Feb. 17, 1925. 1,527,150

J. M. LEAVER, JR

GEAR DRIVE

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Fig. 2.

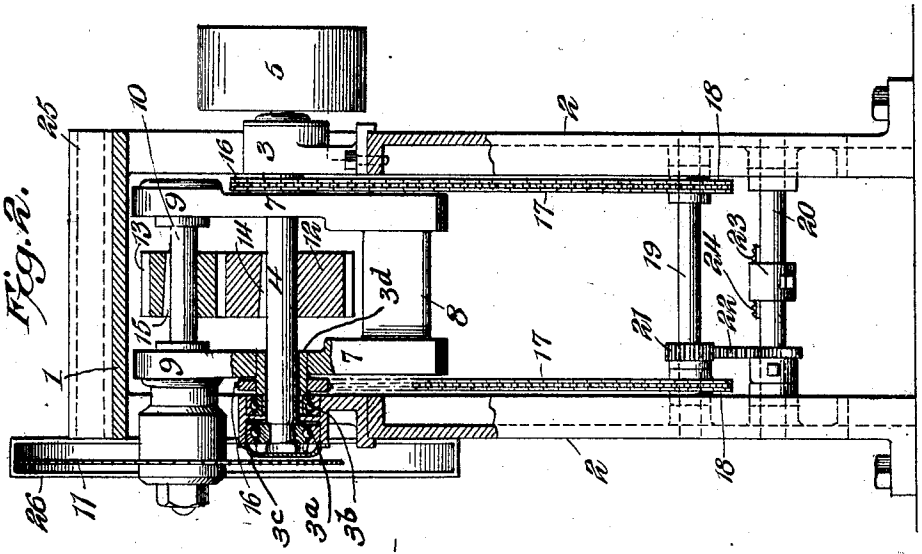
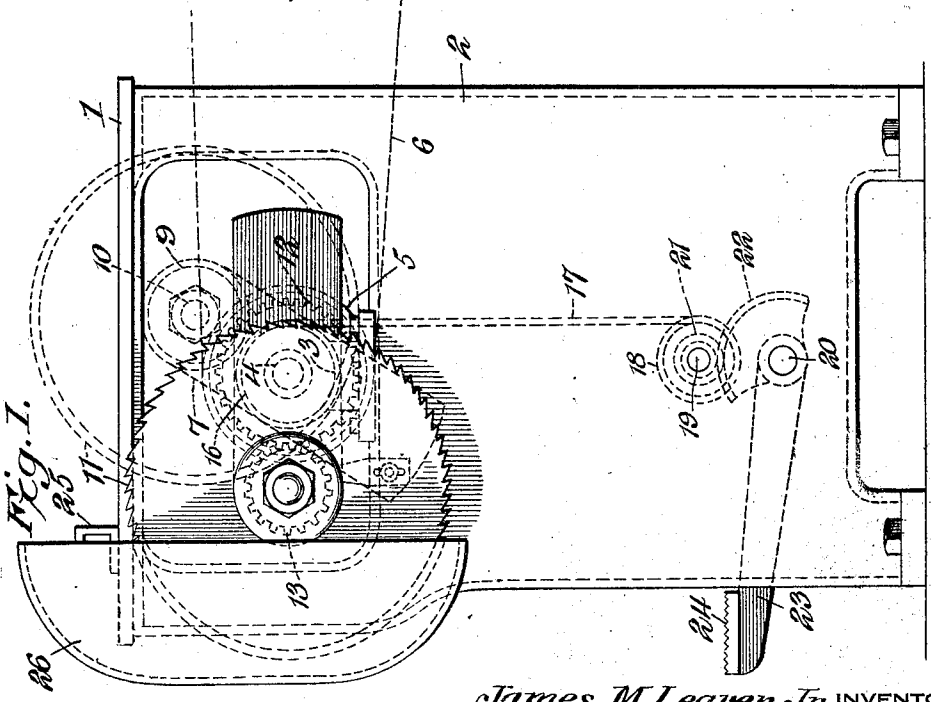


Fig. 1.



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GEAR DRIVE

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Fig. 4.

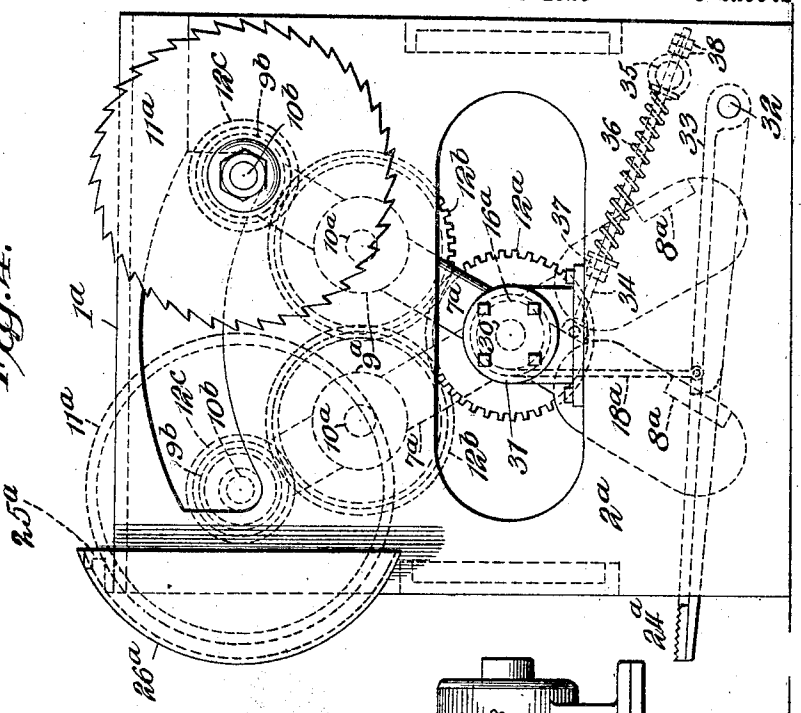
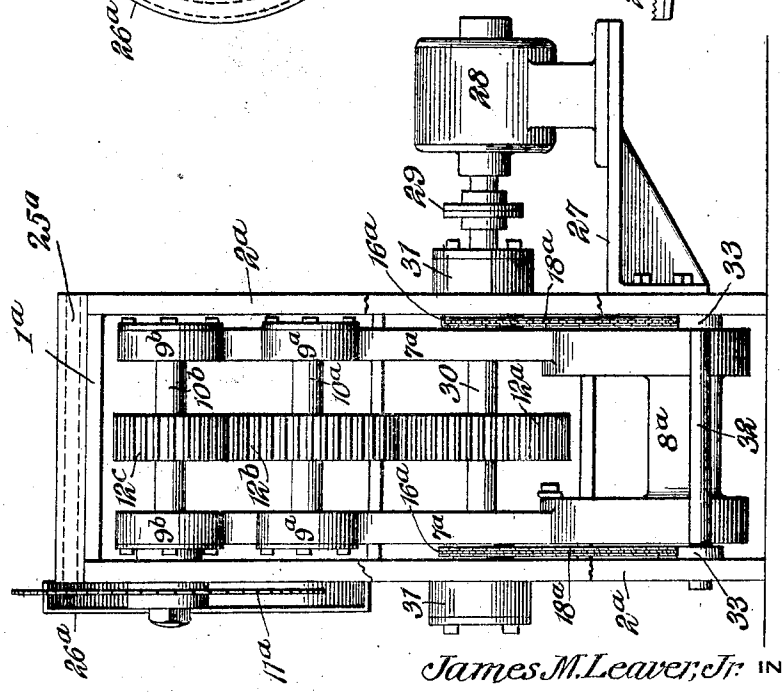


Fig. 3.



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GEAR DRIVE

Filed Dec. 24, 1920 3 Sheets-Sheet 3

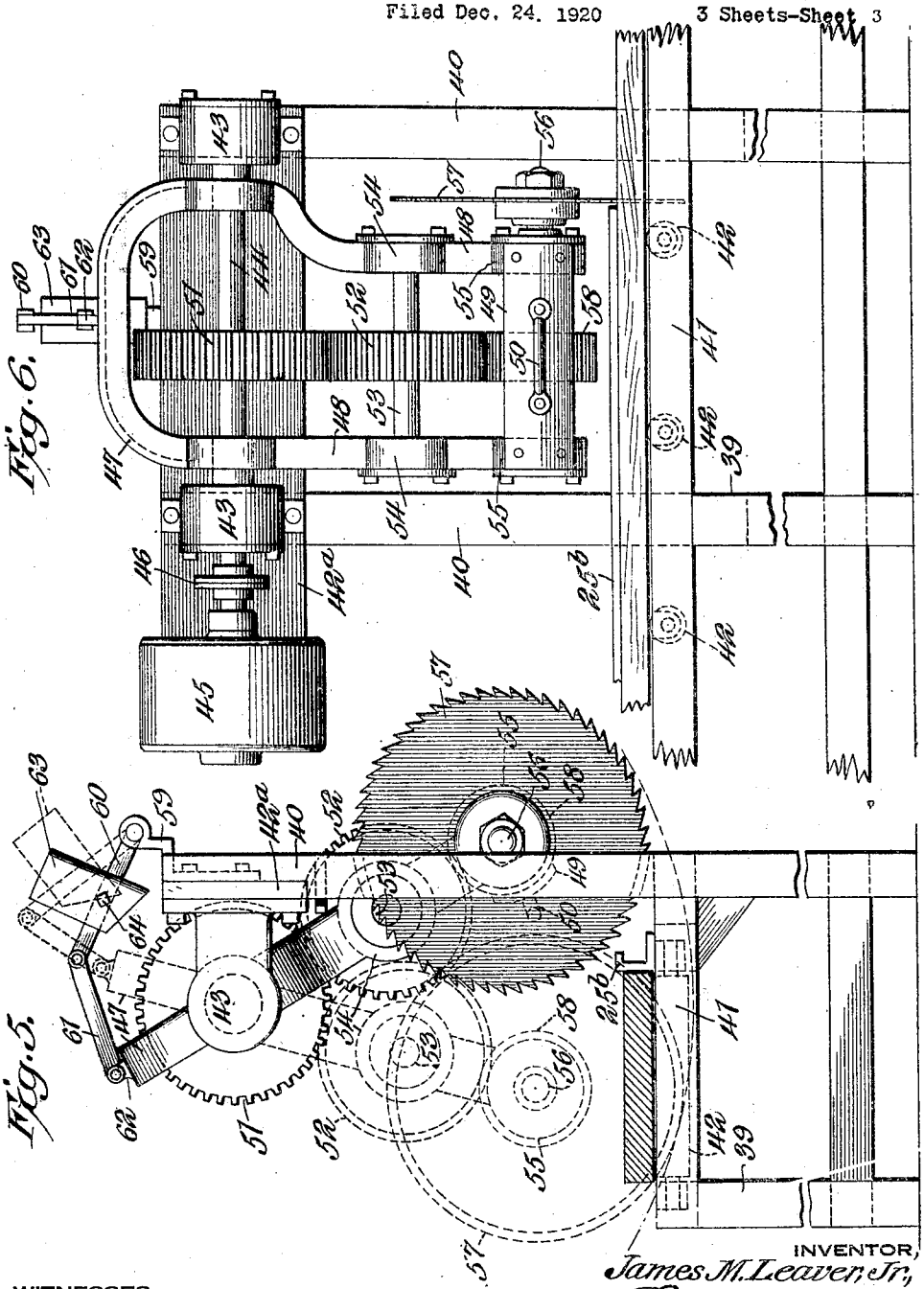

Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE.

JAMES MARSHALL LEAVER, JR., OF OAKLAND, CALIFORNIA.

GEAR DRIVE.

Application filed December 24, 1920. Serial No. 432,988.

To all whom it may concern:

Be it known that I, JAMES M. LEAVER, Jr., a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented new and useful Improvements in Gear Drives, of which the following is a specification.

This invention has reference to planetary gear drives mounted coaxially with oscillatory swinging frames, and is designed for transmitting rotary motion from a source of power to a driven element, with the rate of transmission accelerated.

For convenience of description, it will be considered that the transmission of power is to a rotary tool by way of intermeshing gears proportioned to give the desired ratio, such gears replacing belt drives heretofore customarily used for a like purpose, and thereby entirely avoiding slippage, which is liable to occur in short belt drives and, furthermore, eliminating the necessity of belt tightening devices. The gear drive is further advantageous over a belt drive, in that the machine may be of simpler construction, much more compact, and is preferably direct motor driven, thus saving space and giving positive working results. The invention in its preferred embodiment is applicable to machines in which the tool is rotated and is arcuately raised or advanced to and through the work, or is swung about an axis located above the work and presented to and through the work by a rocking movement about the axis of suspension.

The invention is adaptable particularly to driving a rotary saw, while not necessarily limited to such particular use, and when so employed such saw is efficiently used as a rotary cut-off saw for accurately severing lumber, with a minimum travel of the saw, the lumber remaining stationary during the cut off operation and the saw traversing to and through the lumber in an arcute path.

The invention also embraces improvements in the counterweighting of oscillatory swinging frames and their appurtenances, in machines for sawing wood, inasmuch as the distribution of counterweight appertaining thereto maintains such frames in substantially stable equilibrium when occupying the initial starting position, and insures the return of the swinging frame to their original position, at one end of the oscillatory swinging stroke, from any other position. This distribution of counterweight also serves variously to oppose the downward and assist the upward movements of the swinging frames by reason of shifting of the center of gravity of the counterweight during the backward and forward swinging of the frame. The counterweight is distributed in such modified degree as to insure easy and rapid oscillation of the swinging frames by the operator.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification, with the understanding, however, that the invention is not confined to any strict conformity with the showing in the drawings, but may be changed and modified so long as such changes and modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

Figure 1 is a side elevation of a machine embodying the invention, showing the saw in the initial or inactive position, ready to be lifted to the work through a rising arc.

Fig. 2 is a vertical section in a plane at right angles to the showing of Fig. 1, but with the saw raised to the upper limit of its travel, and having independent mountings for both the rotary saw frame and the drive shaft.

Fig. 3 is an elevation of a type of machine embodying the invention, which may be termed the rotary or floor swing type.

Fig. 4 is an elevation of the structure of Fig. 3 as viewed from the left hand side thereof.

Fig. 5 is an elevation of another type of machine embodying the invention and which, because of its structure and operation, may be termed the suspended swing saw machine.

Fig. 6 is an elevation as seen from the left hand side of Fig. 5.

Referring first to the structure shown in Figures 1 and 2, there is shown a main frame comprising a table 1 mounted on a frame composed of web and flange supports 2, the gear drive of Figures 1 and 2 being shown, but not claimed, in Letters Patent No. 1,359,394 granted to me on November 16, 1920, for an intermittent and oscillatory rotary cutoff saw machine.

Mounted in anti-friction bearings 3^a carried by brackets 3 supported by the side

frames 2 is a drive shaft 4, carrying a pulley 5 at one end, said pulley being arranged to be driven by a belt 6 receiving power from any suitable source, the belt being indicated in Fig. 1 by a dot and dash line. Another bearing 3^b spaced from the bearing 3^a carries a sleeve 3^d. The bearings are retained in the brackets 3 by cap plates 3^c. (Fig. 2).

Mounted rigidly on the sleeves 3^d turning loosely on the shaft 4 without interference from the rotation of the shaft is a rotary saw frame formed of a counterweight structure composed of two arms 7, joined together at one side of the axis of the shaft 4 by an offset connecting member 8, forming part of the counterweight. The counterweighting of the arms 7, and the member 8, is variously positioned relative to the axis of rotation and the longitudinal axis of the structure, whereby the swinging frame in its oscillation is influenced by varying restraint due to continuous change of center of gravity of the counterweight, which always acts to return the frame to its original position of substantially stable equilibrium at the predetermined position of rest, from any other position. On the other side of the axis of the shaft 4 the arms 7 carry journal bearings 9 traversed by a saw arbor 10, mounting a rotary cut-off saw 11. The described construction is also shown in Figs. 8 and 9 of the above-mentioned patent.

The shaft 4 carries a gear wheel 12 between the arms 7, and the arbor 10 carries a gear pinion 13 between the bearings 9, the pinion and gear wheel being connected by keys 15 and 14 to their respective shafts and constantly intermeshing. In this manner, when the drive shaft 4 is rotated by means of the belt 6 the pinion 13 is correspondingly rotated, and in the particular arrangement of the drawings at a higher speed than shaft 4.

The counterweight arms 7 with the saw or tool 11, are capable of rocking on the sleeves 3^b about the longitudinal axis of the shaft 4 so that the saw 11 may be dropped below the level of the table 1, as shown in full lines in Figure 1, or raised above the level of the top of the table 1 as indicated in dotted lines in Figure 1 and shown in full lines in Figure 2, the extent of raising being sufficient to carry the cutting edge of the saw in an upward arc through the thickness and width of the material to be cut.

In order to move the saw arcuately for feeding purposes, the counterweight frame comprising the arms 7 and connecting member 8, has drums 16 fast thereto, these drums being preferably in the form of sprocket wheels, and engaging these sprocket wheels are sprocket chains 17 dropping to other sprocket wheels 18 with which they engage. In Fig. 2 the sprocket wheels 16 are either shrunk on or held by the set screws to the sleeves 3^d, which are rigid with the arms 7, said sleeves turning free of contact with the shaft 4. The sprocket wheels 18 are mounted on a countershaft 19, carried by the frame members 2, near the lower end of the frame, and adjacent to the shaft 19 is another shaft 20 journalled in the frame members 2 and connected to the shaft 19 by means of a pinion 21 on the shaft 19 and a gear segment 22 on the shaft 20. Fast to the shaft 20 is a treadle member 23 provided with a treadle 24 in position to be readily engaged by the foot of a workman, so that on depressing the treadle 24, the gear segment 22 and pinion 21 are actuated in the appropriate direction to wind the chains 17 to rock the counterweight structure 7, 8 and thereby raise the saw above the table 1. From the foregoing it will be noted that the weight of the rotary saw frame or yoke frame composed of parts 7, 8, 9, 10, together with the sleeves 3^d and the bearings 3^b is sustained by the main frame. The drive shaft and its mountings is coaxial with the yoke frame, but free from contact therewith and carrying no other weight than its own. The ball bearings 3^a support the weight of the power or drive shaft, while the bearings 3^b maintain the weight of the sleeves 3^d, the sprocket 16 and the yoke frame.

The table 1 is provided with the usual straight edge or abutment 25 for the work and there is also provided a shield or guard 26 into which the saw 11 moves when retracted from engaging relation with the work.

The machine shown in Figures 1 and 2 and also shown in the aforesaid Letters Patent, but whose gear drive is not there claimed specifically, because it is provided with a gear drive instead of a belt drive, has material advantages over the other machines shown and described in the aforesaid Letters Patent. The employment of gearing instead of belting greatly compacts the drive and eliminates any necessity of belt tightening devices, and avoids putting the elements of the drive under side strains on the bearings, with consequent wear. The driving mechanism comprises a minimum of parts, consisting in Figs. 1 and 2 of two gears, a drive shaft and a drive pulley. The irregular distribution of counterweight relative to the rotary frame of this machine is likewise materially advantageous inasmuch as it provides easy and rapid oscillation of the rotary frame with the least amount of exertion on the part of the operator.

In Figures 3 and 4, there is shown what may be termed a rotary or floor swing saw of somewhat different design from the machine shown in Figures 1 and 2, and employing an electric motor as the driving means instead of a belt. Furthermore, the

machine of Figures 3 and 4 provides an intermediate gear between the power shaft and the saw arbor, which intermediate gear may be made of raw hide or other non-metallic material, thereby materially reducing noise.

In Figures 3 and 4, the main frame includes a table 1^a and side members or legs 2^a, being in this respect generally similar to the showing of Figures 1 and 2. Fast to one of the members 2^a of the main frame is a bracket 27, upon which is mounted an electric motor 28 supplying the motive force for the machine, so that the machine as a whole is self contained and does not need extraneous driving mechanism.

Fast to the armature of the motor 28 by means of a suitable coupling 29 is a power shaft 30, corresponding to the drive shaft 4 of the machine of Figures 1 and 2. This shaft 30 is mounted in suitable journal bearings 31 carried by the frame members 2^a, and mounted on the shaft 30 to rock thereon without participation in its rotative movements are counterweight arms 7^a corresponding to the counterweight arms 7, but of greater length. The bearings 31 and the mounting of the power shaft 30 and arms 7^a correspond with the construction shown in Fig. 2, the intention being that the counterweighted rotary saw frame shall be free from contact with the power shaft 30. The arms 7^a at one side of the shaft 30 are joined by an offset connection 8^a, contributing to the counterweight effect, and on the other side of the shaft 30 the arms 7^a carry two sets of journal bearings 9^a, 9^b spaced apart in the direction of the length of the arms 7^a. The bearings 9^a carry a countershaft 10^a and the bearings 9^b carry a countershaft 10^b. Fast to the shaft 30, between the arms 7^a, is a gear wheel 12^a and carried by the shaft 10^a is an idler gear 12^b, while fast to the shaft 10^b is a pinion 12^c, the gears 12 all intermeshing and the idler gear 12^b being preferably formed of raw hide or other fibrous material for reducing or eliminating noise.

The shaft 10^b carries a saw 11^a, and on the operator's side of the machine, in position to receive the saw 11^a, is a shield or housing 26^a. In the structure shown in Figures 3 and 4, the saw may be always exposed above the table 1^a, instead of dropping below the table when not in action, as in the structure of Figures 1 and 2. The height of the machine may be the same as in the structure of Figures 1 and 2 and the inclusion of the idler or intermediate gear 12^b does not occupy any more space.

Journaled in the lower part of the frame 2^a, is a rock shaft 32 extending across the machine and carrying levers 33 keyed or otherwise made fast thereto, so as to move together. These levers are connected by sprocket chains 18^a to sprocket wheels or drums 16^a fast to the arms 7^a for causing swinging of the saw at the will of an operator. For this purpose one of the rock arms 33 extends to an accessible position at the operator's side of the machine and may be there provided with a treadle 24^a.

Because the saw is constantly exposed above the top of the table 1^a, the counterweight yoke should be under a normal constraint to move away from the operator, which constraint is preferably accomplished through the medium of an irregularly distributed counterweight, which insures stable equilibrium at the predetermined starting position or position of rest. Auxiliary to the counterweighting of the oscillatory swinging yoke frame is a rod 34 connected at one end to one of the arms 7^a and at the other end traversing a rock bar 35 supported by the main frame. Surrounding the rod 34 is a spring 36 abutting at one end the rock bar 35 and at other end abutting adjusting nuts 37 on the rod 34, while other adjusting nuts 38 are carried by the rod 34 where it projects beyond the bar 35. In this manner, the tension of the spring 36 may be adjusted to suit conditions.

When it is desired to feed the saw or tool 11^a to the work, the operator bears upon the treadle 24^a, thus actuating the sprocket chain or chains 18^a and causing the tool 11^a to move from its retracted position shown in dotted lines in Figure 4 to the advance position shown in full lines against the normal restraint produced by the changing center of gravity of the counterweighting of the oscillatory frame and action of the spring 36. On releasing pressure on the treadle 24^a the counterweight effect and the spring 36 returns the parts to their first position. The purpose of the spring 36 is primarily to add resiliency and to assist the counterweight in quickly returning the yoke frame to or towards its position of rest, so that the operator may oscillate the yoke frame rapidly and have the minimum of inertia to contend with at the extreme working end of the stroke. Adjustment of the abutting nuts 37 and 38 on the rod 34 determines the tension of the spring 36, and correspondingly the speed of return and stroke of the yoke frame. The machine of Figures 3 and 4 is provided with a straight edge or abutment 25^a, like the machine of Figures 1 and 2.

In the structure shown in Figures 5 and 6, the machine in the main is like that shown in Figures 3 and 4 being a three-gear machine, but differs therefrom in that the tool carrying arrangement is of the suspended swing type and consequently is a higher machine than either of the other two. There is provided a frame 39 with posts or standards 40 rising therefrom above a table 41,

having rollers 42 journaled therein, to support the work and permit it to be moved easily there along with one long edge against an edge or abutment 25[b].

At the upper end of the posts 40 there is secured a timber 42[a]. Secured to the timber 42[a] are spaced journal bearings 43 in which is mounted a drive shaft 44 extending horizontally, that is, parallel with the table 41. Also carried by the timber 42[a] is an electric motor 45 connected to the shaft 44 by a coupling 46 or otherwise.

Mounted upon the shaft 44 to rock thereon is a yoke frame 47 having depending legs 48 connected at the lower ends by a yoke connection 49 provided with a handle 50 for convenience in manipulation and within reach of an operator so that the frame 48 with parts carried thereby may be moved by the operator across work on the table 41. The construction of the bearings 43 and the mounting of the yoke frame 47 and the power shaft 44 are similar to the corresponding parts shown in Fig. 2, and for the same reasons.

Fast to the shaft 44 is a gear wheel 51 like the gear wheel 12[a] of the structure of Figures 3 and 4, the gear wheel 51 meshing with an idler gear 52 on a countershaft 53 having journal bearings 54 in the yoke 48 intermediately of the length thereof, the gear wheel 52 being preferably formed of fiber or fibrous material to reduce or eliminate noise. At the lower ends of the legs of the yoke 48 are journal bearings 55 for a shaft or arbor 56 carrying at one end a saw or other tool 57 and at an intermediate point a pinion 58, meshing with the gear 52 and receiving power therefrom.

Fast on the timber 42[a] is a bracket 59 to which is connected one end of a toggle lever 60, having its other end 61 connected to a bracket 62 intermediate of the width of the yoke 47. The member of the toggle 60 connected to the bracket 59 carries a weight 63 held thereon by a set screw 64, so that its position along the toggle member may be adjusted.

When the frame 48 is in the full line position shown in Figure 5, that is, before the saw enters the work, the toggle 60 is nearly straightened with the weight 63 active to hold the saw away from the work. When the operator grasps the handle 50, and pulls the saw toward him, the saw is made to enter and traverse the work, rocking about an axis coinciding with the axis of the shaft 44. The toggle or link structure 60 breaks at an intermediate point, as shown in dotted lines in Fig. 5, thereby raising the weight 63 to a location in which the weight tends to return the parts to their first position.

In all three types of machines which have been described, there is a cooperation between the driving means for rotating the saw and the swinging and restraining of the frame which carries the saw. The saw as shown for example in Fig. 1 will, owing to the gear leverage, feed itself into the lumber and through the cut, once it has entered the cut, without assistance. The counterbalance of the frame not only functions as a counterbalance, but also offsets the tendency of the swinging frame to rotate with the drive gear. If the swinging frame were perfectly balanced, and the frame was free to revolve, the instant the power was applied the frame as well as the saw would start to rotate, and the frame would accelerate until it reached a high speed. If the frame were not properly counterbalanced, the machine would be useless because the saw would dig into the work (or pull away from it, according to the direction of the gear rotation) and its movement could not be controlled.

The operation of my gear drive machine is such that if the machine were started and the cutting edge of the saw held, the rotary motion would be imparted wholly to the swinging frame. Either the frame must move or the saw must move. By driving the saw in the direction indicated in the drawings, I make the rotary pull on the swinging frame assist in swinging the frame into and through the cut. Furthermore, the action of the saw is accelerated as the swinging frame advances to the work.

What is claimed is:—

1. In a machine of the character described, the combination with a main frame, of a rockable frame pivotally mounted therein and having a rotary tool and its shaft mounted thereon, of a train of intermeshing power transmitting gears coordinately mounted and operable relative to the axis of rotation of the rockable frame, a rotatable power shaft mounted coaxial with the axis of rotation of the rockable frame, one of the gears being mounted on the power shaft and another gear on the tool shaft, means for imparting to the rockable frame a normal constraint to rock in one direction, and means whereby said frame may be rocked in the opposite direction against its normal constraint.

2. In a machine of the character described, a saw, a pivoted saw frame carrying the saw and saw arbor movable on its axis in an arc toward and from the work, a train of intermeshing power transmittting gears coordinately mounted and operable relative to the pivoting of the saw frame, a rotatable power shaft mounted coaxial with the axis of rocking of the saw frame, with the train of gears between the power shaft and the saw, one of the gears being mounted on the power shaft and another gear on the saw arbor, and means constraining the rockable saw frame toward one limit of its movement and yieldable to the

movement of the frame in the opposite direction.

3. In a machine of the character described, the combination with a support having bearings, of a rockable frame pivotally mounted in said bearings, whereby the weight of said frame is sustained by said support, movable toward and from the work, a rotatable power shaft independently mounted in bearings of said support, coaxially with the axis of rotation of the rockable frame, so that it is free from contact with the rockable frame, a saw arbor and saw also carried by said frame and participating in its movements toward and from the work, a train of intermeshing power transmitting gears between the power shaft and the saw arbor, one of the gears being mounted on the power shaft and another gear on the saw arbor, means constraining said frame to rock away from the work and yieldable to forces tending to rock it toward the work, and operator-controlled and actuated means for rocking said frame toward the work.

4. In a machine of the character described, the combination with a support having bearings, of a rotatable power shaft, a frame pivotally mounted in the bearings of said support, the axis of rotation of said frame and said shaft being coaxial, a saw arbor with its saw carried by the frame at one side of the longitudinal axis of the power shaft and rockable with the frame, counterweight means on the frame at the other side of said axis tending to assist to move the saw arbor and saw bodily in one direction, resilient means coacting with the counterweight means to return the rockable frame to normal position, operator-controlled means for rocking the frame toward the work, and a train of intermeshing power transmitting gears connecting the power shaft and the saw arbor, whereby the driving power for the saw is directly transmitted without slip to the saw arbor, and the counterweight means offsets the tendency of the rockable frame to yield too freely to the feed of the saw into the work.

5. In a machine of the character described, the combination with a support, of a rotatable power shaft, a counterweighted frame mounted on the support to rock about the longitudinal axis of the power shaft without interference from the rotation of the shaft, a saw arbor and saw carried by the counterweighted frame in spaced relation to the power shaft, and intermeshing power transmitting gears carried by and movable with the frame for positively connecting the power shaft and saw arbor together at all times to drive the saw arbor at a constant speed from the power shaft irrespective of the position of the frame, the driven gear being rotatable about the drive gear while both gears are in motion, the counterweight on the frame offsetting the tendency of the frame to yield too freely to the feed of the saw into the work.

6. In a machine of the character described, a main machine frame, a yoke-shaped counterweighted saw carrying frame rockably mounted on the main frame and comprising a pair of arms joined at one side of the axis of the carrying frame by an offset connecting member forming part of the counterweight, a saw arbor carried by the rockable frame and joining said arms at the opposite side of the axis, a saw on said arbor, a rotatable power shaft mounted coaxial with the longitudinal axis of the rockable frame so that its rotation is free of the rockable frame, and a train of gears between the power shaft and the saw arbor and connecting the same and constituting positive power transmitting means between the power shaft and the saw arbor, the counterweight offsetting the tendency of the saw carrying frame to yield too freely to the feed of the saw into the work.

7. In a machine of the character described, a counterweighted rockable frame with spaced side arms, shafts journaled in the side arms, one of the shafts constituting a power shaft and rotatable freely and independently of the side arms and located at the axis of movement of the frame, another shaft constituting a support for a driven element movable with the frame, and intermeshing gears connecting the power shaft and the second mentioned shaft and located on the two shafts between the side arms, the driven gear being rotatable about the drive gear while both gears are in motion.

8. In a machine of the character described, a support, a rockable frame pivotally mounted on said support, a rotatable driving element mounted coaxial with the axis of rotation of the rockable frame, a driven element mounted on the rockable frame and rockable about the driving element with the axis of the driven element at all times equidistant from the driving element, and intermeshing gearing connecting the driving element and the driven element and constituting the means of transmitting power between the driving and the driven elements.

9. In a machine of the character described, the combination with a saw, of a saw frame movable toward and from the work, a rotatable power shaft about which the saw frame is mounted to rock freely and independently of the rotation of the shaft, a counterweight at one end of the saw frame, the saw being mounted at the other end of the frame, a resilient means coacting with the counterweight to impart a normal constraint to the saw frame to move away from the work, and a train of intermeshing power transmitting and speed increasing

gears movable with the frame, the drive gear being mounted on the power shaft and the driven gear on the saw shaft, the driven gear being rotatable about the drive gear while both gears are in motion, whereby the rotary pull on the saw frame assists in swinging said frame through the cut in the lumber.

10. In a machine of the character described, the combination with a saw, of a saw frame movable toward and from the work, a rotatable power shaft about which the saw frame is mounted to rock freely and independently of the rotation of said shaft, a train of intermeshing power transmitting and speed increasing gears for the saw movable with the frame, one of the gears being mounted on and driven by the power shaft, means for imparting to the frame a normal constraint to rock in one direction, and manually operated means whereby the frame may be rocked in the opposite direction against its normal constraint, the action of the saw being accelerated as the saw frame advances to its work, whereby the saw will assist in feeding itself into the lumber and through the cut in the lumber once it has entered the cut.

11. In a machine of the class described, the combination with a support, of a rotary cutter carrying frame pivotally mounted on said support, a rotary cutter and its shaft mounted on the carrying frame, a rotatable power shaft mounted coaxial with the axis of rotation of the carrying frame, a train of intermeshing power transmitting gears between the power shaft and the rotary cutter shaft, one of the gears being mounted on the power shaft and another on the rotary cutter shaft, means constraining to rock the frame away from the work and yieldable to forces tending to rock it toward the work, and operator-controlled means for rocking the frame toward the work.

12. The combination with a support, of a swinging saw-carrying frame on said support, a saw carried by said frame, means for swinging said frame, and means associated and functioning with said frame serving variously to oppose the downward and assist the upward movements of the frame, and also serving to return the frame to its normal starting position at one end of its swinging working stroke from any other position.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

JAMES MARSHALL LEAVER, Jr.