

Aug. 4, 1931.

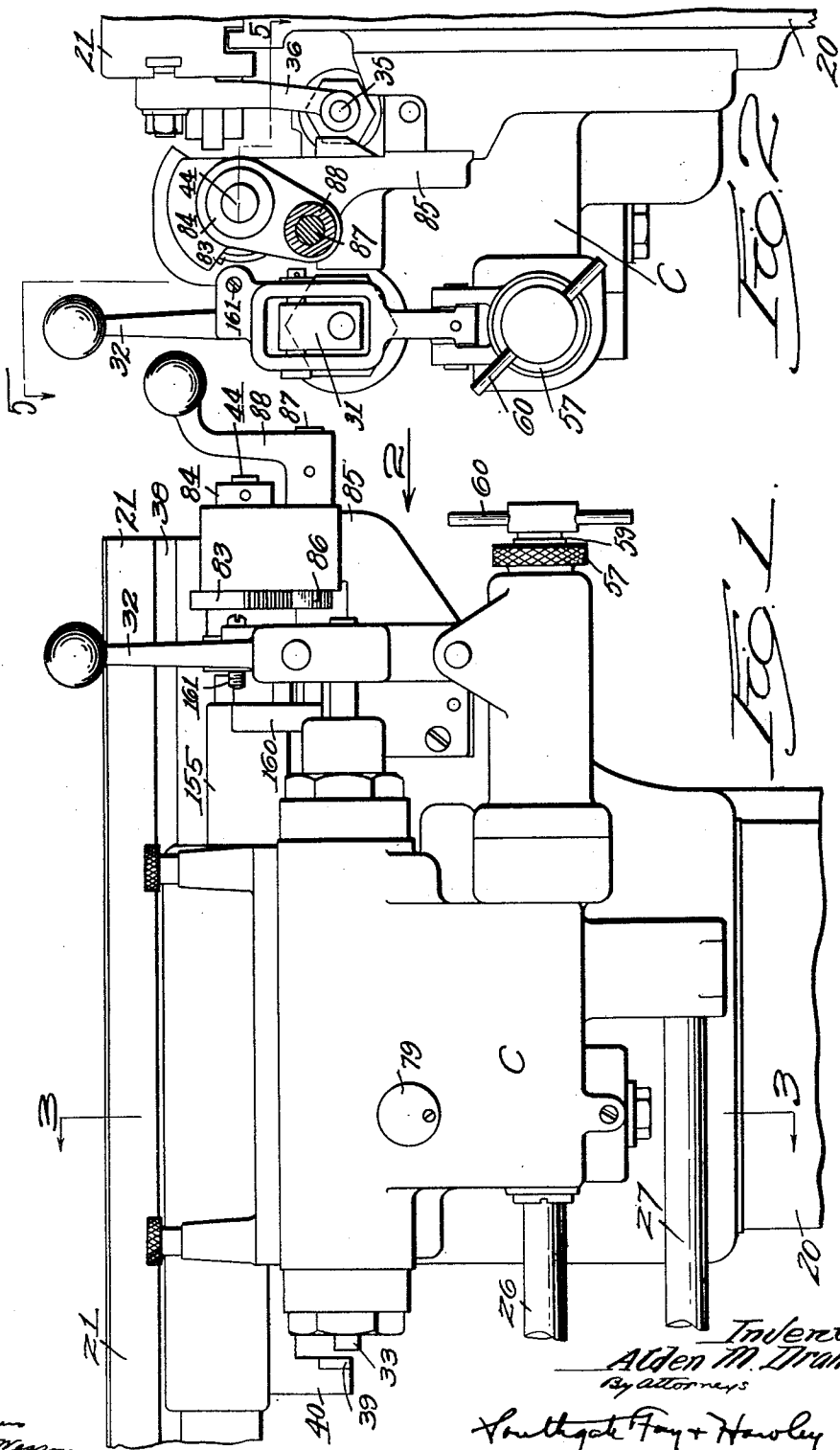
A. M. DRAKE

1,817,180

CONTROL MECHANISM FOR INTERNAL GRINDING MACHINES

Filed Aug. 1, 1927

6 Sheets-Sheet 1



W. F. New
C. F. Messon

Southgate Fay + Hawley

Aug. 4, 1931.

A. M. DRAKE

1,817,180

CONTROL MECHANISM FOR INTERNAL GRINDING MACHINES

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6 Sheets-Sheet 2

Fig. 3

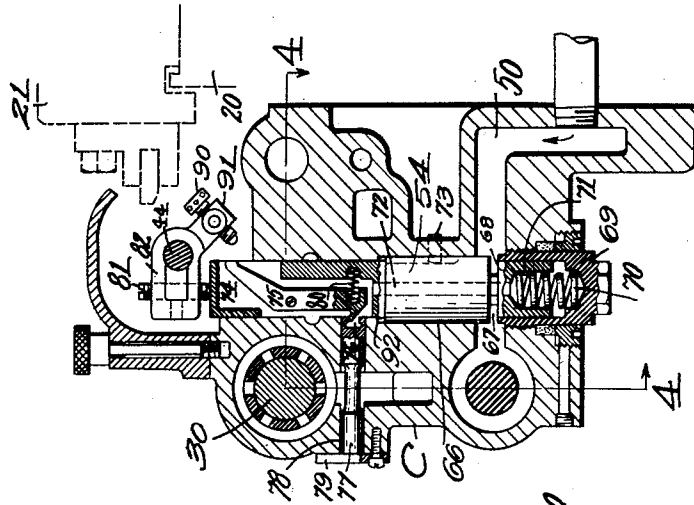
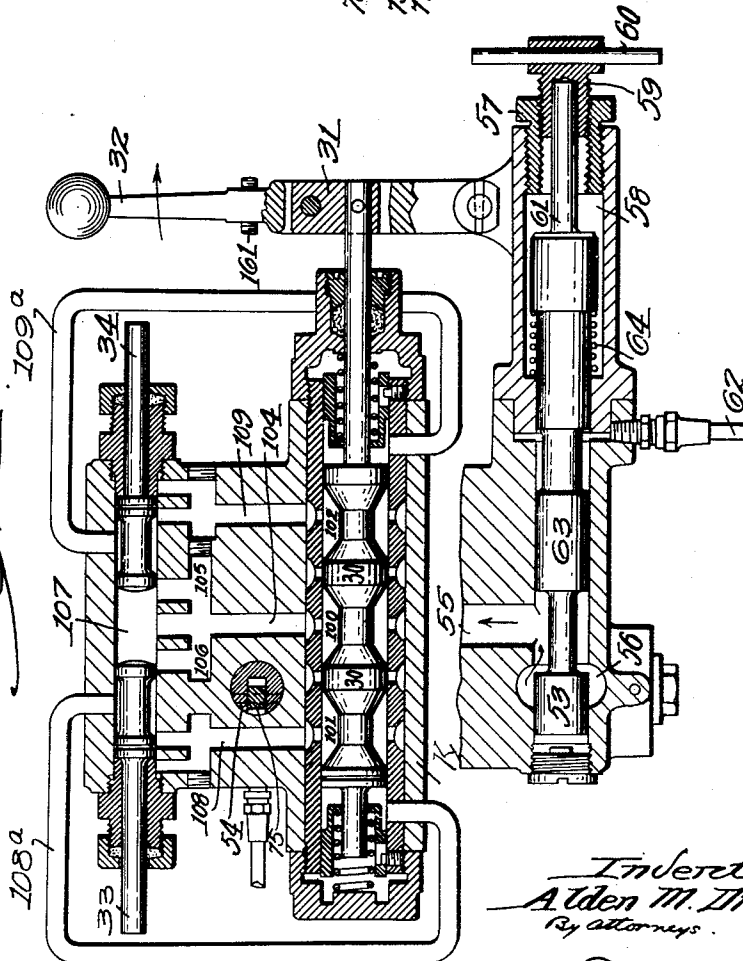


Fig. 4



Inventor
Alden M. Drake
By attorneys.

Southgate Fay & Hawley

Witness
G. F. Messon

Aug. 4, 1931.

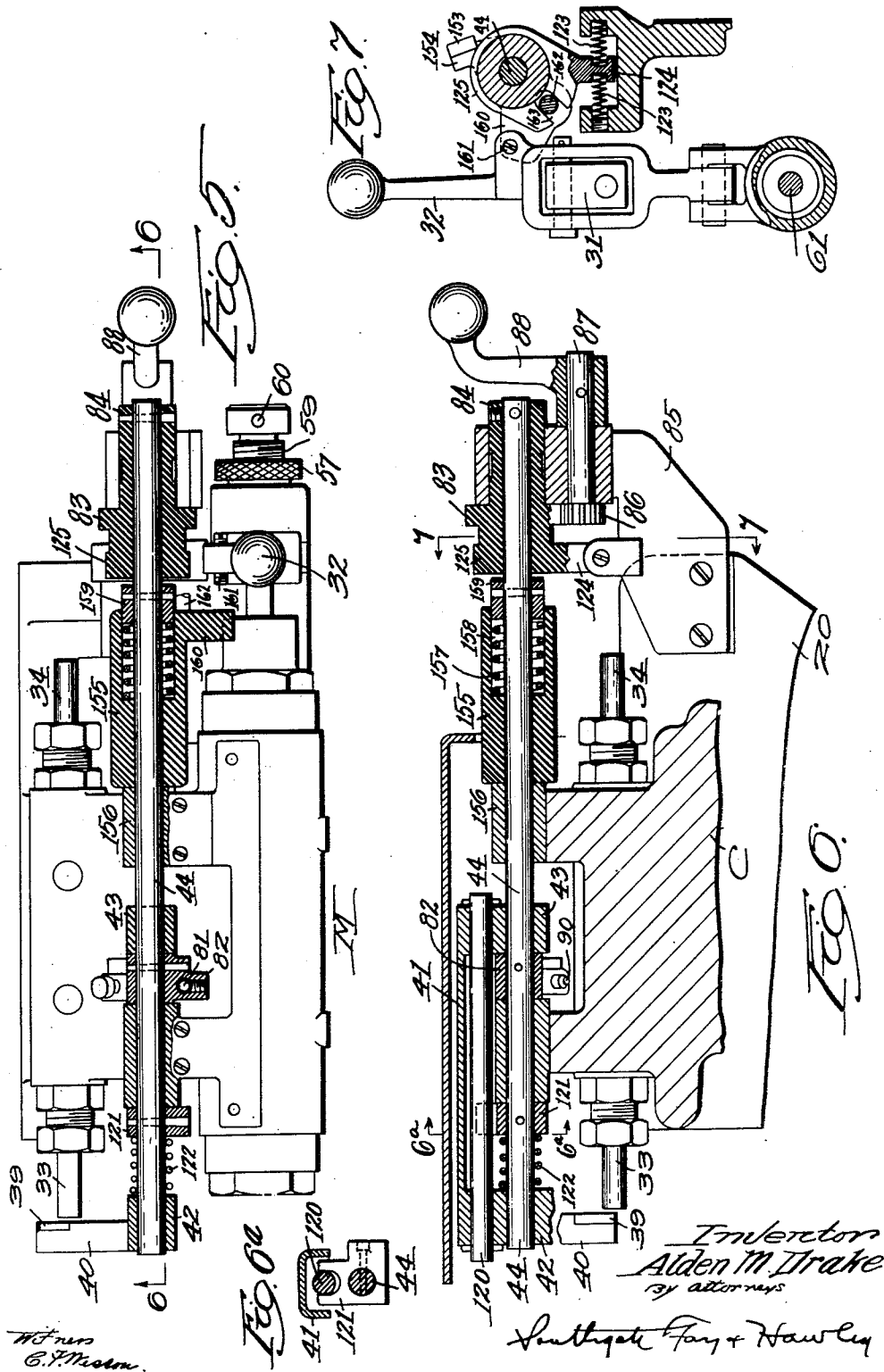
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CONTROL MECHANISM FOR INTERNAL GRINDING MACHINES

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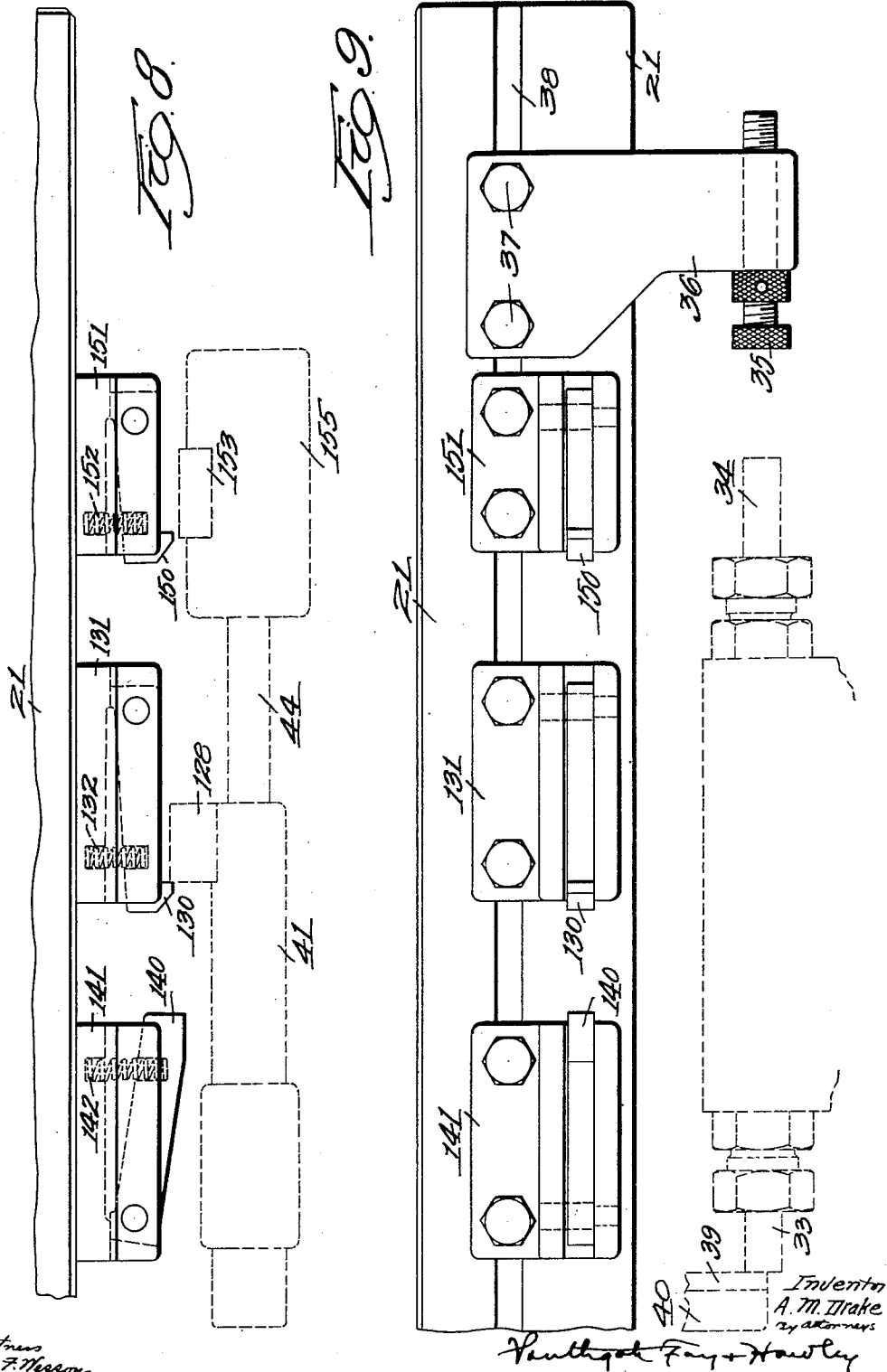
A. M. DRAKE

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CONTROL MECHANISM FOR INTERNAL GRINDING MACHINES

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Witness
G. F. Nelson.

Aug. 4, 1931.

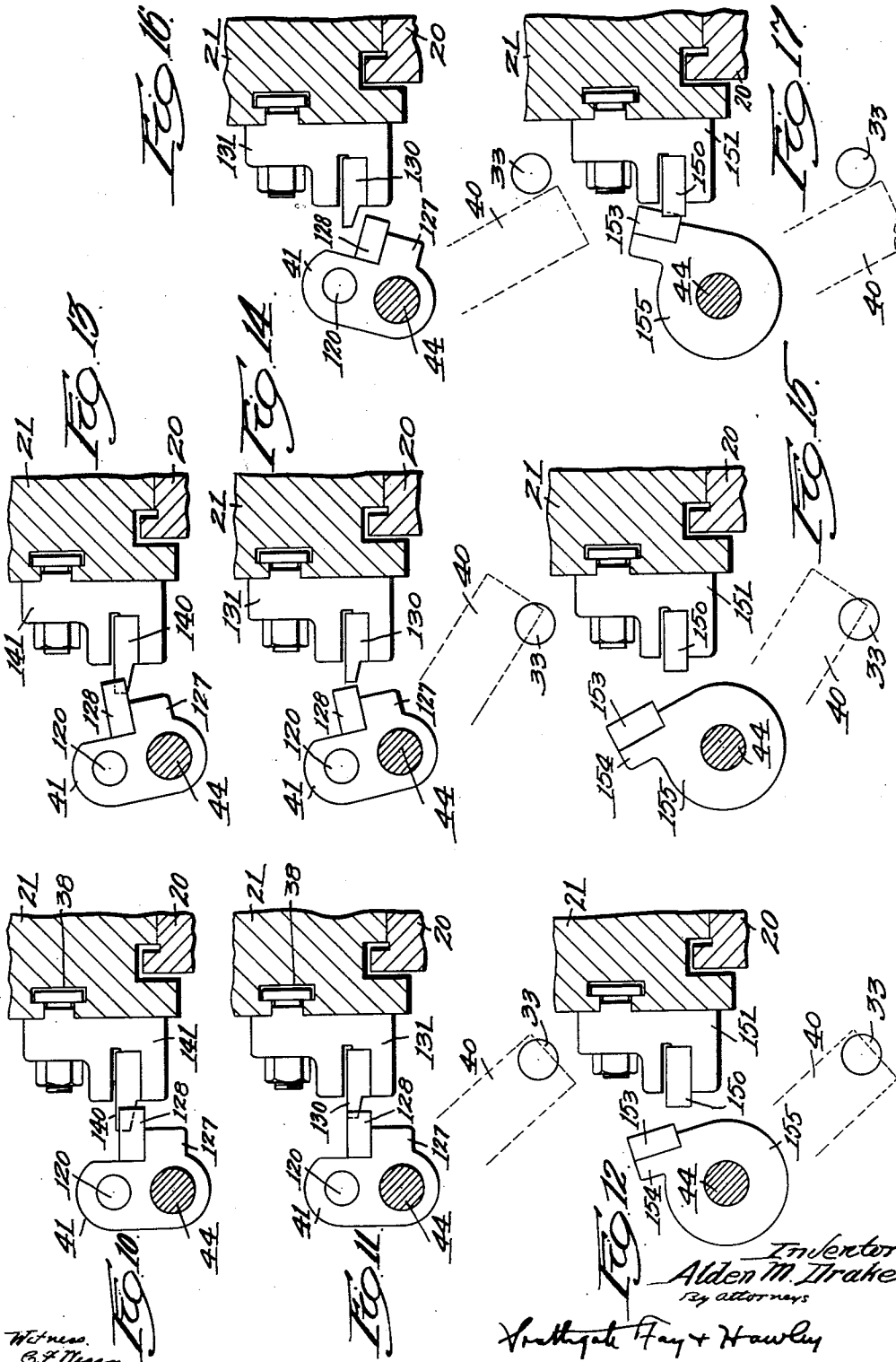
A. M. DRAKE

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CONTROL MECHANISM FOR INTERNAL GRINDING MACHINES

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6 Sheets-Sheet 5



Witness
C. F. Mason

Inventor
Alden M. Drake
By attorneys
Smith, Gay & Hawley

Aug. 4, 1931.

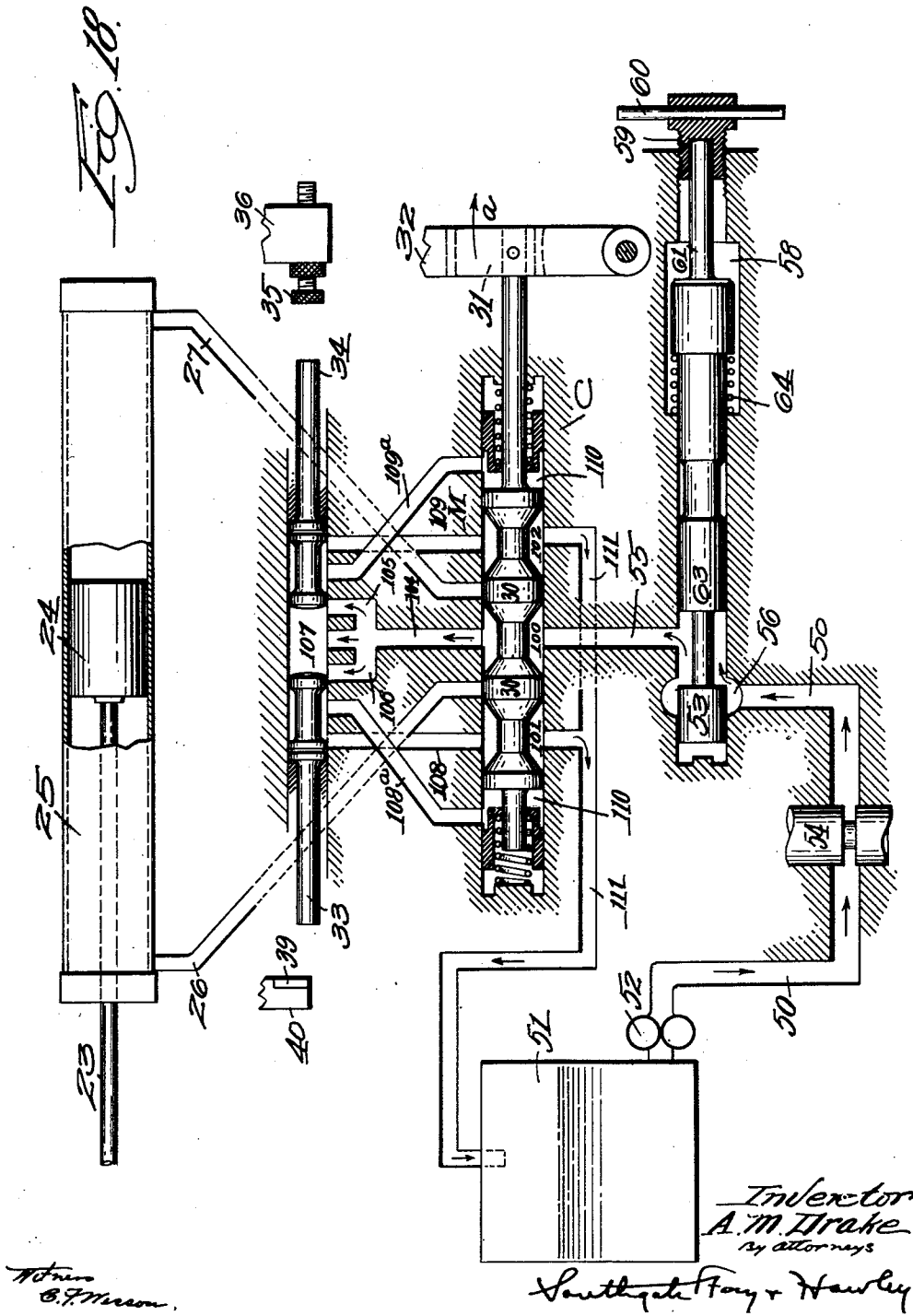
A. M. DRAKE

1,817,180

CONTROL MECHANISM FOR INTERNAL GRINDING MACHINES

Filed Aug. 1, 1927

6 Sheets-Sheet 6



UNITED STATES PATENT OFFICE

ALDEN M. DRAKE, OF GREENFIELD, MASSACHUSETTS, ASSIGNOR TO GREENFIELD TAP AND DIE CORPORATION, OF GREENFIELD, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

CONTROL MECHANISM FOR INTERNAL GRINDING MACHINES

Application filed August 1, 1927. Serial No. 209,661.

This invention relates to machines for producing accurate surfaces of revolution by a grinding operation and relates more particularly to improvements in the control mechanism thereof. The invention, while capable of more or less general application, possesses particular advantages as applied to an internal grinding machine such as is shown in my prior application, Serial No. 91,208, filed February 27, 1926.

It is a general object of my invention to provide an improved control mechanism for a grinding machine by the use of which the various operations of the machine may be controlled in a semi-automatic manner.

A further object is to provide a control mechanism so designed that the operator may handle the machine with unusual ease and convenience and that the probability of mistake or error on the part of the operator is greatly reduced.

An important feature of the invention relates to the provision of a manually operated device effective by movements in different directions to control both the rate and extent of relative travel between the tool and the work, and also to bring the parts to rest at a predetermined relation.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawings in which

Fig. 1 is a side elevation of my improved control mechanism;

Fig. 2 is an end elevation thereof, looking in the direction of the arrow 2 in Fig. 1;

Fig. 3 is a sectional end elevation, taken along the line 3—3 in Fig. 1;

Fig. 4 is a longitudinal sectional view, taken along the irregular line 4—4 in Fig. 3;

Fig. 5 is a sectional plan view, taken along the line 5—5 in Fig. 2;

Fig. 6 is a sectional side elevation, taken along the line 6—6 in Fig. 5;

Fig. 6^a is a detail sectional elevation, taken along the line 6^a—6^a in Fig. 6;

Fig. 7 is a sectional end elevation, taken along the line 7—7 in Fig. 6;

Fig. 8 is a plan view of the table dogs;

Fig. 9 is a side elevation thereof;

Figs. 10 to 17 inclusive are detail sectional end elevations, illustrating the operation of the control mechanism; and

Fig. 18 is a diagrammatic view, illustrating the operative connections of the valve mechanism.

Referring to the drawings, I have shown portions of a base or frame 20 on which a table 21 is longitudinally slidable. In the machine shown in my prior application, above referred to, a rotatable work support is mounted on the table 21 and is reciprocated relative to a grinding wheel which is mounted for transverse adjustment on the base or frame 20. The operation of my improved control mechanism will be described with reference to such a machine but it will be understood, however, that the use and advantages of the control mechanism are not limited to any particular arrangement of the wheel and work, and that the relative movement of the wheel and work may be reversed within the scope of my invention.

The table 21 is connected to a piston rod 23 (Fig. 18) having a piston 24 slidable in a cylinder 25 mounted in fixed position on the frame 20 and having pipes 26 and 27 connecting the opposite ends of the cylinder to a main valve mechanism M, which includes a sliding piston valve 30 mounted in a casing C and having a block 31 mounted thereon. Said block 31 has a pin-and-slot connection with a hand lever 32 by which the piston valve 30 may be manually operated.

The valve 30 is also automatically controlled by auxiliary valves 33 and 34, the valve 34 having its stem positioned for engagement by a contact screw 35 (Fig. 9) adjustably secured in a bracket 36, which in turn is secured by bolts 37 seated in a T slot 38 in the side of the table 21.

The stem of the auxiliary valve 33 is similarly engaged by a contact block 39 (Fig. 6) in an arm 40 extending downward from a supporting member 41 having spaced bearings 42 and 43 slidable on a rod 44 mounted in the upper part of the valve casing C. The

mechanism for positioning and actuating the arm 40 will be hereinafter described.

The general construction and operation of the main valve mechanism M and the auxiliary valves 33 and 34 is substantially similar to that shown and disclosed in the prior patent to Morgan No. 1,633,557, issued June 21, 1927.

Oil under pressure is supplied through a pipe 50 (Fig. 18) from a tank 51 by a suitable pump or other pressure device 52 and that the flow of oil is controlled by two speed adjusting valves 53 and 54.

Speed control

The valve 53 is used for adjusting the rate of table travel during the normal grinding operation of the machine. The oil approaches the piston valve 53 through the pipe 50 and flows from the valve 53 to the main valve mechanism M through an inlet 55. The oil from the pipe 50 enters an annular recess 56, the outlet of which may be more or less restricted by manual adjustment of the piston valve 53, this adjustment being indicated diagrammatically in Fig. 18 and in detail in Fig. 4.

Referring to Fig. 4, a threaded bushing 57 is inserted in the end of a valve chamber 58 and is internally threaded to receive the threaded hub or shank 59 of a handle 60. The part 59 is also recessed to receive the valve stem 61 of the piston valve 53. By turning the handle 60, the valve 53 may be caused to more or less completely restrict the outlet of the annular recess 56. A drain pipe 62 (Fig. 4) takes care of any leakage past the portion 63 of the piston valve 53, and a spring 64 holds the valve stem 61 firmly seated in the axial recess in the portion 59 of the handle 60. By the mechanism above described, the normal rate of travel of the table 21 may be conveniently adjusted.

The valve 54 is provided for changing the rate of table travel with reference to different steps in the grinding operation, the valve 54 being manually or semi-automatically shifted in position by the operator during the grinding operation. The details of construction of the valve 54 are best shown in Fig. 3.

The valve 54 is mounted for sliding movement in a vertical opening 66 in the valve casing C and is provided with an annular groove 67 and a slightly reduced end portion 68. The end portion 68 is slidable in a cap or closed bushing 69 threaded in the lower portion of the casing C and suitably packed to prevent leakage. A coil spring 70 is mounted in the cap or bushing 69 and extends upward into a recess 71 in the end portion 68 of the valve 54. An axial opening 72 through the valve 54 prevents the accumulation of an unbalanced pressure below the valve.

The valve 54 is held from angular move-

ment by a pin 73, or in some other convenient manner, and is provided with a longitudinal slot 74 in which a latch 75 is pivoted. The lower end of the latch 75 is provided with a shoulder or projection adapted to engage the upper wall of a recess 76 in the end of a stud 77 secured in a transverse recess 78 of the casing C by a lock plate 79.

A spring 80 presses the latch 75 toward position to enter the recess 76. The upper end of the valve 54 is engaged by an adjusting screw 81 in an arm 82 fixed to the rod 44 (Fig. 6) previously described.

A gear 83 has a hub 84 fixed to the rod 44, said hub being mounted in a bearing in a bracket 85 secured to the frame 20. A pinion 86 is mounted on a short shaft 87 and meshes with the gear 83. The shaft 87 also has a bearing in the bracket 85 and is provided with a handle 88 by which the shaft 87 may be rocked in either direction, causing a reduced rocking motion of the rod 44 in the opposite direction. The gear 83 and pinion 86 are provided for increasing the leverage of the handle 88.

When it is desired to reduce the rate of table travel for the wheel truing or finish grinding operations, the handle 88 is rocked to move the rod 44 in an anti-clockwise direction, as viewed in Fig. 3, thus depressing the adjusting screw 81 and the speed control valve 54 and causing the valve to be latched in its depressed position. Such movement of the valve shifts the annular groove 67 from a position adjacent the diameter in the oil inlet pipe 50 to a position nearer to the periphery of the pipe, thus reducing the effective opening through which oil may flow, and thus directly reducing the flow of oil.

A second adjusting screw 90 (Fig. 3) is mounted in a second arm 91 formed integral with the arm 82 previously described and fixed to the rod 44. If the rod 44 is thereafter rocked in a clock-wise direction as viewed in Fig. 3, the screw 90 will engage the upper end of the latch 75, releasing the latch and allowing the valve 54 to move upward to its original position, the upward movement being limited by engagement of the valve with a shoulder 92 (Fig. 3) in the valve casing.

By means of the two valves 53 and 54 thus described, I am able to control the normal speed of table travel and also to reduce the speed for special operations without changing the adjustment for the normal table travel.

Main and auxiliary valve mechanism

A detailed description of the main and auxiliary valve mechanism is not considered necessary for the purposes of this application, which relates more particularly to certain devices for controlling the valve mech-

anism, rather than to the structure of the valve mechanism itself.

Briefly stated, the valve mechanism is constructed and operated as follows, reference being made to the diagrammatic disclosure in Fig. 18.

The main valve 30 is provided with annular recessed portions 100, 101 and 102. The valve chamber 56 previously described is connected with the inlet pipe 55 to the valve recess 100, which recess is further connected by an inlet pipe 104 and branch inlet pipes 105 and 106 to the center portion of the auxiliary valve cylinder 107. The end portions of the auxiliary cylinder are continuously connected by pipes 108 and 109 to annular recesses 101—102 around the main valve 30, and the pipes 26 and 27 from the table operating cylinder 25 are connected at intermediate points to the main valve cylinder as shown. An exhaust pipe 111 is always in communication with the annular recesses 101 and 102 of the main valve. The end portions 110 of the main valve cylinder are connected by pipes 108a and 109a to ports in the side of the auxiliary valve cylinder.

The parts are shown in Fig. 18 in mid-position, with the table at rest. If the handle 32 is pulled to the right as indicated by the arrows a, the recess 100 will connect the inlet pipe 55 to the cylinder connection 27 and at the same time the annular recess 101 will connect the pipe 26 to the exhaust pipe 111. The piston 24 will thereupon move to the left, carrying with it the grinding machine table on which are mounted the dogs 35 and 39.

Continued movement to the left will cause the dog or contact screw 35 to engage the stem of the auxiliary valve 34, moving it to the left to connect the branch inlet pipe 105 with the connecting pipe 109a, so that pressure is exerted in the recess 110 at the right of the main valve 30, which valve will thereupon be moved to the left to connect the pipe 27 to the exhaust 111 and to connect the pipe 26 to the inlet pipe 55, thus causing the piston 24 to travel to the right. The travel in the right hand direction is similarly limited by engagement of the dog 39 with the stem of the auxiliary valve 33, causing the connections to be again reversed.

The piston 24 will thus be reciprocated between predetermined limits until the handle 32 is moved to mid-position, either manually or automatically, carrying with it the main valve 30 and causing the table to come to rest with the valve in the mid-position shown in Fig. 18, in which event the cylinder connections 26 and 27 are blocked off from the inlet chamber 100.

It will be noted that pressure is continually exerted in the portion of the auxiliary valve chamber 107 between the auxiliary valves 33 and 34, which pressure moves the valves outward as soon as they are released

by their respective dogs, thus normally maintaining them in the position shown in Fig. 18.

For a more detailed description of the construction and operation of the valve mechanism, reference is again made to the Morgan Patent No. 1,633,557 previously cited.

Semi-automatic control mechanism

The rocking of the rod 44 by the handle 88 not only varies the rate of travel but also introduces semi-automatic changes in the length of table travel, the travel of the table being increased for the truing operation, and the table being automatically brought to rest with the wheel withdrawn from the work upon the completion of the finish grinding operation.

For effecting the first mentioned result, the increased travel of the table for truing the wheel, the member 41 (Fig. 11) which supports the valve contact arm 40 is rocked about the axis of the rod 44 to change its engagement with the table dogs to be described. To effect such rocking movement, the member 41 is provided with a guide rod 120 (Fig. 6) parallel to the rod 44 but offset therefrom. A forked arm 121 (Fig. 6a) is secured to the rod 44 and slidably engages the guide rod 120.

This construction permits the rod 44 to rock the member 41, while said member is also freely slidable relative to the rod 44. A spring 122 holds the member 41 yieldingly in the left hand position indicated in Figs. 5 and 6. Further movement to the left is prevented by engagement by the bearing 43 of the member 41 with the member 82 fixed on the shaft 44.

The rod 44 is normally maintained yieldingly in mid-position by a pair of springs 123 (Fig. 7) engaging an arm 124 projecting downward from the flanged end 125 of the hub 84 on which the gear 83 is formed.

The member 41 has a rearwardly projecting shoulder 127 (Fig. 10) on which a block 128 is secured, normally engaged by a stop dog 130 (Fig. 8) pivoted on a stand 131 adjustably secured to the table 21 and yieldingly pressed outward by a spring 132.

A second stop dog 140 is pivoted on a stand 141, also adjustably secured to the table 21, and yieldingly pressed outward by a spring 142. The dog 130 is preferably hook-shaped and reversed in position with reference to the dog 140, so that these dogs may be adjusted more closely adjacent to each other when so desired.

The relative position of the block 128 and the dog 130 during the normal grinding operation is as indicated in Fig. 11, with the corresponding position of the contact arm 40 and the stem of the auxiliary valve 33 also indicated.

In Fig. 10, the corresponding relation of the block 128 and the dog 140 is indicated, it being clear that the dog 140 is somewhat

thicker and also projects somewhat further into the path of the block 128.

The block 128 is thus normally engaged by the dog 130 to reverse the travel at right hand limit of movement, and during such normal operation the dog 140 is inoperative.

A third dog 150 (Fig. 8) is mounted on a stand 151 adjustably secured to the table 21 and is yieldingly pressed outward by a spring 152. This dog is shown as being hook-shaped, similar to the dog 130, thus permitting adjustment somewhat closer to the stand 131. The dog 150 is used to bring the table to rest, and co-operates with a special contact block 153 (Fig. 17) under certain conditions of operation.

The contact block 153 is fixed on a projection 154 (Fig. 7) of a member 155 (Fig. 5) slidably and rotatably mounted on the rod 44 and normally held yieldingly against a bearing 156 for the rod 44 on the casing C. The member 155 is pressed yieldingly against the bearing 156 by a spring 157 seated in a recess 158 in the right hand end of the member 155 and engaging a collar 159 secured on the rod 44.

The member 155 has a flange 160 (Fig. 7) projecting forward into alignment with a contact screw 161 on the handle 32. The flange 160 is wide enough to engage the screw 161 in every angular position of the member 155.

A stud 162 is fixed in the flange 160 (Fig. 7) and projects into a notch 163 in the flanged portion 124 attached to and angularly movable with the gear 83, as previously described. This pin-and-slot connection between the member 155 and the gear 83 permits the member 155 to be moved axially of the rod 44 while at all times positioned angularly by the gear 83.

As the flange 160 directly engages the screw 161 on the handle 32, which in turn is directly connected to the main piston valve 30, such engagement will move the main valve to neutral mid-position, stopping the table, instead of causing reversal thereof as occurs when one of the auxiliary valves is engaged and moved.

Operation

Having described the details of construction of my improved machine, I will now describe the preferred operation thereof, having particular reference to Figs. 10 to 17. As previously stated, the flange 160 of the member 155 is aligned with the screw 161 in the handle 32, in every operative angular position of the member 155. Similarly, the contact arm 40 is aligned with the stem of the auxiliary valve 33 in every operative angular position, as indicated in Figs. 11 and 14.

The position of the parts in normal operation is shown in Figs. 10, 11 and 12, the block 128 on the member 41 being engaged by the

dog 130 to reverse the travel at the normal right hand limit thereof, the dog 140 being beyond the range of movement and therefore inoperative, and the dog 150 being out of the path of the block 153 (Fig. 12). In these figures, it is assumed that the handle 88 is standing in its normal upright position, which it occupies during the regular grinding operation.

With the parts thus positioned, the machine will reciprocate at the speed determined by the valve 53, the dog 130 reversing the travel at the right hand limit of movement by causing engagement of the arm 40 with the stem of the valve 33, and the dog 36 (Fig. 9), causing reversal at the left hand limit of movement by engaging the stem of the auxiliary valve 34.

After the rough grinding is completed and it is desired to separate the wheel and the work far enough to carry the wheel past the diamond-point or truing device, the member 41 is rocked by the handle 88 to the position shown in Figs. 13, 14 and 15, in which position the block 128 will clear the dog 130 but will be engaged by the dog 140. The table will therefore be automatically reversed but with a longer range of travel, and at the same time the speed control valve 54 (Fig. 3) will be depressed and locked by the latch 75, thus reducing the rate of travel during the truing and finishing operations. The dog 150 is still out of the path of the block 153.

As soon as the truing is completed, the operator releases the handle 88, which is immediately returned to mid-position by the springs 123 (Fig. 7), and the table 20 will then be reciprocated between the normal limits but at reduced speed, under the control of the dogs 130 and 36, until the finish grinding is completed.

The operator then rocks the handle 88 in the opposite direction, causing the parts to move to the position shown in Figs. 16 and 17, in which the block 128 (Fig. 16) clears the dog 130, permitting the wheel and work to be separated, but in which such separation is limited by engagement of the dog 150 (Fig. 17) with the block 153, thereupon sliding the member 155 on the rod 44 until the handle 32 is brought to mid-position, thus placing the main valve in neutral position and stopping the table travel with the wheel and work separated.

It should be further noted that the rocking of the rod 44 to the position shown in Fig. 16 causes the screw 90 (Fig. 3) to engage the latch 75, releasing the valve 54 and restoring the normal or higher rate of table travel.

The handle 88 is then released, the operator changes the work, and again starts the machine by pulling the handle 32 toward him, thus moving the main valve to one of

its operative positions, after which the usual reciprocation of the table follows.

I have thus provided an extremely simple arrangement by which the operator may decrease the speed and simultaneously increase the table travel for the truing operation by movement of the lever 88 in one direction. He continues the finish grinding at reduced speed but within normal limits of travel by merely releasing the lever 88, and he restores the normal speed and brings the table to rest in a predetermined position by rocking the handle 88 in the opposite direction, after which he may again start the machine in operation by a simple forward movement of the handle 82.

I thus achieve semi-automatic control of a grinding machine so that certain predetermined results will follow simple movements of the operator, without relying in any way upon his judgment or volition in determining the changes in speed which take place or the limits of table travel.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein shown and described, otherwise than as set forth in the claims, but what I claim is:—

1. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, dogs on said table defining different points of reversal of said table, a valve determining the speed of said table, a control member movable to disable one of said dogs and thereby increase the range of travel by a predetermined amount and effective by the same movement to move said valve to reduce the table speed, and means to lock said valve in said reduced speed position.

2. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, dogs on said table defining different points of reversal of said table, a valve determining the speed of said table, and a control member movable to disable one of said dogs and thereby increase the range of travel by a predetermined amount and effective by the same movement to move said valve to reduce the table speed, said control member being also effective by movement in a second direction to cause the table to come to rest in a predetermined position.

3. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, dogs on said table defining different points of reversal of said table, a valve determining the speed of said table, a control member movable to disable one of said dogs and thereby increase the range of travel by a predetermined amount and effective by the same movement to move said valve to reduce the table speed, and means to lock said valve in said reduced

speed position, said control member being also effective by subsequent movement in a second direction to cause the table to come to rest in a predetermined position and to simultaneously release said valve from reduced speed position.

4. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, a control handle and connections between said actuating mechanism and said control handle rendered effective by movement of said handle in one direction to increase the travel and reduce the speed of said table, rendered effective by return movement of said control handle to normal position to restore the original limits of travel while maintaining the reduced speed, and rendered effective by movement in a different direction to cause said table to stop in a predetermined position.

5. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, a control handle and connections between said actuating mechanism and said control handle rendered effective by movement of said handle in one direction to increase the travel and reduce the speed of said table, rendered effective by return movement of said control handle to normal position to restore the original limits of travel while maintaining the reduced speed, and rendered effective by movement in a different direction to cause said table to stop in a predetermined position and to initiate restoration of the original speed adjustment.

6. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, a valve controlling the table speed, valve adjusting means, valve locking means and a single manually operated device effective by one movement to actuate said valve adjusting means to provide a predetermined reduced speed and to cause said locking means to hold said valve locked in such adjusted position when said device is restored to initial position, said device being also effective by movement in the opposite direction from initial position to thereafter actuate said locking means to release said valve, and yielding means to restore said valve to initial position.

7. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, a valve controlling the table speed, valve adjusting means, valve locking means and a single manually operated device effective by one movement to actuate said valve adjusting means to provide a predetermined reduced speed and to cause said locking means to hold said valve locked in such adjusted position when said device is restored to initial position, said device being also effective by movement in the opposite direction from initial position to thereafter actuate said locking means to re-

lease said valve, yielding means to restore said valve to initial position, and additional means to yieldingly maintain said manual device normally in mid-position.

5 8. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, a starting lever therefor, means to increase the travel and reduce the speed, and a second lever movable in one
10 direction to operate said means, and means to stop the table in a predetermined position and initiate restoration of the original speed, said second lever being adapted to control said last means upon movement in a second
15 direction.

9. In a grinding machine, fluid operated mechanism, an inlet valve, a manually controlled rock shaft and connection through which rocking movement of said shaft in one
20 direction from initial position depresses said valve to throttling position, means actuatable by said shaft during said rocking movement to lock the valve in such position, said means being effective to hold it in position when said
25 rock shaft is restored to initial position, and means actuatable by the rock shaft upon movement thereof in the opposite direction from initial position to release said valve, from its locked position.

30 10. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, a control rock shaft, means to yieldingly maintain said rock shaft in mid-position, an actuating handle for said
35 rock shaft, reducing gearing between said handle and said rock shaft, a reversing dog engaged by an abutment mounted on said rock shaft when said handle is in mid-position, a second dog engaged by said abutment
40 when said handle is displaced angularly in one direction, and a stop dog engaged by a second abutment mounted on said rock shaft when said handle is angularly displaced in the opposite direction.

45 11. In a grinding machine, a base, a table movable thereon, fluid actuated mechanism for moving said table, and means to control said mechanism, said means comprising dogs on said table, a manually controlled rock
50 shaft, a contact member slidably mounted on said shaft and manually positioned angularly to engage either one of two dogs to vary the table travel, a second contact member slidably mounted on said shaft and manually
55 movable angularly by movement of said shaft in the opposite direction to engage a third dog, and connections effective to stop the table at a predetermined point upon such engagement of said third dog.

60 In testimony whereof I have hereunto affixed my signature.

ALDEN M. DRAKE.