an example.

I claim,—

1. In a drilling or similar apparatus, the combination of a table, a slide carried by the table, a series of tools carried by the slide, means for operating the tools, a cam engaging the slide and means for rotating the cam to govern the feed of the tools.

2. In a drilling or similar apparatus, the combination of a table, a reciprocating slide carried by the table, a series of tools carried by the slide, means for operating the tools and means for operating the slide, comprising a shaft adapted to carry any one of a series of cams proportioned to the depth of the drilling in any given operation.

3. In a drilling or similar apparatus, the combination of a slide, tools carried by the slide, a removable cam for reciprocating the slide, and regulable means for operating the cam, so that the cam may be operated to vary its speed of rotation.

4. In a drilling or similar apparatus, the combination of a series of tools, a slide carrying the tools, an operating shaft, tool-operating gears on the shaft, cams for reciprocating the slide, a cam shaft for carrying the cams and an adjustable mechanism connecting the operating shaft to the cam shaft.

5. In a drilling or similar apparatus, a bed or table, a slide, tools and their operating gears carried by the slide, a shaft bearing cams for advancing the slide and journaled in the bed or table, and means for intermittently rotating the shaft.

6. The combination of a series of bearing blocks bound together to form a slide, a series of tools each borne by a block of the slide, a frame embracing and secured to the bearing-blocks, a tool shaft journaled in the frame, and tool operating gears.

7. In a drilling or similar apparatus, the combination of a series of tool-spindles lying side by side each spindle bearing a chuck, separable blocks each bearing a spindle and a nut at the end of each spindle for locking the chuck, the spindles lying close to each other and the whole being arranged within a small space.

8. In a drilling or similar apparatus, a hollow tool-spindle, in combination with a split-nut in one end of the spindle, and a nut with differential threads respectively engaging the spindle and the split-nut to lock the split-nut in place.

9. In a drilling or similar apparatus, the combination with a hollow tool-spindle threaded at the operating end, a conical split-nut entering the spindle and exteriorly threaded at the other end, and a nut having differential threads, the finer threads engaging the conical nut, the coarser threads engaging the spindle to adjust and lock in place the conical nut.

10. In a drilling or similar apparatus, a hollow tool-spindle, a conical split-nut entering one end of the spindle and split on opposite sides from each end nearly to the other end to form four grasping jaws, the spindle and the conical nut being exteriorly threaded, and a nut to engage the threads.

11. The combination of a series of bearing-blocks bound together to form a slide, a series of tools borne by the slide and projecting from the slide, and a series of split-nuts and a series of locking-nuts which alone serve to contract the jaws of the split-nuts and lock the split-nuts upon the tools.

12. In a drilling or similar apparatus, the combination with a series of tools, a slide bearing the tools, an operating shaft connected to the slide, a clutch member traveling with the shaft and clutch-operating means comprising a pair of arms embracing the clutch, sleeves at the base of the arms, and a guide rod upon which the sleeves slide.

13. In a drilling or similar apparatus, the combination of a series of tools, a series of tool-spindles and a series of helical gears for operating the tool-spindles so that the end thrust is taken up by the direction of the operating force.

14. In a drilling or similar apparatus, the combination with means for carrying tools and means for operating the tools, of a feed-mechanism comprising a series of cams, a shaft for operating the cams, a ratchet and pawl mechanism for intermittently turning the shaft and devices connected with the operating means for throwing the pawl out of engagement.

15. In a drilling or similar apparatus, the combination with a slide, tools carried by the slide, a series of cams for forcing the slide forward, means for retracting the slide at the end of the operation, means for effecting the feeding of the tools carried by the slide, and a stop against which the feeding-mechanism abuts to disconnect the feeding-mechanism.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

FRIEDRICH NOSSAGK.

Witnesses:
E. J. JOCHEN,
ALBERT LANDBECK.