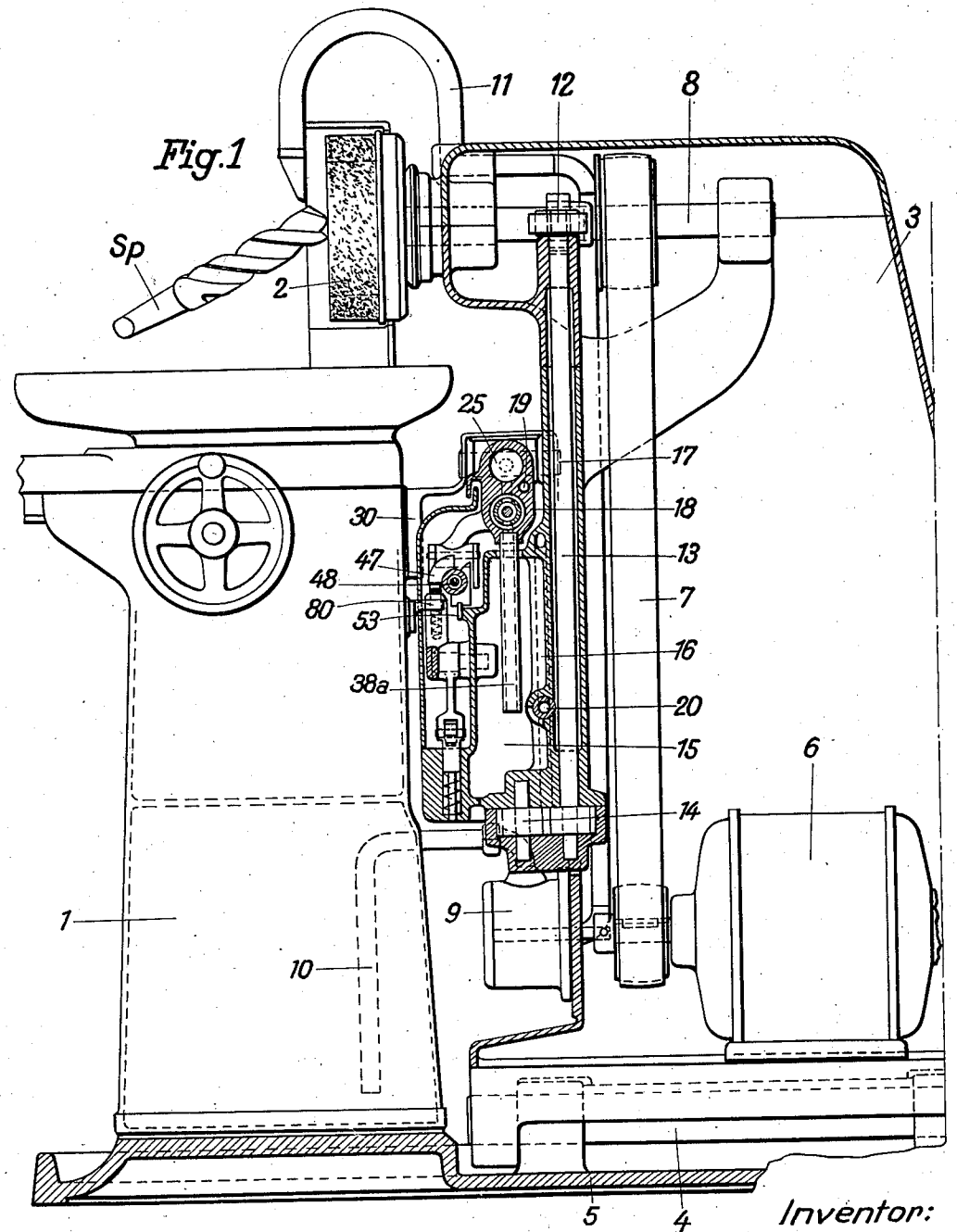
May 10, 1932. V. JERECZEK 1,857,549

GRINDING MACHINE

Filed Feb. 27, 1930 3 Sheets-Sheet 1

Fig.1



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GRINDING MACHINE

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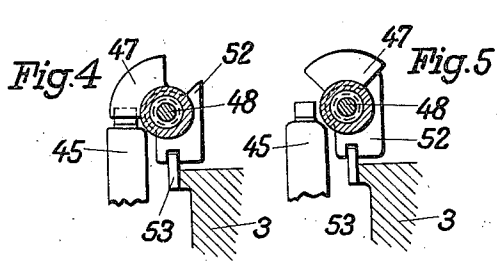

Fig.4

Fig.5

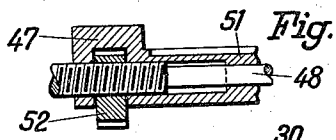

Fig.6

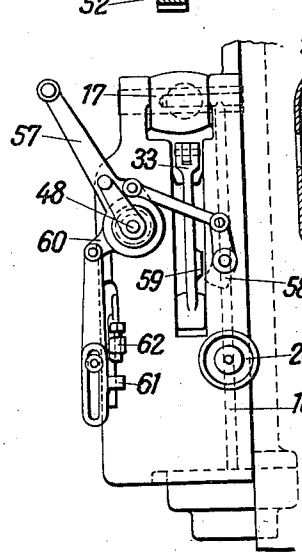

Fig.3

Fig.2

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GRINDING MACHINE

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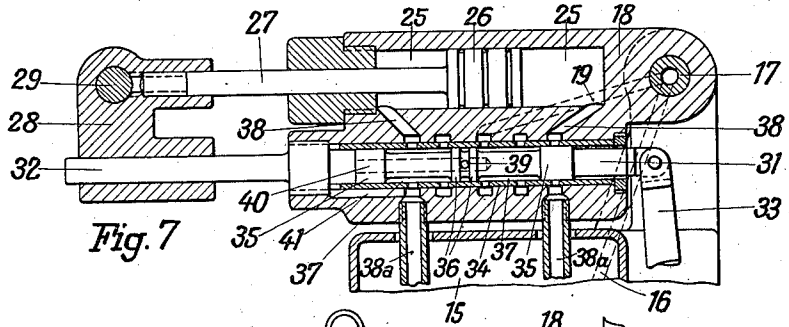


Fig. 7

Fig. 8

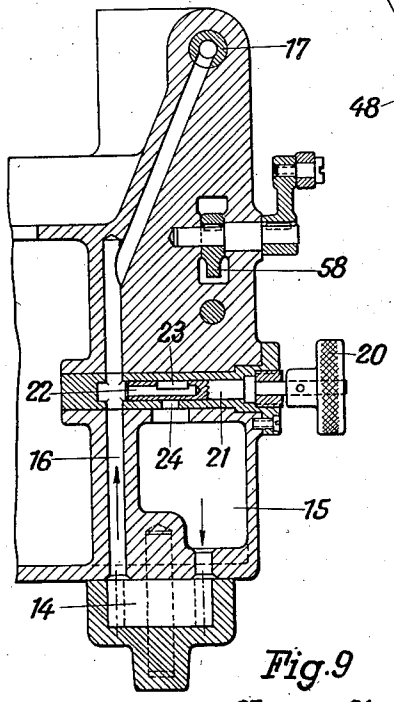


Fig. 10

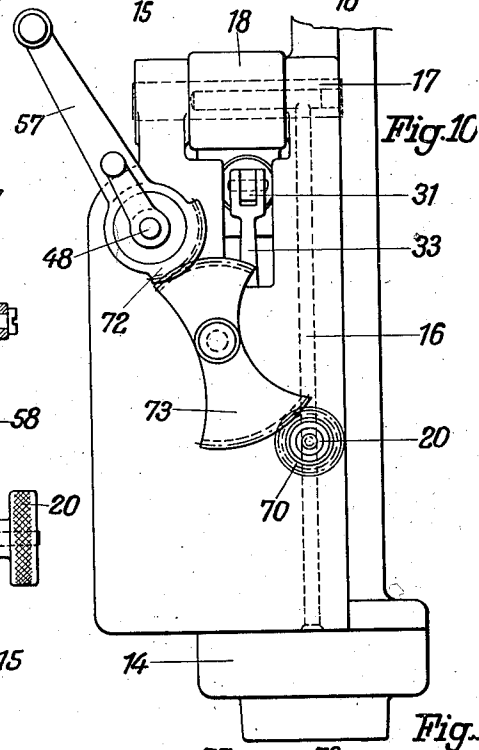


Fig. 9

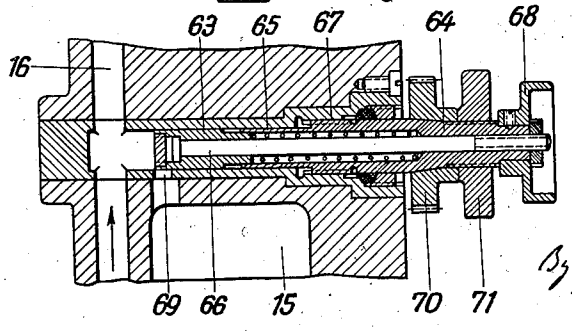
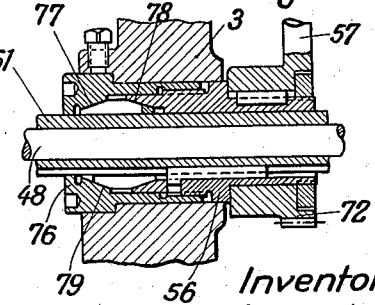


Fig. 11



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Patented May 10, 1932

1,857,549

UNITED STATES PATENT OFFICE

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GRINDING MACHINE

Application filed February 27, 1930, Serial No. 431,886, and in Germany February 27, 1929.

This invention relates to grinding machines particularly adapted for grinding twist drills in which the grinding wheel, for the purpose of zone displacement, is moved with its front face past the pivotal clamping head holding the twist drill, on a pivot located thereunder.

In the present machine the pivot for the pivotal arm is located close to the floor and the pivotal arm is of such length that the grinding wheel describes an extremely flat or substantially straight orbit. This results in a better grinding, and in addition in such an extremely slight angular rotation in the pivotal bearing that no noteworthy friction occurs in the latter.

A further feature of the invention lies in the fact that the long pivotal arm is designed as a hollow body, in which a common driving motor for producing the rotation of the grinding spindle, for driving the cooling pump and producing the pivotal movement of the pivotal arm is mounted.

In addition, according to the invention, the swinging motion is effected by an automatically reversing hydraulic driving mechanism which results in very reliable, rapid and silent working.

In the accompanying drawings, which show a number of embodiments of the invention:

Fig. 1 shows a partial sectional side elevation of the machine, in which the pivotal arm can be fixed in its end position by means of a mechanical locking device.

Fig. 2 illustrates a side elevation of the pivotal arm and also a section through an hydraulic pivotal arm driving mechanism in which the stationary saddle for the twist drill clamping chuck is omitted.

Fig. 3 is a partial side elevation illustrating a stopping device.

Fig. 4 a part section illustrating an arrangement and method of operating a disengageable stroke limiting stop.

Fig. 5 a partial section illustrating the releasable stop in another position.

Fig. 6 is a part section at right angles to Figs. 4 and 5.

Fig. 7 shows an enlarged section through the working cylinder and the control cylinder of the embodiment according to Figs. 1 and 2.

Fig. 8 is a section through a hand-actuated control valve of the pressure pipe.

Fig. 9 is a section through a control valve of another embodiment.

Fig. 10 illustrates a detail of the mechanical drive of the valve according to Fig. 9; and

Fig. 11 is a section illustrating the mechanical drive of the valve according to Fig. 9 and the braking device for the pivotal arm.

The embodiment shown in Figs. 1–8 of the grinding machine which is particularly applicable for grinding twist drills is provided in the known manner with a stationary stand 1, carrying at the top a chuck (not shown in the drawings) for the twist drill *Sp.* to be ground. The stand 1 is of box-shaped design and contains in its lower part a cooling liquid.

The grinding wheel 2 is mounted on a pivotal arm 3, which is also of box-shape and is adapted to swing on a pin 4 of the base plate 5 of the stand 1. The pivot 4 thus lies in the lowest possible position so that the entire height of the pivotal arm 3 can be utilized for fixing or mounting the control and driving parts.

According to the invention the pivotal arm 3 is given a swinging movement by mechanical means so that the machine minder is relieved of the necessity of swinging the grinding wheel along past the drill. In the embodiment shown in the drawing the swinging movements are produced by an automatically controlled hydraulic driving mechanism adapted to be disengaged and adjustable relatively to the length of the stroke and the number of swinging movements, and which is rendered operative by the same motor which effects the rotation of the grinding wheel and the operation of the cooling pump.

In the interior of the pivotal arm 3 an electro-motor 6 is mounted, which through a belt drive 7 drives the grinding wheel spindle 8 and acts directly on the cooling pump 9 which sucks the cooling medium from inside the stand 1 through a suction pipe 10

and delivers it through a delivery pipe 11 to the twist drill grinding wheel.

The spindle 8, through a screw or bevel gear 12 drives a vertical spindle 13 which in turn actuates a priming pump 14, by means of which the hydraulic pivoting mechanism of the arm 3 is actuated. The pump 14 is mounted on the face of the hollow pivotal arm 3 facing the stand 1 and receives liquid under pressure, for example oil, from a container 15, which takes part in the swinging movement of the arm 3 and in turn carries the device described below for adjusting the pivotal angle or stroke of the pivotal arm 3.

From the pressure side of the pump 14 a delivery pipe 16 passes to a hollow pivot 17, simultaneously serving as carrier and pivot for a casting 18 containing the driving piston and the control piston. A pipe 19 for controlling the hydraulic driving mechanism extends from the central aperture of pivot 17.

The delivery pipe 16 is controlled by a valve 20 (Fig. 8), by means of which a complete or partial short-circuiting of the circulating pressure medium can be effected. For this purpose the spindle 21 of the valve 20 is provided on its inner end with a central bore 22, which by means of a transverse boring is in continuous connection with the delivery pipe 16. A lateral aperture 23 on the spindle 21 passes a channel 24 of the spindle bearing, which is in continuous connection with the container 15 for the pressure medium. By suitably turning the valve 20 connection is established between the delivery pipe 16 and the container 15, whereby the delivery pipe is short-circuited, i. e. the pump 14 delivers the pressure medium over the shortest path through the boring 22, the lateral opening 23 and the channel 24 back to the pressure medium container 15, so that the pressure medium cannot affect the hydraulic swinging mechanism. By partly closing the channel 24 it is also possible to effect a partial short-circuiting of the circulating pressure medium, so that the valve 20 renders it possible to cut out entirely the hydraulic drive of the pivotal arm 3 or to influence its speed or number of revolutions.

As already stated the casting 18 is pivotally mounted on the pivot 17, which casting contains the guide for the driving piston of the hydraulic swinging mechanism and its control piston. The casting 18 in the embodiment shown in the drawings thus takes part in the swinging movements of the pivotal arm 3 and in this connection can itself execute a slight swinging movement around the pivot 17, so that seizing of the working piston is eliminated.

In the boring 25 of the casting 18 a piston 26 is guided, the rod 27 of which is secured to a bell-crank lever 28, pivoted at 29 to a bracket 30 of the stand 1. Underneath the piston 26 and parallel thereto is mounted the control piston 31, one end of which is guided by a spindle 32 in an eyelet of the bell crank lever 28 and its other end is pivotally connected with a bell crank lever 33 which effects control of the reciprocating movements of the piston 28.

The control piston 31 moves in a sleeve 34 (Fig. 7) and is provided at the ends with guide pistons 35 between which two narrower guide rings 36 are fitted. Between each guide piston 35 and ring 36 the diameter of the piston 31 is reduced forming chambers 37 which are connected by means of pipes 38*a* with the oil container 15, when the control piston effects reversal of the swinging movement. The boring 25 on both sides of the piston 26 is in continuous communication with the spaces 37 by means of pipes 38 and corresponding slots in the sleeve 34.

In the middle position of the control piston a contraction between the guide rings 36 comes into position in front of the end of the pressure medium pipe 19. In this position the delivery pipe 19 is connected across the contraction, a boring 39 and a longitudinal boring 40 of the control piston 31 through a longitudinal channel 41 with the pressure medium discharge pipe 38*a*, so that a short-circuiting of the pressure system again takes place.

In normal operation of the machine this position of the control piston is overcome by the action of the swinging masses, but, as explained hereunder, means are also provided to stop the control piston 31 in this position, to enable the pivotal drive to be disengaged, even without the valve 20 being actuated. When the control piston is stopped in this way, the pivotal arm, as also explained below, can move into its extreme pivotal position, in which the grinding wheel 2 moves from contact with the point of the twist drill to be ground.

The swinging movements of the lever 33, by means of which the reciprocating motions of the control piston 31 are effected, are produced by a lever 42, which is rotatably mounted at 43 on the pivotal arm 3 and which has a slot connection with the arm 44 of the bell crank lever 33. An arm 45 of the lever 42 swings between stops 46 and 47 of an adjusting spindle 48 provided with right and left hand screw threads. When the arm 45 impinges against one of the stops, the bell crank lever 33, 44 is swung to effect the reversal of the hydraulic drive and the direction of swing. The reversal is effected jerkily, in that a roller mounted on an upwardly directed lever arm 49 runs in known manner over a spring controlled pin 50.

According to Figs. 4–6 the stop 47 is mounted on a sleeve 51, which according to Fig. 2 is reciprocatingly mounted in a guide boss. It engages a nut 52 in engagement with the

thread of the spindle 48 and, similarly to the stop 46 is prevented, by a guide bar 53, from rotating against the spindle. When the spindle 48 is turned by the handle mounted on its outer end, the distance of the stops 46, 47 is increased or diminished and the stroke of the pivotal arm 3 correspondingly altered.

The adjusting spindle 48 takes no part in the swinging movements of the pivotal arm 3. It is held stationary by members 54 which engage on the one hand with the bell crank lever 28 and on the other hand with a ring 55 pivotally but not slidably mounted with respect to the spindle 48.

The sleeve 51 of the stop 47 is reciprocatingly mounted on the adjusting spindle 48 and is provided with key engagement with a sleeve 56 rotatably mounted on the pivotal arm 3. On this sleeve is mounted an adjusting lever 57, the swinging of which effects a rotation of the sleeve 56 and of the sleeve 51 carrying the stop 47, so that the stop 47 is swung out of the path of the lever 45 (Figs. 4 and 5) and the pivotal arm 3 can move into its extreme position, without the hydraulic driving mechanism being reversed.

According to Fig. 3 a locking member 58 is operatively connected with the lever 57, which locking member is adapted to pass between two eyes 59 of the lever arm 33 and to lock the lever against further movement. The entrance of the locking member 58 between the eyes 59 takes place when the control piston 31 is in the middle position referred to above, in which the pressure medium pipe is short-circuited and cannot act on the hydraulic drive. In order to enable the lever 33 to be brought into this locked position by the rotation of the lever 57, the boss of the sleeve 56 on the lever 57 is provided with an arm 60, by means of which a stop 61 is moved perpendicularly up and down, when the lever 57 is swung. The stop 61 moves in the path of an adjustable stop 62 of the lever 42, so that on reversing the lever 57, the stop 61 causes the lever 42 and the lever 33 to turn into the position corresponding to the middle position of the control piston whereby the hydraulic drive is cut out, although the motor 6 continues to run. When the lever 57 is returned to its initial position, the locking member 58 comes out from between the eyes 59, so that the lever 42 can then be moved farther by hand and the control be brought into the operative position. Simultaneously the pivotal stop 47 is again brought within reach of the lever arm 45, so that the automatic reversing of the hydraulic drive can be resumed.

In Fig. 9 a modified embodiment of the valve 20 is shown in section. this modified form can be used instead of the valve shown in Figs. 1 and 2, for the purpose of controlling the flow of the pressure medium. The valve is designed as safety valve which is adapted to carry off any excess pressure which may occur and which in addition is operatively connected with the adjusting lever 57 in such a manner that on reversing the lever the pressure is simultaneously cut off from the hydraulic drive, so that the particular middle position of the control piston shown in Figs. 1 and 2 can be dispensed with, in which the control piston effects a short circuiting of the pressure medium circulation when the stop 47 is moved out of the path of the lever arm 45. The valve 20 according to Fig. 9 is provided with two sleeves 63 and 64, which are adapted to be held apart by a spring 65. The relative position of the two parts of the valve can be altered by axial adjustment of a central connecting pin 66. The sleeve 64 is screwed onto the valve bore at 67, so that if the handle 68 is turned, the whole of the valve moves forward or backward, and the channel 69 discharging into the pressure medium container 15 is more or less uncovered by the valve sleeve 63. If for any reason an excessively high pressure occurs in the pipe 16, the valve sleeve 63, by compression of the spring 65, can be moved in the direction of the stationary valve part 64, so that the channel 69 is automatically uncovered, to relieve the pressure. The turning of the valve, which results in a longitudinal displacement of the entire valve body in consequence of the screw engagement 67, may also be effected by a toothed wheel 70, which can be fixedly clamped by means of a lock nut 71 on a tapering part of the valve sleeve 64. This toothed wheel 70, according to Fig. 10, engages through a toothed segment 73 with a segment 72 on the periphery of the hub of the lever 57, so that on reversing this lever, not only is the stop 47 disengaged, to permit the maximum throw of the swinging arm 3, but at the same time a rotation of the valve 20 is also effected to such an extent that the opening 69 is uncovered and the pump 14, by cutting out the hydraulic drive, can act direct on the pressure medium container 15.

By this means a direct coupling between the cut-out lever 57 and the regulator valve 20 is effected whereby the stops 61, 62 provided in Figs. 1–3 may be dispensed with. In this case, in order that the hydraulic drive can immediately become operative again without effecting any additional operation, when the lever 57 is again reversed, a third stop 80 (Fig. 1) may be provided which, as shown in Fig. 1 is rigidly mounted on the stand 1 and sets the control lever 45 in return movement position shortly before the limit of the swinging movement of the pivotal arm 3 in the right hand direction is reached. This return movement becomes at once operative when, by reversing the lever 57 or by opening the valve by hand, the pressure is again restored on the hydraulic drive.

In order, in any case, not to leave the

stopping of the pivotal arm 3 when the motor continues to run, entirely to the valve 20, and in order to render possible stoppage of the pivotal arm in any desired position, it is possible, simultaneously with the reversing of the lever 57 and the consequent actuation of the valve 20, to effect a stoppage of the pivotal arm by a braking action. This arrangement is shown by way of example in Fig. 11. In consequence, the boss of the lever 57 provided with teeth 72 has a screw engagement with a sleeve 76 rigidly secured on the pivotal arm 3, through which passes the sleeve 51 carrying the stop 47. The sleeve 76 is provided internally with a tapered surface 77 and the boss-sleeve 56 of the lever 57 with a tapering surface 78 of opposite inclination. Between these tapering surfaces, a split sleeve 79 capable of being compressed is loosely mounted on the sleeve 51. If the lever 57 is swung into its extreme cut-out position, its boss 56 screws into the stationary sleeve 76 to such an extent that the sleeve 79 is compressed and brakes the sleeve 51 and consequently the entire pivotal arm 3 against further movement.

The parts are arranged in such a manner that the arm 57 can first execute a partial rotation without having any effect on the clamping sleeve 79. As a result of this, it is possible that the pivotal arm can be first allowed to pass into the desired position before complete cutting-out of the pressure from the hydraulic drive and the mechanical stoppage of the pivotal arm by means of the clamping sleeve 79 takes place. This applies in fact to the extreme position of the pivotal arm, i.. which the grinding wheel 2 has completely released the twist drill 3p. Meanwhile, if the lever 57 is returned in one movement to its end position, the pivotal arm is at once fixed in the particular position. If the lever 57 is then moved back the pivotal arm 3 can complete its movement in the particular direction, provided the cutting-out of the hydraulic drive and the braking of the pivotal arm has not taken place in an end position and the control piston has been already reversed. It will be understood that in such an embodiment of the invention the locking catch 58 provided in Figs. 1–2 and the driving parts belonging thereto can be dispensed with.

I claim:—

1. A grinding machine comprising a long hollow arm pivoted on the base of the machine, a grinding wheel mounted on said arm, a driving motor, a transmission between said motor and grinding wheel, a pump mounted upon said arm driven from said motor, an hydraulic mechanism including a working cylinder and a control piston for effecting a swinging movement of the pivoted arm, adjustable stroke limiting devices for the control piston, and means whereby one of the stroke-limiting stops can be disengaged to enable the pivoted arm to move into its extreme oblique position.

2. A grinding machine comprising a long hollow arm pivoted on the base of the machine, a grinding wheel mounted on said arm, a driving motor, a transmission between said motor and grinding wheel, a pump mounted upon said arm driven from said motor, an hydraulic mechanism including a working cylinder and a control piston for effecting a swinging movement of the pivoted arm, adjustable stroke limiting devices for the control piston, a device for disengaging one of the stroke-limiting stops and a mechanical locking device co-operating therewith.

3. A grinding machine comprising a long hollow arm pivoted on the base of the machine, a grinding wheel mounted on said arm, a driving motor, a transmission between said motor and grinding wheel, a pump mounted upon said arm driven from said motor, an hydraulic mechanism including a working cylinder and a control piston for effecting a swinging movement of the pivoted arm, adjustable stroke limiting devices for the control piston, an adjusting lever for the control piston, a stop for actuating said lever, said stop being controlled by the stroke-limiting stops.

4. A grinding machine comprising a long hollow arm pivoted on the base of the machine, a grinding wheel mounted on said arm, a driving motor, a transmission between said motor and grinding wheel, a pump mounted upon said arm driven from said motor, an hydraulic mechanism including a working cylinder and a control piston for effecting a swinging movement of the pivoted arm, adjustable stroke limiting devices for the control piston, a device whereby one of the stroke-limiting stops can be disengaged, and means whereby the pressure is cut-off from the hydraulic driving mechanism on disengaging the said stop.

5. A grinding machine comprising a long hollow arm pivoted on the base of the machine, a grinding wheel mounted on said arm, a driving motor, a transmission between said motor and grinding wheel, a pump mounted upon said arm driven from said motor, an hydraulic mechanism, a pressure pipe, a valve, adjustable stroke limiting devices for the control piston, a stop disengaging device, and means whereby the valve can be moved by the stop disengaging device.

6. A grinding machine comprising a long hollow arm pivoted on the base of the machine, a grinding wheel mounted on said arm, a driving motor, a transmission between said motor and grinding wheel, a pump mounted upon said arm driven from said motor, an hydraulic mechanism including a working cylinder and a control piston for effecting a

swinging movement of the pivoted arm, adjustable stroke limiting devices for the control piston, a device for disengaging one of the stroke-limiting stops, and a mechanical braking device co-operating with the stop disengaging device.

In testimony whereof I affix my signature.

VIKTOR JERECZEK.