

Jan. 1, 1946.

J. M. FENNER ET AL

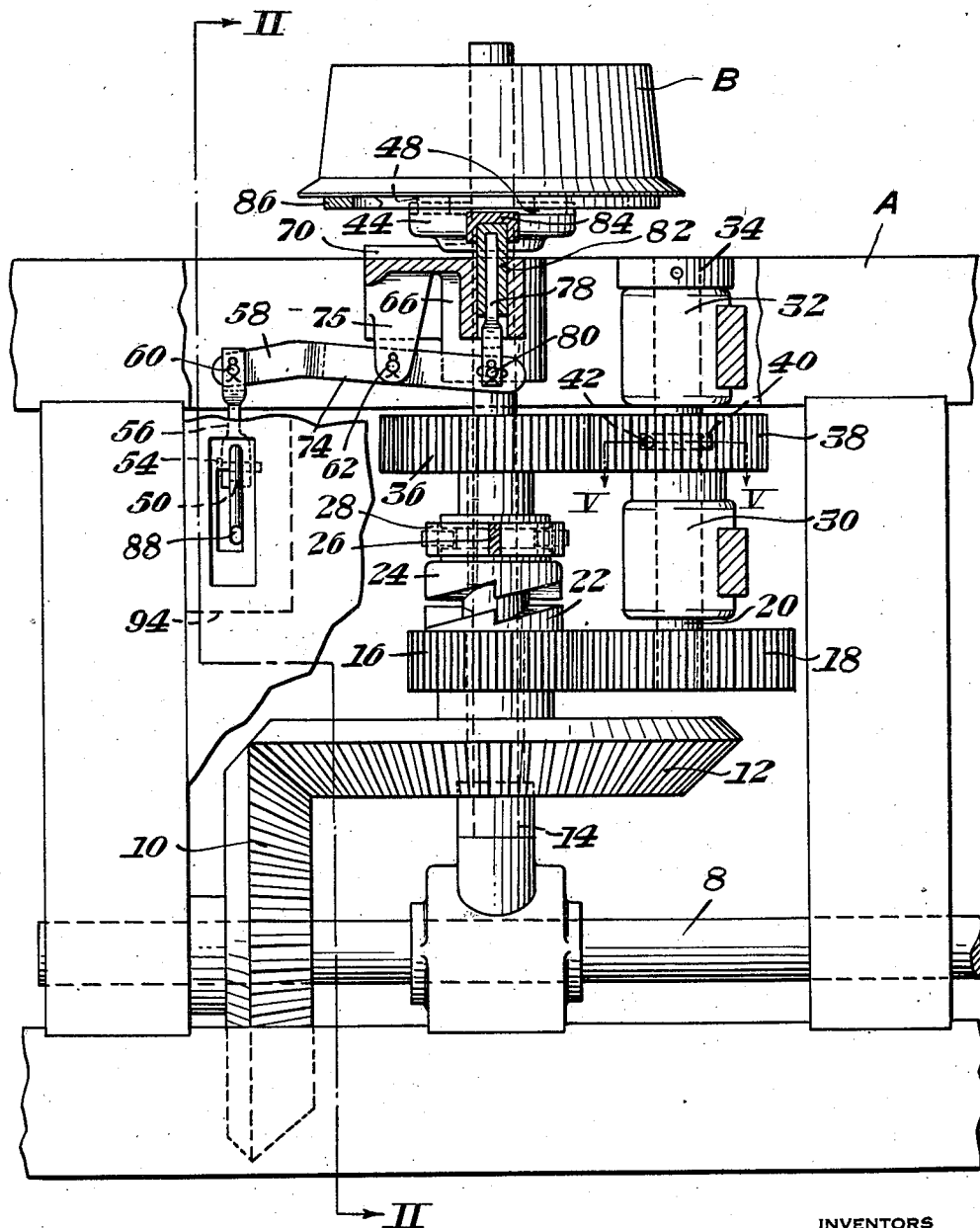
2,391,957

WIRE-DRAWING BLOCK

Filed Nov. 6, 1943

3 Sheets-Sheet 1

Fig. 1.



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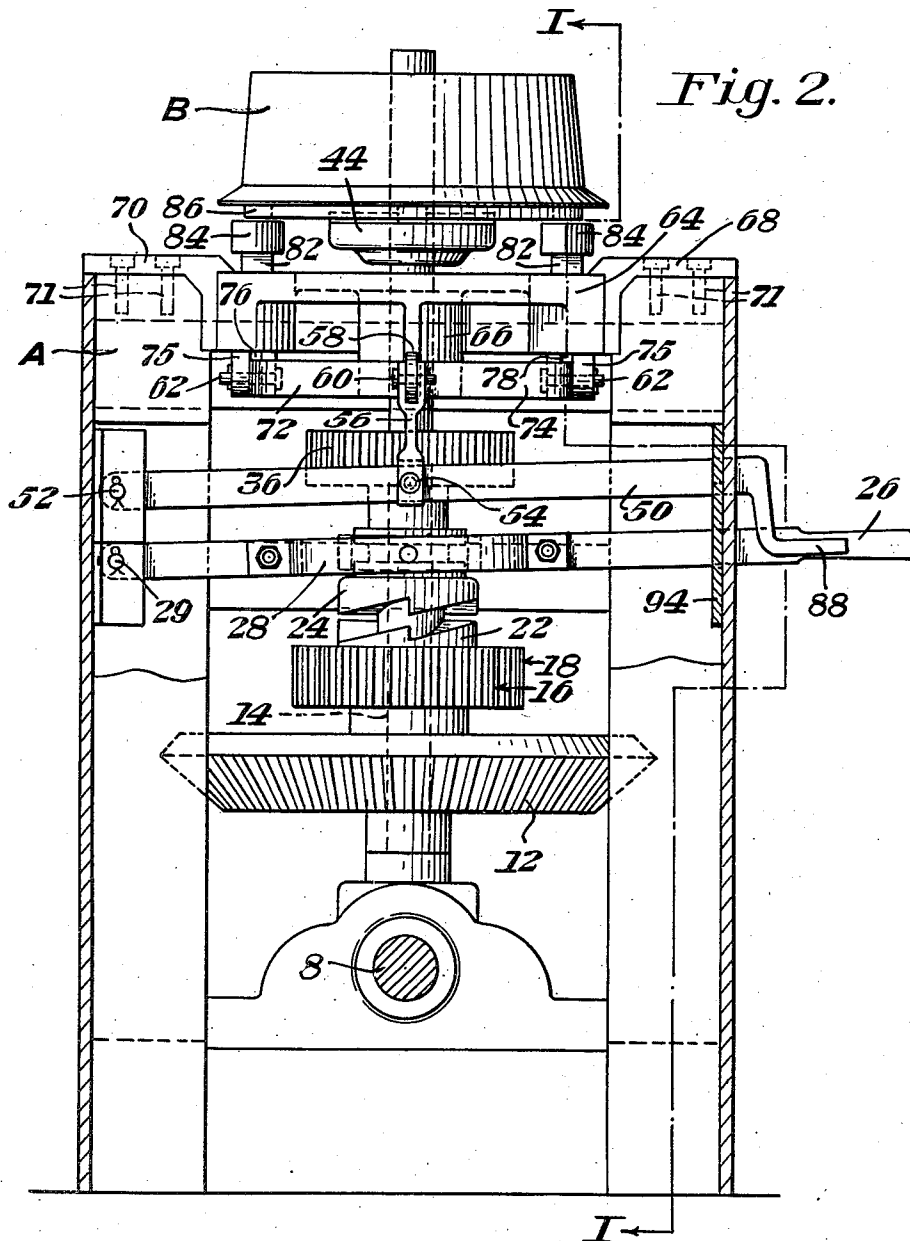
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

*Fig. 3.*

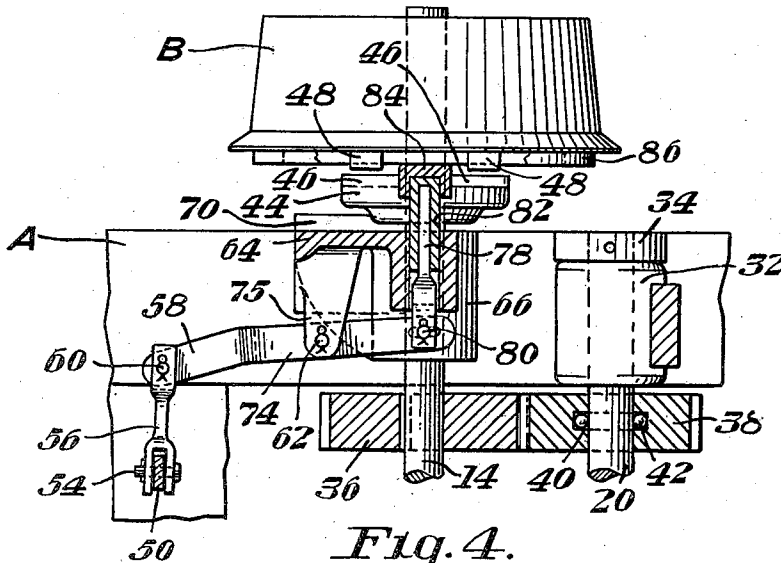


*Fig. 4.*

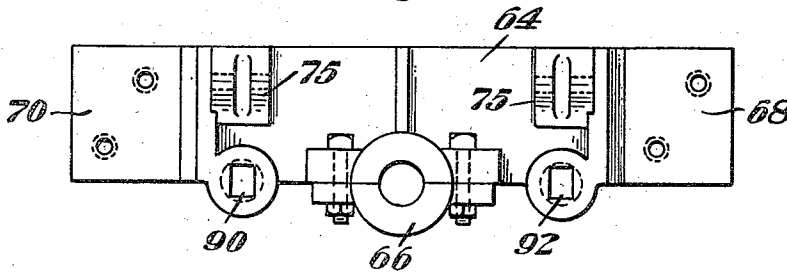


*Fig. 5.*

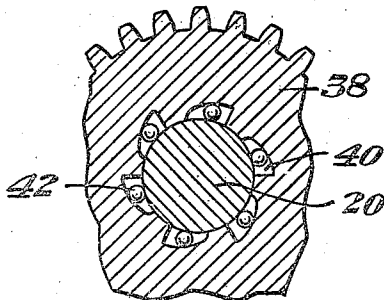
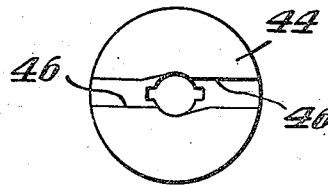


*Fig. 6.*



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## UNITED STATES PATENT OFFICE

2,391,957

## WIRE-DRAWING BLOCK

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Application November 6, 1943, Serial No. 509,266

6 Claims. (Cl. 205—20)

In wire or rod drawing operations, the work being drawn customarily is pulled through the drawing dies by means of a rotary power-driven block upon which the drawn wire or rod is wound as it is pulled through the dies, the output from the dies being determined and limited by a number of factors, one of which is the speed at which the work is drawn through the dies, which speed is determined by the acceleration of the drawing block from zero to maximum speed thereof. If this acceleration is too high, the wire will break before the block reaches its maximum speed, or where the operating speed is slow, output is reduced, this being the usual circumstance.

In accordance with the present invention, there are provided certain improvements in the construction of driving mechanism for a drawing block, whereby the output of the drawing operation is very substantially increased, and the block can be operated at a much higher speed than formerly, but without danger of breaking the wire during acceleration of the block to the higher speed.

In general, it may be noted that for simplicity and economical maintenance, a jaw clutch is used in the conventional practice to start the block. But a jaw clutch starts a block almost instantly, so that, therefore, the maximum speed that wire can be drawn in this manner is comparatively low. Accordingly, in accordance with the present invention, to obtain a higher speed, mechanism has been developed whereby the block is brought to full speed by two successive steps as will become apparent hereinafter.

The present invention will be more readily understood by reference to the accompanying drawings, in which:

Figure 1 represents a side elevational view, partly in section, of a slow starting high speed block embodying the improvements of the present invention, the view being taken substantially on line I—I of Figure 2;

Figure 2 is a further sectional elevation of the improved mechanism, the view being taken on the line II—II of Figure 1;

Figure 3 is a fragmentary sectional elevation similar to the upper part of the mechanism of Figure 1, but showing the draw block disengaged from its driving connection;

Figure 4 is an inverted plan view of the cross-piece which forms an upper bearing for the drive shaft and connection for raising and lowering the draw block into and out of engagement with its driving means;

Figure 5 is a detailed sectional plan view of a

clutch for driving one of the power-transmission gears, the view being taken on the line V—V of Figure 1, looking in the direction of the arrows; and

5 Figure 6 is a plan view of a clutch member employed for driving the draw block.

Referring more particularly to the drawings, the reference character A represents a frame on which is mounted a block B for pulling wire through drawing dies.

10 Customarily, the drawing block B operates at a single speed, the acceleration to this speed being sufficiently slow to avoid breaking the wire being drawn.

15 A drive shaft 8 is shown carrying a bevel gear 10, the shaft 8 being driven from a suitable source of power (not shown). The gear 10, in turn, meshes with a bevel gear 12 which is mounted on a spindle 14 and is freely rotatable around the said spindle, so that the gear 12 is rotating continuously and independently of the spindle.

20 The gear 12 has a spur gear 16 mounted on it, the spur gear 16 being shown as an integral part of the bevel gear 12. The spur gear 16 meshes with a spur gear 18 mounted on a countershaft 20 and keyed to the shaft so that the gear 18 and shaft 20 are rotating continuously with the gears 10 and 12.

30 Gear 16 carries a spiral clutch member 22, while the spindle 14 has keyed to it for vertical movement as well as rotation with the spindle, the complementary spiral clutch member 24, which is controlled by a lever 26 and yoke 28, the lever being pivoted to the rear of the frame A at point 29.

35 The spindle 14 carries the block B through suitable clutch instrumentalities which will be referred to in greater detail hereinafter, engagement of such clutch instrumentalities as well as engagement of clutch members 22 and 24 causing the block B to be rotated at high speed, which is the speed of rotation of the shaft 8 and gears 12 and 16.

40 As shown, the gear 18 is larger than the gear 16, and is keyed to the countershaft 20. The countershaft 20 rotates in bearings 30, 32 and is surmounted by a ring 34 suitably secured to the shaft for rotation therewith, this ring riding on top of the bearing 32, thereby suspending the countershaft 20 and maintaining the countershaft in place.

45 The spindle 14 also carries a gear 36 which is keyed to the spindle for vertical movement with the spiral clutch member 24. Gear 36 is shown

as being the same size and with the same number of teeth as gear 18, and meshes with gear 38 on countershaft 20, gear 38 being shown as being the same size and with the same number of teeth as gear 16.

This arrangement is such that the block B can be started at slow speed, the speed reduction being effected through gears 16, 18, 38 and 36, the clutch members 22 and 24 being disengaged.

The gear 38 is releasable from shaft 20 through the provision of a one-way friction clutch which consists of a plurality of eccentric pockets 40 in the surface of the gear 38 in which are disposed balls 42 which are of suitable hardness, as well as are the pockets 40, to withstand operating pressures. At slow starting speeds the balls 42 are retained in the constricted portions of the pockets 40, forming a drive connection between the shaft 20 and gear 38, which connection is broken responsively to engagement of clutch members 22 and 24, which engagement accelerates gear 36 and causes gear 38 to turn faster than the countershaft 20.

When this occurs, the balls 42 are caused to move outwardly into the enlarged portions of the pockets 40, thereby breaking the drive connection between gear 38 and countershaft 20, thereby permitting the resulting relative movement therebetween.

It has been noted above that the block B is controlled by a clutch mechanism, this mechanism enabling the block to be stopped independently of the remainder of the mechanism. This clutch mechanism includes a disk 44 which is rotatably mounted on the spindle 14, and is fixed thereto, the disk 44 having a shoulder 46 thereon for engagement with lugs 48 on the under surface of the block B.

The block B is lowered and raised into and out of engagement with the rotating disk 44 by means of a foot treadle lever 50 which is attached to the rear of frame A at the pivot 52, this pivot enabling the lever 50 to swing vertically up and down. Midway of the lever 50, at point 54 there is pivotally attached a connecting link 56, which link is attached to a rocker lever 58 at connection 60. The lever 58 is hinged at points 62 on cross-piece 64. This cross-piece 64 is a casting which has a portion 66 which serves as a vertical bearing support for spindle 14. The cross-piece 64 is supported on the rear and front sides of the wire-drawing frame by arms 68 and 70 held in place by screws 71.

The rocker lever or yoke 58 is a U-shaped member having arms 72 and 74 which are pivoted at points 62 to brackets 75 on cross-piece 64, near the ends of which arms are mounted lifting pins 76 and 78, each of which lifting pins is pivoted to the arms 72, 74 of the rocker yoke by pivot pins, such as shown at 80 which form pivotal connections between the lifting pins and the arms of the rocker lever 58, and actuate the lifting pins.

The pins 76 and 78 are each substantially entirely enclosed in a cap member, such as is indicated at 82, which cap members are surmounted with enlarged secondary bearings caps 84, which are forced into place on the cap 82, and held frictionally thereon. These secondary caps bear against a flange 86 on the underside of the block B near the periphery thereof so that when the operator presses down on the treadle 88 of lever 50, the links 56 are actuated to rock the rocker lever 58 so as to lift the lift pins 76 and 78 with their cap structures so that lugs 48 under the block B become disengaged from the

constantly rotating clutch member 44 by the lifting action of the pins on the block B, thus stopping the rotation of the block. The lift pins and their caps operate through cylindrical openings 90, 92 in the cross-piece 64.

In operation, the equipment is started at slow speed, the lever 50 is tripped by the operator from its holding notch in a lock plate 94 mounted on the side frame of the machine. Lever 26 is similarly mounted and secured.

The raising of lever 50 to the position shown in Figure 2 actuates the rocker lever 58 to depress the lifting pins 76 and 78, thereby lowering the block B so that the lugs 48 of the block B are engaged by shoulders 46 of the continuously rotating clutch member 44. The block B then is driven from shaft 8 through gears 10, 12, 16, 18, countershaft 20, gears 38, 36, spindle 14 and clutch 44. This slow speed of rotation is dependent upon the gear ratios between smaller gear 16 and larger gear 18, and smaller gear 38 and larger gear 36.

When the speed of the block B is to be increased, lever 26 is tripped to engage clutch member 24 with clutch member 22 for driving the block B directly from shaft 8 through spindle 14. Engagement of clutch members 24 and 22 causes gear 36 to rotate at the speed of spindle 14, thereby causing gear 38 to run substantially faster than its countershaft 20, this causing the balls 42 in the ball clutch to be forced into the larger parts of the pockets 40, thereby breaking the driving connection between the shaft 20 and its gear 38.

The breaking of this driving connection is effected smoothly and gradually responsively to displacement of the balls 42 from their wedging position to their free position, this action also serving to cushion mechanical shock transmitted to the drawing block B as it is shifted from slow to high speeds responsively to engagement of the clutch members 22 and 24; and there is no hesitancy or momentary stoppage when the machine is shifted from slow speed to high speed, thereby obviating either breaking of the wire being drawn, or the "necking down" of such wire, the drawing proceeding smoothly and without interruption. The block B may be stopped at any time by simply lifting lever 50 to cause lifting pins 76, 78 to lift the block B out of engagement with the clutch member 44.

From the foregoing, it will be seen that the clutch elements 22 and 24 constitute a master control clutch for the apparatus, engagement of these clutch elements through actuation of the lever 26 shifting the speed of rotation of the spindle and block from slow speed to high speed, while the slow speed gear train constituting the second bevel gear 12, the first spur gear 16 and the second spur gear 18 continues to be operated, so that it is immediately available to rotate the spindle at slow speed responsively to actuation of lever 22 to separate the clutch elements 22 and 24, whereby restoring automatically the driving connection between the third spur gear on the countershaft 20 and the said countershaft by wedging the balls 42 in the narrow portions of the pockets 40 by shifting the fourth spur gear from high speed to low speed, thus shifting the third gear from high speed to low speed.

It will be seen that the first spur gear 16 is equal in size and the number of teeth to the third spur gear 38, and that the second spur gear 18 is equal in size and number of teeth to the fourth spur gear 36, which is mounted on

the spindle 14 to rotate the spindle, so that the gear ratio between the first spur gear 16 and second spur gear 18 is equal to the gear ratio between the third spur gear 38 and fourth spur gear 36, so that except when the clutch elements 22 and 24 are engaged, the spindle 14 rotates at the same speed as the countershaft 20.

With reference to the rocker yoke 58 and its arms 72 and 74, it is apparent that the point of application of power, that is the connection 60, must be on the longitudinal axis of the yoke, so that the arms 72 and 74 will have equal motion around the fulcrums 60, so that the lifting pins 76 and 78, which are of equal length, and which are diametrically opposite to each other, will have equal motion for moving the block B exactly parallel to the spindle 14 each time that the block is lifted from the clutch disk 44 and lowered onto the said clutch disk, so that there will be a tendency of binding between the block and spindle as the block is lifted and lowered.

It may be noted also that the cap members 32 are fitted snugly over the lifting pins, and that the secondary caps 34 are the actual abutment members engaging the underside of the block at the peripheral flange 36, thereof, so that when the block is stopped by lifting from the clutch disk 44 when the latter is rotating at high speed, the cap members 34 are subject to considerable wear and consequently they are readily replaceable by simply slipping new ones in place of those that have become worn.

We claim:

1. Multiple speed mechanism for driving a wire-drawing block at a plurality of selected speeds, which comprises the combination with the wire-drawing block, of a rotary spindle carrying the block, a driving shaft, a bevel driving gear mounted on the shaft and driven thereby, a second bevel gear driven by the driving gear, the second bevel gear being mounted on the spindle but being rotatable independently of the spindle, a first spur gear integral with the second bevel gear, a clutch element rigidly mounted on the first spur gear, a countershaft, a second spur gear on the countershaft in mesh with the first spur gear, the second spur gear being larger than the first spur gear for driving the countershaft at a predetermined slower speed than the speed of the first spur gear and second bevel gear, a third spur gear on the countershaft, a fourth spur gear mounted on the spindle meshing with the said third spur gear, the third and fourth spur gears having a ratio inversely of the ratio between the second and third spur gears, whereby the spindle is driven at a speed of rotation equal to that of the countershaft, clutch means on the spindle and slidable relatively thereto for engagement with the clutch means mounted on the first spur gear, mechanism for operating clutch means for driving the block directly from the second bevel gear and first spur gear and at a speed of rotation greater than that obtained through the countershaft, and means in the third spur gear for breaking driving connection between the countershaft and third spur gear responsively to acceleration of the third spur gear incident to engagement of the said clutch means, whereby the said third spur gear is driven at a speed of rotation greater than that of the countershaft.

2. Multiple speed mechanism for driving a wire-drawing block at a plurality of selected speeds, which comprises the combination with the wire-drawing block, of a rotary spindle

carrying the block, a driving shaft, a driving gear mounted on the shaft, a second gear mounted on the spindle but rotatable relative thereto and independently thereof, the said second gear being in mesh with the driving gear, a countershaft, means on the countershaft adapted to be driven from the second gear at a predetermined speed of rotation less than that of rotation of the second gear, clutch means mounted on the second gear and continuously driven therewith, complementary clutch mechanism carried by the spindle and slidable relative thereto, means for transmitting motion from the countershaft to the spindle, instrumentalities for operating the clutch mechanism on the spindle for bringing the same into engagement and disengagement, respectively, with the clutch means on the second gear, whereby the wire-drawing block may be driven directly from the second gear subsequent to an initial relatively slower rotation through motion transmitted through the countershaft, and means releasably connecting the motion-transmitting means from the countershaft to enable the said means to be driven at a speed of rotation greater than that of the countershaft.

3. Multiple speed mechanism for driving a wire-drawing block at a plurality of selected speeds, which comprises the combination with the wire-drawing block, of a rotary spindle carrying the block, a driving shaft, a bevel driving gear mounted on the shaft and driven thereby, a second bevel gear driven by the driving gear, the second bevel gear being mounted on the spindle but being rotatable independently of the spindle, a first spur gear integral with the second bevel gear, a clutch element mounted on the first spur gear, a countershaft, a second spur gear on the countershaft in mesh with the first spur gear, the second spur gear being larger than the first spur gear for driving the countershaft at slow speed, a third spur gear on the countershaft, a fourth spur gear on the spindle, the fourth gear being mounted on the spindle for rotating the spindle, a clutch member on the spindle adapted to engage the clutch element on the first spur gear for driving the spindle at accelerated speed directly from the driving shaft through the bevel gears and first spur gear, and a one-way clutch between the third spur gear and the countershaft, the said clutch including means for automatically releasing the third spur gear from the countershaft responsively to acceleration thereof from the fourth spur gear in response to acceleration thereof incident to operative engagement of the clutch member on the spindle and the clutch element on the first spur gear.

4. Multiple speed mechanism for driving a wire-drawing block at a plurality of selected speeds, which comprises the combination with the block, of a rotary spindle carrying the block, a driving shaft, a driving gear mounted on the driving shaft, a countershaft, a first gear train connecting the spindle and countershaft, the said gear train including gears mounted on the spindle but rotative independently thereof, and a gear on the countershaft, the gears on the spindle being driven directly by the driving gears, a clutch member carried by the gears on the spindle, the gear train having a gear ratio producing a speed of rotation of the countershaft substantially less than that of the gears on the spindle, a second gear train between the countershaft and spindle including a second gear on

the countershaft and another gear on the spindle for rotating the said spindle, the said second gear train having a gear ratio equal to but inversely of that of the first gear ratio, whereby the spindle is driven at the same speed as the countershaft, a clutch member keyed to the spindle, operating mechanism for the clutch member for engaging the clutch member with the said clutch member on the said gears, thereby driving the spindle at an accelerated speed directly from the said driving shaft and driving gear, means for the second gear train for automatically breaking driving connections between the gear train and countershaft responsively to acceleration of the gear train and block when the clutch members are engaged for rotating the block at high speed, and means for lifting the block from the spindle for stopping the block while continuing rotation of the spindle.

5. Multiple speed mechanism for driving a wire-drawing block at a plurality of selected speeds, which comprises the combination with the wire-drawing block, of a rotary spindle carrying the block, a driving shaft, a bevel driving gear mounted on the shaft and driven thereby, a second bevel gear driven by the driving gear, the second bevel gear being mounted on the spindle but being rotatable independently of the spindle, a first spur gear integral with the second bevel gear, a clutch element mounted on the first spur gear, a countershaft, a second spur gear on the countershaft in mesh with the first spur gear, the second spur gear being substantially larger than the first spur gear for driving the countershaft at a predetermined slower speed than the speed of the first spur gear and second bevel gear, a third spur gear on the countershaft, a fourth spur gear mounted on the spindle and fixed thereto for rotation of the spindle, the fourth spur gear meshing with the third spur gear and being substantially larger than the third spur gear, the third and fourth spur gears having a gear ratio equal to the gear ratio between the second and third spur gears, whereby the spindle may be rotated continuously at a speed equal to the speed of rotation of the countershaft, a clutch element on the spindle adapted to be engaged with the clutch element on the first spur gear, whereby the spindle and block may be driven at a fast speed, with attendant fast rotation of the third spur gear from the now rapidly rotating fourth spur gear, and a one-way clutch in the third spur gear adapted to break automatically the driving connections between the third spur gear and driving shaft upon acceleration of rotation of the third spur gear

5 faster than the rotation of the countershaft, the clutch comprising eccentric pockets in the gear, and ball members in the pockets bearing on the countershaft, the balls becoming wedged between the gear and countershaft at slow speed to drive the gear and countershaft together and becoming displaced into wide portions of the said pockets at high speed of the gear, thereby breaking the driving connection between the gear and countershaft and enabling the gear to rotate around the shaft independently thereof.

6. Multiple speed mechanism for driving a wire-drawing block at a plurality of selected speeds, which comprises the combination with the wire-drawing block, of a rotary spindle carrying the block, a driving shaft, a bevel driving gear mounted on the shaft and driven thereby, a second bevel gear driven by the driving gear, the second bevel gear being mounted on the spindle but being rotatable independently of the spindle, a first spur gear integral with the second bevel gear, a clutch element mounted on the first spur gear, a second spur gear on the countershaft in mesh with the first spur gear, the second spur gear being substantially larger than the first spur gear for driving the countershaft at a predetermined slower speed than the speed of the first spur gear and second bevel gear, a third spur gear on the countershaft, a fourth spur gear mounted on the spindle and fixed thereto for rotation of the spindle, the fourth spur gear meshing with the third spur gear and being substantially larger than the third spur gear, the third and fourth spur gears having a gear ratio equal to the gear ratio between the second and third spur gears, whereby the spindle may be rotated continuously at a speed equal to the speed of rotation of the countershaft, a clutch element on the spindle adapted to be engaged with the clutch element on the first spur gear, whereby the spindle and block may be driven at a fast speed with attendant fast rotation of the third spur gear from the now rapidly rotating fourth spur gear, a one-way clutch in the third spur gear adapted to break automatically driving engagement between the third spur gear and driving shaft upon acceleration of rotation of the third spur gear faster than the rotation of the countershaft, and mechanism for lifting the block from the spindle to stop the block without disturbing rotation of the spindle, and for lowering the block onto the spindle while the spindle is rotating at slow speed.

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