Dec. 7, 1937. H. H. ASBRIDGE 2,101,383

PRECISION GRINDING MACHINE

Filed Oct. 28, 1936 3 Sheets-Sheet 1

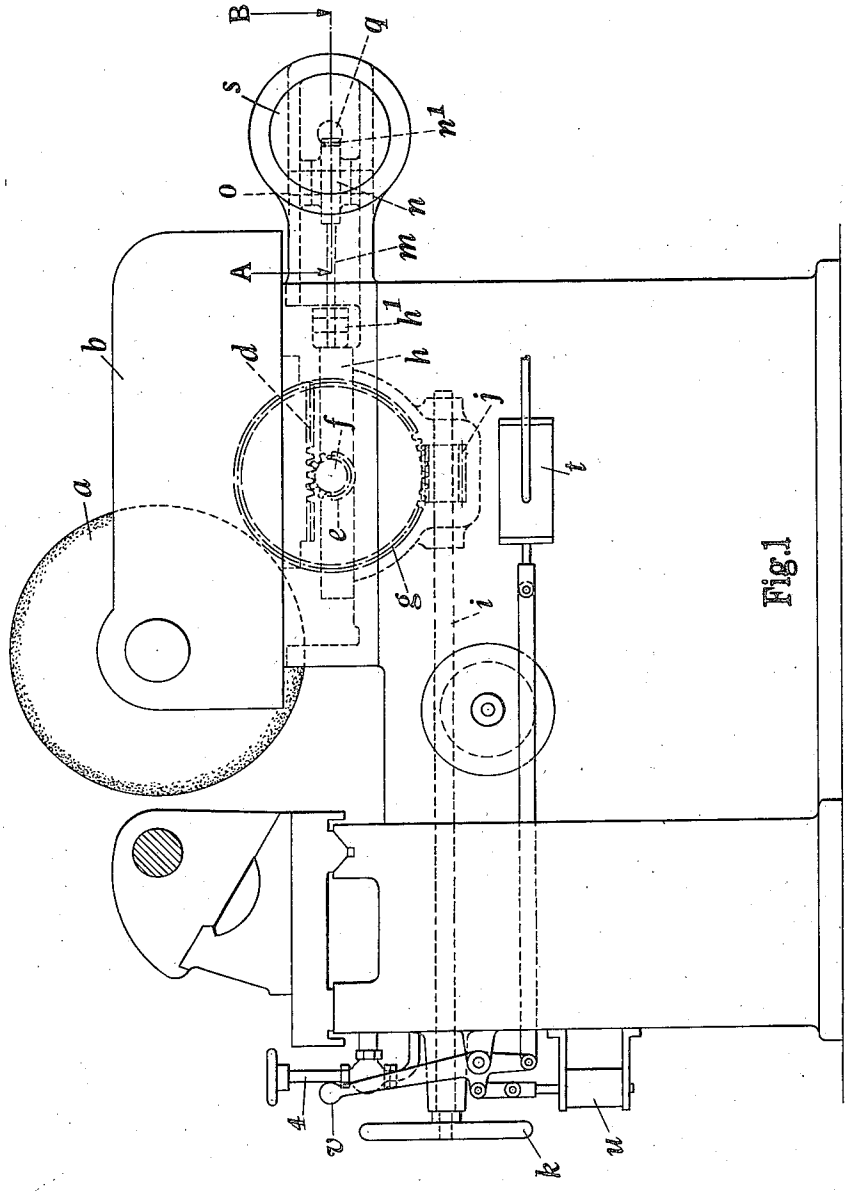


Fig.1

H. H. Asbridge INVENTOR

By Glascock Downing & Seibold ATTYS.

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Filed Oct. 28, 1936 3 Sheets-Sheet 2

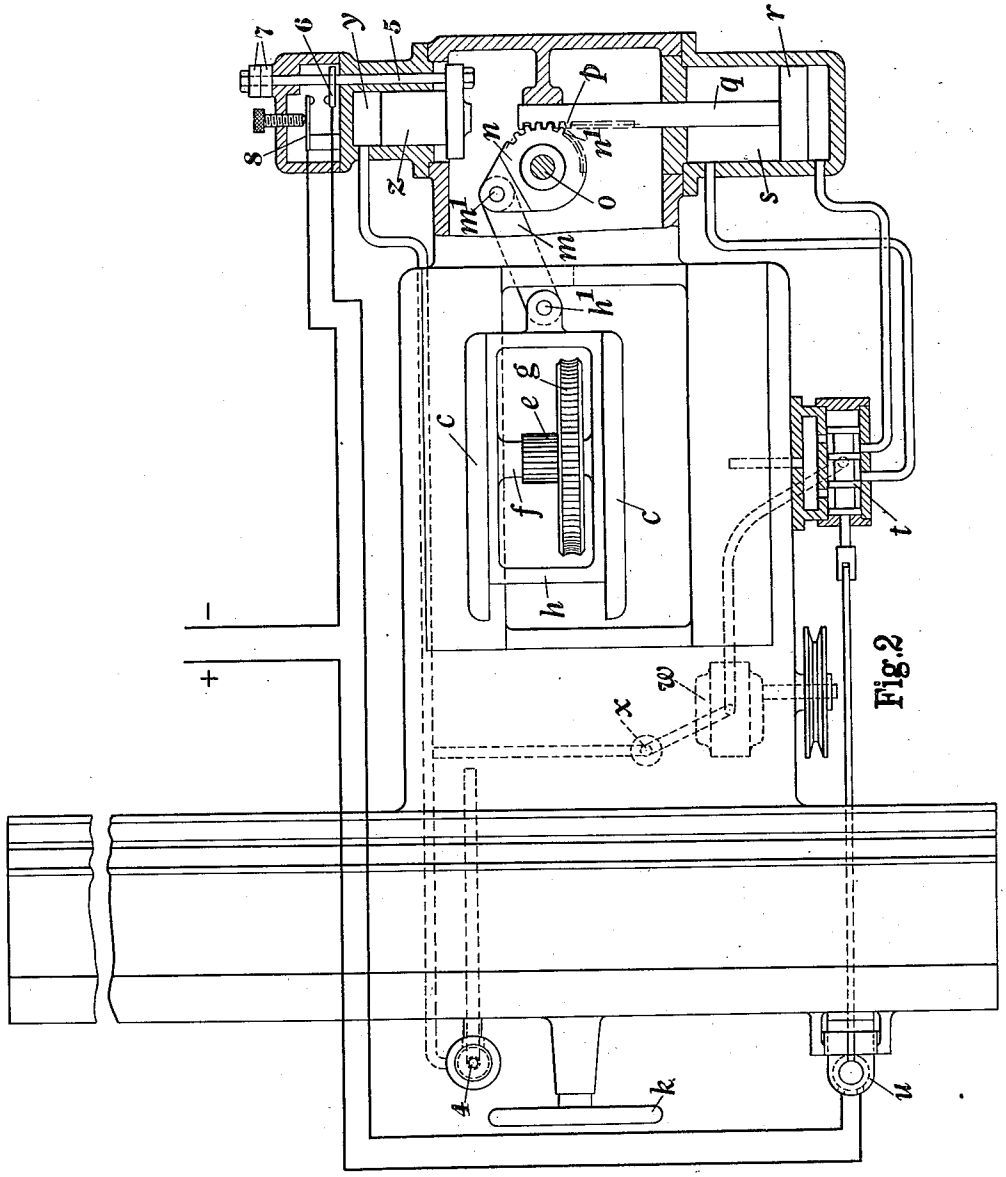


Fig. 2

H. H. Asbridge
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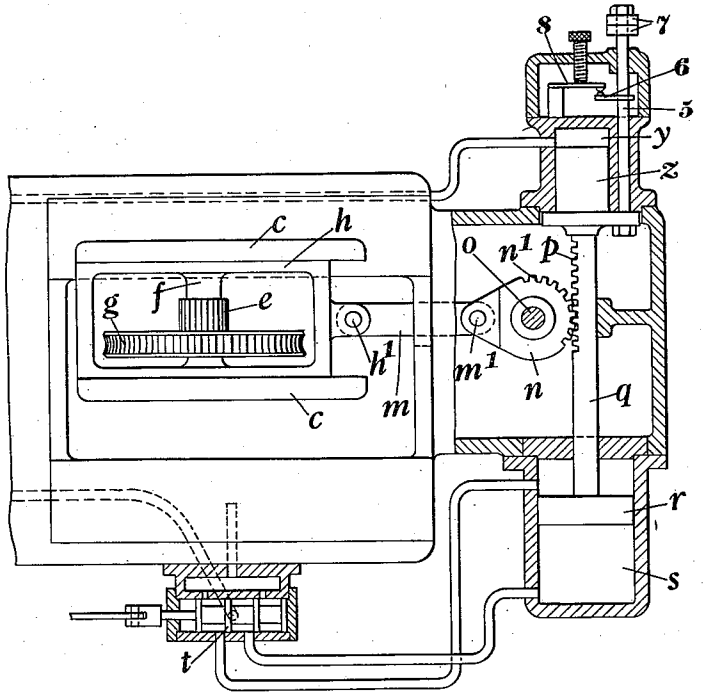


Fig.3

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Patented Dec. 7, 1937

2,101,383

UNITED STATES PATENT OFFICE

2,101,383

PRECISION GRINDING MACHINE

Harry Hales Asbridge, Ashton-on-Mersey, England, assignor to The Churchill Machine Tool Company Limited, Broadheath, near Altrincham, England, a British company

Application October 28, 1936, Serial No. 108,077
In Great Britain November 12, 1935

9 Claims. (Cl. 51—95)

This invention relates to precision grinding machines of the type in which a cylindrical workpiece is ground by the face of a grinding wheel which is moved for feed purposes towards the workpiece surface. The workpiece is carried upon a reciprocating table and the grinding wheel head upon a slide which is moved at right angles to the direction of reciprocation of the said table.

It is known to be desirable to reduce the rate of feed of the grinding wheel onto the workpiece as the work approaches the desired finished size in order to allow the grinding wheel to give a higher degree of finish to the workpiece, to eliminate spring or bending of the work due to pressure from the grinding wheel, and to give a higher degree of accuracy to the finished workpiece owing to all cutting and feed stresses having been eliminated.

Attempts have been made which aim at reducing the amount of feed to the grinding wheel at some point prior to the finished workpiece size being reached in order to obtain the advantages before referred to but such attempts have not been entirely successful.

It is the object of the present invention to provide improved grinding wheel feeding means which attain in a most satisfactory way the advantages before indicated.

My invention comprises the provision between the part which provides the power for imparting feed movements to the grinding wheel head and the latter, of transmission means which give a continuously diminishing rate of feed to the said head for a constant rate of movement of the power operated part.

My invention further comprises the provision of means which when the grinding wheel has contacted or is about to contact with the workpiece, slows down the rate of traverse of the grinding wheel head, the rate of feed of the latter being then at a continuously diminishing rate until the finished size of work is reached.

My invention further comprises imparting feed movements to the grinding wheel head from a hydraulic cylinder with double acting plunger therein, the latter operating through a toggle lever mechanism to move the grinding wheel head, the toggle levers being in line when the feed movement is completed.

The invention further comprises the provision of a dashpot with leak off means for reducing the rate of movement of the hydraulic plunger when the grinding wheel contacts with the workpiece or just prior to such contact.

The invention further comprises the provision of means for the rapid withdrawal of the grinding wheel when the work has reached the finished size.

The invention further comprises the improved automatic feed cycle as hereinafter described.

Referring to the accompanying explanatory drawings:—

Figure 1 is an elevation showing a grinding machine somewhat in diagram form with my improved feed mechanism applied thereto.

Figure 2 is a plan view of the machine shown in Figure 1 with the workhead and grinding wheel head removed, the right hand portion of the figure being a sectional plan on the line AB of Figure 1.

Figure 3 is a view showing a part of Figure 2 but with the feed motion at the limit of its traverse.

a indicates the grinding wheel mounted upon the head *b* which is carried by slideways *c* and has a rack *d* thereon at its underside engaged by a pinion *e* secured upon a shaft *f* to which is secured a worm wheel *g*. The shaft *f* is journalled in a frame or slide *h* which also carries the bearings of a shaft *i* on which is splined a worm *j* meshing with the worm wheel *g*. There is a hand wheel *k* upon the shaft *i* and this can be turned to move the grinding wheel head for setting purposes.

The frame or slide *h* is pivotally connected to a link *m* which is pivotally connected to a member *n* which turns freely about a fixed shaft *o*. The member *n* at the part n^1 thereof constitutes a toothed quadrant which is engaged by a rack *p* upon the rod *q* of the double acting hydraulic piston *r*. Hydraulic fluid is supplied to the cylinder *s* containing such piston by the valve *t* which can be operated by a solenoid *u* and by a handle *v*. The pressure fluid is obtained from a gear type pump *w* which also through a non-return valve at *x* maintains a pressure in a cylinder *y* in which is a piston *z* which can move outwards to a limited extent as shown in Figure 2 when it can be engaged by the end of the racked rod *q* when it acts to slow down the rate of movement of the rod. A leak-off valve at 4 determines the rate at which the piston *z* moves under the pressure of the racked rod *q*. The piston *z* and cylinder *y* with the leak-off valve 4 act as a controlled dashpot device with respect to the movement of the piston *r* and racked rod *q*.

Attached to the head of the piston *z* is a rod 5 which carries an electric contact 6 and has thereon adjustable collars or nuts 7 which serve to limit the outward movement of the piston *z* under

the pressure of the fluid in the cylinder *y*. Associated with the movable contact **6** is a fixed contact **8**, the two contacts being in an electric circuit containing the solenoid *u*.

The operation of the mechanism is as follows:—

In Figure 2, the parts are in the positions they occupy when the grinding wheel head is withdrawn from the work head to its full extent as allowed by the piston *r*, rack *p*, quadrant n^1, member *n*, link *m*, frame *h*, pinion *e* and rack *d*.

The valve *t* is now moved by the handle *v* to cause fluid to pass to the lower side of the piston *r* in Figure 2. The piston starts to move upwards and turns (through the rack *p* and quadrant n^1) the member *n* so as to bring the pivotal connection m^1 between the link *m* and part *n* move into line with the axes of the pivotal connection h^1 between the frame *h* and link *m* and of the shaft *o*. At first due to the angular relationship of the pin m^1 to the parts h^1 and *o*, the frame will be moved fairly rapidly relatively to the rod *q* but as the pin m^1 comes more into line with the parts h^1 and *o* its rate of movement will fall relatively to the piston rod *q* as will be readily understood until it is a minimum or zero in the Figure 3 position. Before the piston rod *q* reaches the Figure 3 position, it engages the head of the piston *z* which slows down the rate of movement of the piston *r*. The rod *q* is timed to engage the dashpot piston *z* at about the time when the grinding wheel makes contact with the workpiece. When the piston is pressed fully in, the contact **5** engages the contact **6** and the solenoid *u* is energized with the result that it reverses the valve *t* and the piston *r* is moved back to its initial position. The pressure in the cylinder *y* will then assist the piston *r* and give a quick return to the grinding wheel head.

What I claim is:—

1. Means for imparting feed movements to a grinding wheel head comprising a hydraulic cylinder, a double acting plunger therein, toggle mechanism operated by said plunger, a slide, a grinding wheel on said slide, said slide being moved by said toggle mechanism, a dashpot, and means to bring said dashpot into operation to slow down the travel of said plunger at a predetermined point in the travel of the latter.

2. Means for imparting feed movements to a grinding wheel head as claimed in claim 1, having means to supply hydraulic fluid under pressure to the dashpot specified and a leak off from the said dashpot.

3. Means for imparting feed movements to a grinding wheel head comprising a hydraulic cylinder, a double acting plunger therein, a rack moved by said plunger, a rack pinion moved by said rack, a crank moved by said rack pinion, a connecting rod secured to said crank and to said grinding wheel head, a dashpot, a plunger therein and an abutment movable with said dashpot plunger and so positioned as to be contacted by said rack at a predetermined point in the travel of the latter and to slow down the rate of travel thereof.

4. Means for imparting feed movements to a grinding wheel head as claimed in claim 3, having means to supply hydraulic fluid under pressure to the dashpot specified and a leak off from the said dashpot.

5. Means for imparting feed movements to a grinding wheel head comprising a hydraulic cylinder, a double acting plunger therein, a rotary member arranged for rotation on movement of said plunger, a linearly movable member movable with said grinding wheel head, means coupling said rotary member to said linearly movable member to impart a continuously diminishing rate of linear movement thereto for constant rate rotary movement of said rotary member, together with a dashpot, a plunger therein and an abutment movable with said dashpot plunger so disposed as to be contacted by one of the movable parts previously specified at a predetermined point in the travel thereof.

6. Means for imparting feed movements to a grinding wheel head as claimed in claim 5, having means to supply hydraulic fluid under pressure to the dashpot specified and a leak off from the said dashpot.

7. Means for imparting feed movements to a grinding wheel head as claimed in claim 1, having means to supply hydraulic fluid under pressure to the dashpot specified and a leak off from the said dashpot, together with a reversing valve to control the flow of fluid to said hydraulic cylinder, electromagnetic means to control said valve, a switch to control said electromagnetic means and means to operate said switch actuated by movement of said dashpot plunger.

8. Means for imparting feed movements to a grinding wheel head as claimed in claim 3, having means to supply hydraulic fluid under pressure to the dashpot specified and a leak off from the said dashpot, together with a reversing valve to control the flow of fluid to said hydraulic cylinder, electromagnetic means to control said valve, a switch to control said electromagnetic means and means to operate said switch actuated by movement of said dashpot plunger.

9. Means for imparting feed movements to a grinding wheel head as claimed in claim 5 having means to supply hydraulic fluid under pressure to the dashpot specified and a leak off from the said dashpot, together with a reversing valve to control the flow of fluid to said hydraulic cylinder, electromagnetic means to control said valve, a switch to control said electromagnetic means and means to operate said switch actuated by movement of said dashpot plunger.

HARRY HALES ASBRIDGE.