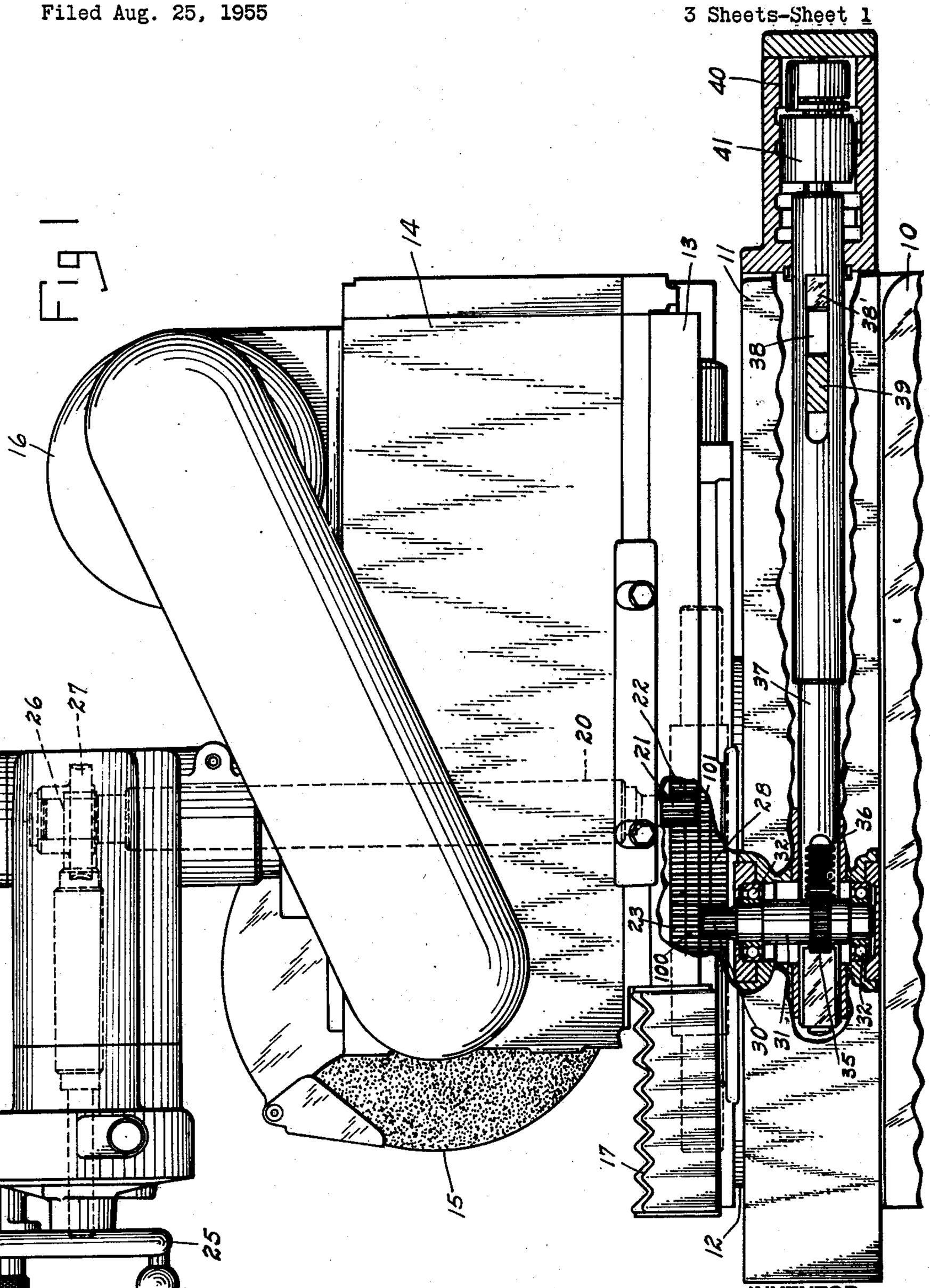
Sept. 2, 1958 A. J. JONES 2,849,843

FEED MECHANISM

Filed Aug. 25, 1955

3 Sheets-Sheet 1

Fig 1



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FEED MECHANISM

Filed Aug. 25, 1955 3 Sheets-Sheet 2

Fig 2

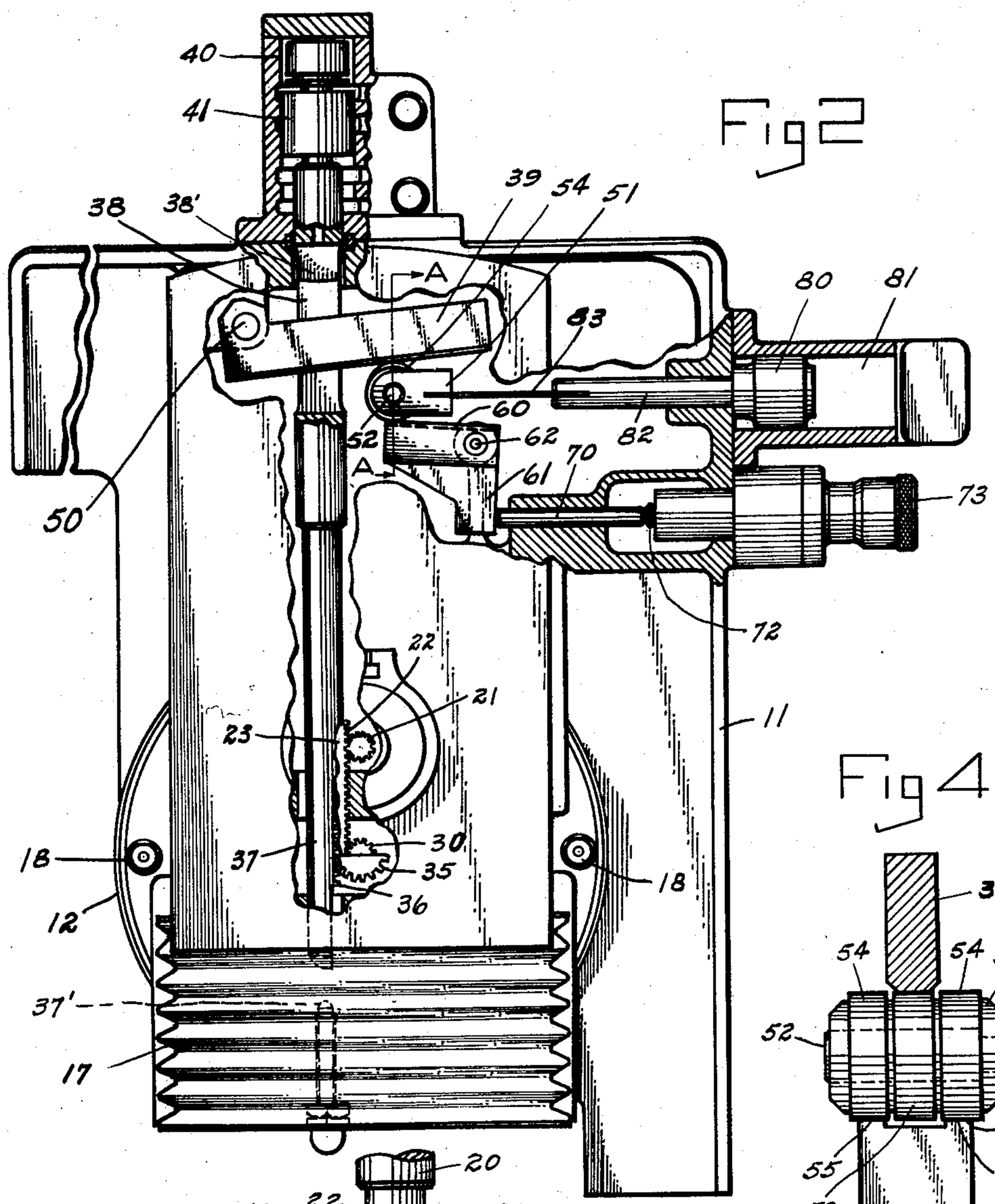

Fig 3

Fig 4

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Sept. 2, 1958 A. J. JONES 2,849,843

FEED MECHANISM

Filed Aug. 25, 1955 3 Sheets-Sheet 3

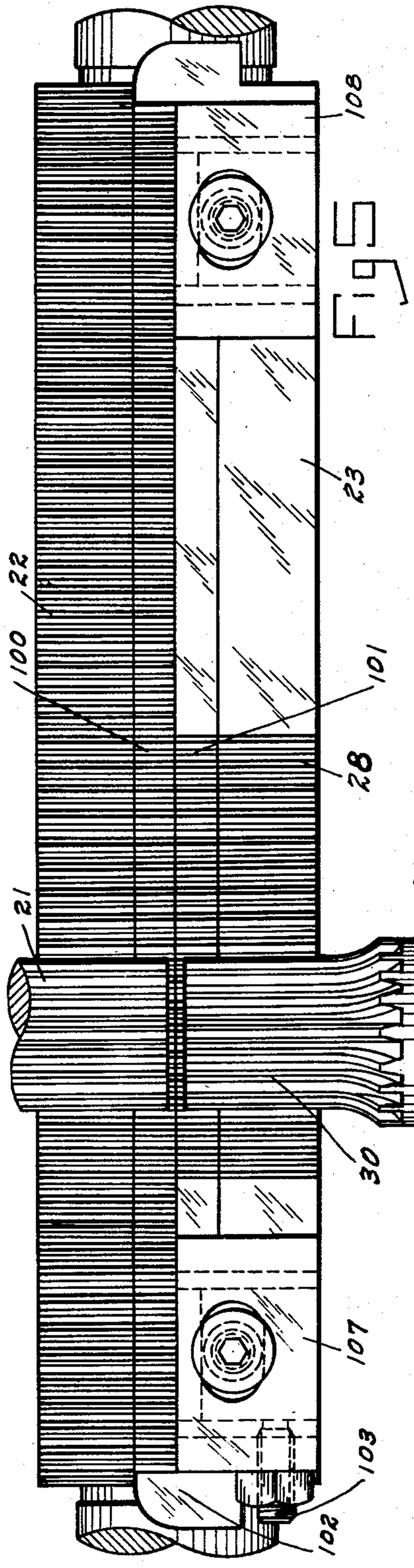

Fig. 5

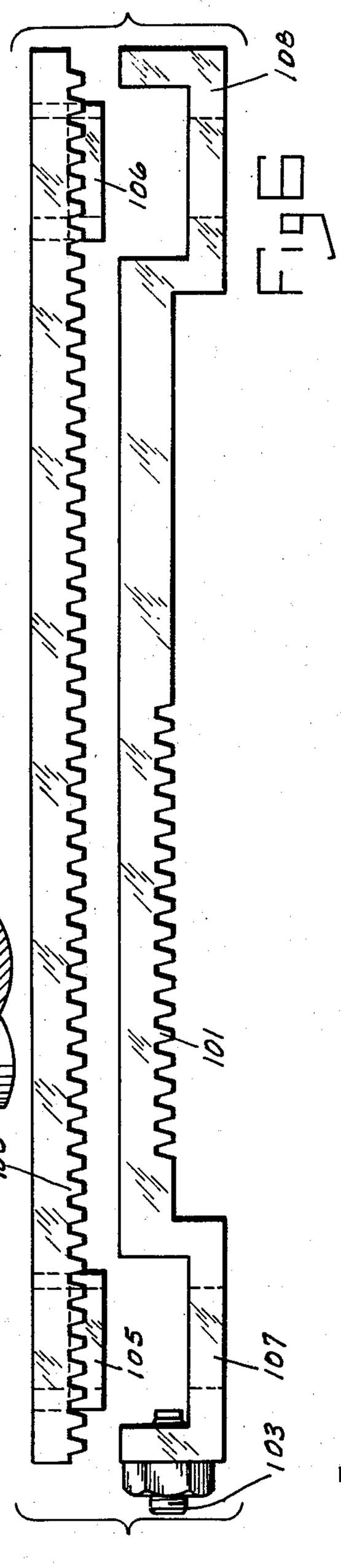

Fig. 6

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United States Patent Office

2,849,843

Patented Sept. 2, 1958

2,849,843

FEED MECHANISM

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Application August 25, 1955, Serial No. 530,465

7 Claims. (Cl. 51—165)

Most feed mechanisms for grinding machines in recent years have consisted of some combination of feed screw and nut with power means to effect relative rotation and hence a feeding movement between them.

Another type of feed mechanism not so generally used consisted of a sliding wedge in engagement with a portion of the feed mechanism so that as the wedge was shifted, the feed mechanism was permitted to advance.

Both of these types of feed have one thing in common: They have a substantial surface contact between moving parts which requires a corresponding application of power to overcome friction and effect the feed movement.

It is an object of this invention to provide a feed mechanism for a grinding machine wherein friction between coacting parts is reduced to a minimum.

It is another object of this invention to provide a slow feed mechanism wherein all contact between moving parts is reduced to line contact.

A further object is to provide a feed mechanism wherein the co-acting surfaces are free of lubricant and therefor have metal-to-metal contact with the corresponding freedom from variation common to surfaces which are necessarily separated by a film of lubricant.

Another object is to provide means for adjusting both the rate and the extent of grinding feed.

Another object is to provide means for applying power feed to the wheel base of a universal grinding machine.

Another object is to provide a feed mechanism which the power feed element and the manual adjustment for the wheel support function through a common rack.

In the drawings:

Figure 1 is an end elevation partly in section.

Figure 2 is a plan view partly cut away to show essential details.

Figure 3 is a partial front elevation showing the relation between certain elements of the feed mechanism.

Figure 4 is an end elevation partly in section, showing in detail, the relation between the co-acting elements of the feed control device.

Figure 5 is a right hand end view of the rack and pinion combination for actuating the wheel base.

Figure 6 is a plan view of the auxiliary racks shown as being spaced from one another but in the longitudinal relation in which they are assembled.

Numeral 10 indicates a bed and 11 an intermediate support mounted on said bed. Said member 11 is provided with a finished circular surface 12 on which is mounted a wheel slide 13 having a mating circular surface 12, and on which said wheel slide may be angularly adjusted and to which it may be clamped by nuts 18. Wheel base 14 is slidably mounted on said slide member. Grinding wheel 15 is rotatably mounted on said wheel base 14 and driven by a motor 16 also mounted on wheel base 14. The front portion of the guide surfaces on slide 13 are protected by an accordion-type guard 17 which may be mounted in any suitable manner. Wheel base 14

may be manually fed or adjusted on said slide 13 by means of a conventional hand operated mechanism consisting of a vertical shaft 20 having a pinion 21 at the lower end thereof. Said pinion engages teeth 22, which extend the full length of the upper portion of rack 23. Said rack has two cylindrical end portions which are slidably mounted in suitable bearings in slide member 13. Vertical shaft 20 is connected to hand wheel 25 through gearing which consists of a worm 26 in engagement with a worm wheel 27 on the upper end of said vertical shaft. Said worm 26 may be rotated by hand wheel 25 to advance or retract wheel base 14 on the guide surfaces of slide 13 by engagement between pinion 21 and rack teeth 22. Said rack is held stationary during such adjustment by engagement of the lower teeth 28 thereon with a fixed pinion 30 on the upper end of shaft 31. Said teeth extend over a shorter distance than teeth 28. Both sets of teeth are in alignment. Said shaft 31 is rotatably mounted in fixed bearings 32 in support member 11. Pinion 35 on shaft 31 engages rack 36 on feed shaft 37. Said shaft is mounted for axial movement in member 11. Means for effecting said axial movement consists of a cylinder 40 formed at the right hand end of member 11 and having a piston 41 slidably mounted therein and attached to or formed on the end of feed shaft 37. Since member 11 is attached more or less permanently to the bed it is, in effect, a part of the bed so far as the hydraulic feed motors are concerned.

Feed shaft 37 has a slotted portion 38 through which a bar 39 extends. Said bar is pivotally mounted at 50 so that when shaft 37 is shifted axially by piston 41, one end of the slot 38 engages bar 39 causing it to rotate on its pivot 50. Bar 39, when so rotated, engages a roller member consisting of a roller support 51 in which is mounted a roller shaft 52. Said roller shaft has three rollers rotatably mounted thereon, a center roller 53 and two end rollers 54. Roller 53 is adapted to engage the front side of bar 39. Rollers 54 are adapted to engage the spaced tracks 55 on the surface 60 of a feed control member 61. Said member is pivotally mounted at 62 and may be adjusted on said pivotal mounting to present tracks 55 to rollers 54 as either a horizontal or an inclined surface. The means for effecting such an adjustment consists of a pin 70 slidably mounted in support member 11 and adapted to engage the front end of feed control member 61. The other end of said pin is in position to be engaged by a screw 72 which may be turned for adjustment of member 61 in a clockwise direction by knob 73. Roller support 51 may be shifted across surface 60 by means of a piston 80 slidably mounted in cylinder 81 and having a piston rod 82 attached to said roller support by means of a resilient member 83. Said resilient member leaves the roller support free to move out of line with piston rod 82.

Operation

Fluid under pressure from any suitable source is introduced alternately to opposite ends of cylinder 40 to effect movement of piston 41 and feed shaft 37. Rack teeth 36 on said shaft engage pinion 35 on shaft 31 rotating same and also pinion 30 on the upper end of said shaft. Said pinion 30 engages lower teeth 28 on rack 23. Rotation of pinion 30 shifts rack 23 and through upper teeth 22 in engagement with pinion 21 on the manual feed shaft 20, wheel base 14 moves with said rack.

The rapid movement of piston 41 is cushioned by a conventional cushioning device (not shown) at substantially the same time that the curved upper surface 38' of slot 38 engages pivoted bar 39. The front side of said bar engages roller 53 on shaft 52. The rollers 54 on either side of rollers 53 on the same shaft are pressed

against tracks 55 on the surface 60 of adjustable feed control member 61. Said roller is moved horizontally by introducing fluid under pressure into the left end of cylinder 81 and shifting piston 80 to the right. As the rollers 54 move along the tracks 55 the feed shaft is permitted to feed the wheel support through a distance equal to the amount of inclination of the tracks 55. The feed movement stops when the end of feed shaft 37 engages a positive stop 37' which has a curved surface. It should be noted that the curved surface 38' co-acts with the upper surface of member 39. The curved surfaces of rollers 53 and 54 co-act with the under surface of member 39 and the spaced upper surfaces 55 of member 61 respectively. The end of feed shaft 37 engages a curved positive stop 37'. In each case, the point or line contact serves to penetrate any lubricant film to maintain an unchanging metal to metal contact at all points.

The means for taking up back-lash between pinions 21 and 30 consists of auxiliary upper and lower rack members 100 and 101 adjustably mounted in a slot 102 in rack 23. Said upper auxiliary member has end portions 105 and 106 interlocked with end portions 107 and 108 of said lower auxiliary rack members by allowing sufficient clearance to permit relative longitudinal adjustment for removing back-lash. Each of said end portions has a slotted opening through which a screw passes to attach said auxiliary rack members to main rack 23. An adjusting screw 103 threaded in the end portion 107 of one of said auxiliary rack 101 and bearing against the end portion 105 of the other auxiliary rack 100 serves as a means for shifting said auxiliary rack members in opposite directions so as to take up lost motion between the respective pinions.

For taking up back-lash between rack 36 and pinion 35 any of the conventional mechanisms provided for this purpose will be satisfactory.

I claim:

1. In a grinding machine, a bed, a grinding wheel support slidably mounted on said bed, a grinding wheel rotatably mounted on said support, means for feeding said wheel for a grinding operation including a hydraulic motor comprising a piston and cylinder, one of which is attached to said bed, the other of which is operatively connected to said wheel support to provide a rapid positioning movement of said wheel toward a workpiece, means to change said rapid movement to a grinding feed including a feed control cam having a linear surface, means for adjusting said surface to different angles, a follower member movable along said surface, means for moving said follower, and means actuated by said hydraulic motor for engaging said follower.

2. In a grinding machine, a bed, a grinding wheel support slidably mounted on said bed, a grinding wheel rotatably mounted on said support, means for feeding said wheel for a grinding operation including a hydraulic motor comprising a piston and cylinder, one of which is attached to said bed, the other of which is operatively connected to said wheel support to provide a rapid positioning movement of said wheel toward a workpiece, means to change said rapid movement to a grinding feed including a feed control cam having a linear surface, means for adjusting said surface to different angles, a follower member movable along said surface, means for moving said follower, and means actuated by said hydraulic motor for engaging said follower.

3. In a grinding machine, a bed, a grinding wheel support slidably mounted on said bed, a grinding wheel rotatably mounted on said support, means for feeding said wheel for a grinding operation including a hydraulic motor comprising a piston and cylinder, one of which is attached to said bed, the other of which is operatively connected to said wheel support to provide a rapid positioning movement of said wheel toward a workpiece, means to change said rapid movement to a grinding feed including a feed control cam pivotally mounted on said bed and having a linear operative surface, precision means for angularly adjusting said cam whereby to change the rate of said grinding feed, a follower member movable along said cam and means for moving same, and means actuated by said motor for engaging said follower.

4. In a grinding machine, a base, a feed mechanism comprising a rack slidably mounted in said base, a motor for moving said rack comprising a piston and cylinder, an intermediate slide member mounted on said base for angular adjustment thereon in a horizontal plane and having spaced guide members thereon, a rack slidably mounted in said intermediate member, connections between said first mentioned rack and said second mentioned rack including a vertical shaft, spaced pinions on said shaft, one for engaging each of said racks, a wheel support slidably mounted on said intermediate member and an adjustable connection between said wheel support and said rack in said intermediate member.

5. In a grinding machine, a base, a feed mechanism comprising a rack slidably mounted in said base, a motor for moving said rack comprising a piston and cylinder, an intermediate slide member mounted on said base for angular adjustment thereon in a horizontal plane and having spaced guide members thereon, a rack slidably mounted in said intermediate member, connections between said first mentioned rack and said second mentioned rack including a vertical shaft, spaced pinions on said shaft, one for engaging each of said racks, a wheel support slidably mounted on said intermediate member and an adjustable connection between said wheel support and said rack in said intermediate member including a pinion for engaging said rack and manually operated means for rotating said pinion to adjust the position of said wheel support on said intermediate member.

6. In a grinding machine, a base, a feed mechanism comprising a rack slidably mounted in said base, a motor for moving said rack comprising a piston and cylinder, an intermediate slide member mounted on said base for angular adjustment thereon in a horizontal plane and having spaced guide members thereon, a rack slidably mounted in said intermediate member and having upper and lower teeth, connections between said first mentioned rack and said second mentioned rack including a vertical shaft, spaced pinions on said shaft, one for engaging each of said racks, a wheel support slidably mounted on said intermediate member and an adjustable connection between said wheel support and said rack in said intermediate member including a shaft extending vertically through said wheel support and having a pinion on the lower end thereof to engage said rack, and means for eliminating back-lash between the two pinions engaging said rack including a longitudinal groove between said upper and lower rack teeth, a pair of auxiliary rack members slidably mounted in said groove, one in engagement with said upper pinion and the other in engagement with said lower pinion and means for effecting adjustment between said auxiliary racks in opposite directions whereby to take up back-lash between said upper and lower pinions.

7. In a grinding machine, a base, a feed mechanism in said base, an intermediate slide member mounted on said base for angular adjustment thereon in a horizontal plane and having spaced guide members thereon, a rack slidably mounted in said intermediate member and

having upper and lower teeth, connections between said feed mechanism and said rack including a vertical shaft, a pinion on said shaft for engaging said lower rack teeth, a wheel support slidably mounted on said intermediate member and an adjustable connection between said wheel support and said rack in said intermediate member including a shaft extending vertically through said wheel support and having a pinion on the lower end thereof to engage said rack and shift said wheel support relative to said rack, and means for eliminating back-lash between the two pinions engaging said rack including a longitudinal groove between said upper and lower rack teeth, a pair of auxiliary rack members slidably mounted in

said groove, one in engagement with said upper pinion and the other in engagement with said lower pinion and means for effecting adjustment between said auxiliary racks in opposite directions whereby to take up back-lash between said upper and lower pinions.

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