April 9, 1963 M. A. SIVERSON 3,084,725

DECELERATION AND ACCELERATION DEVICE FOR A SAWMILL CARRIAGE

Filed Oct. 13, 1961 4 Sheets-Sheet 1

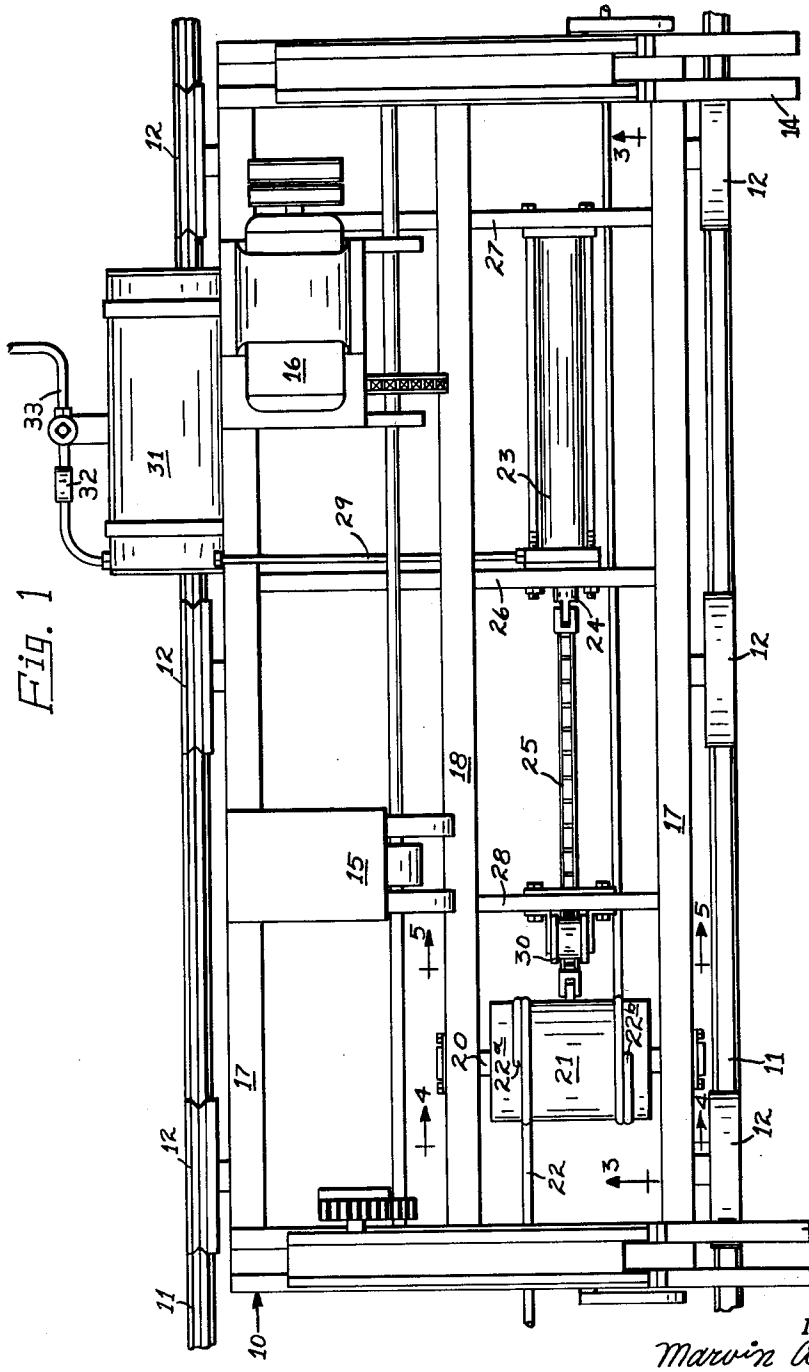


Fig. 1

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Fig. 3

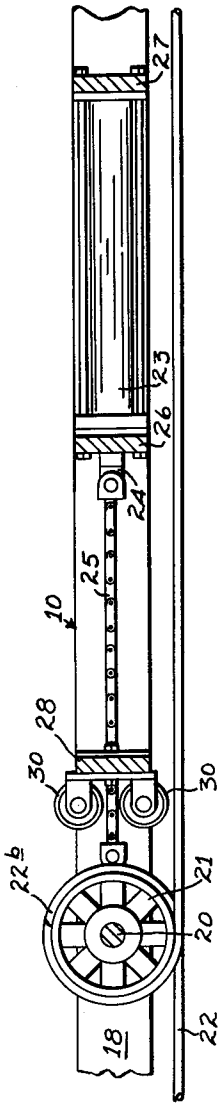
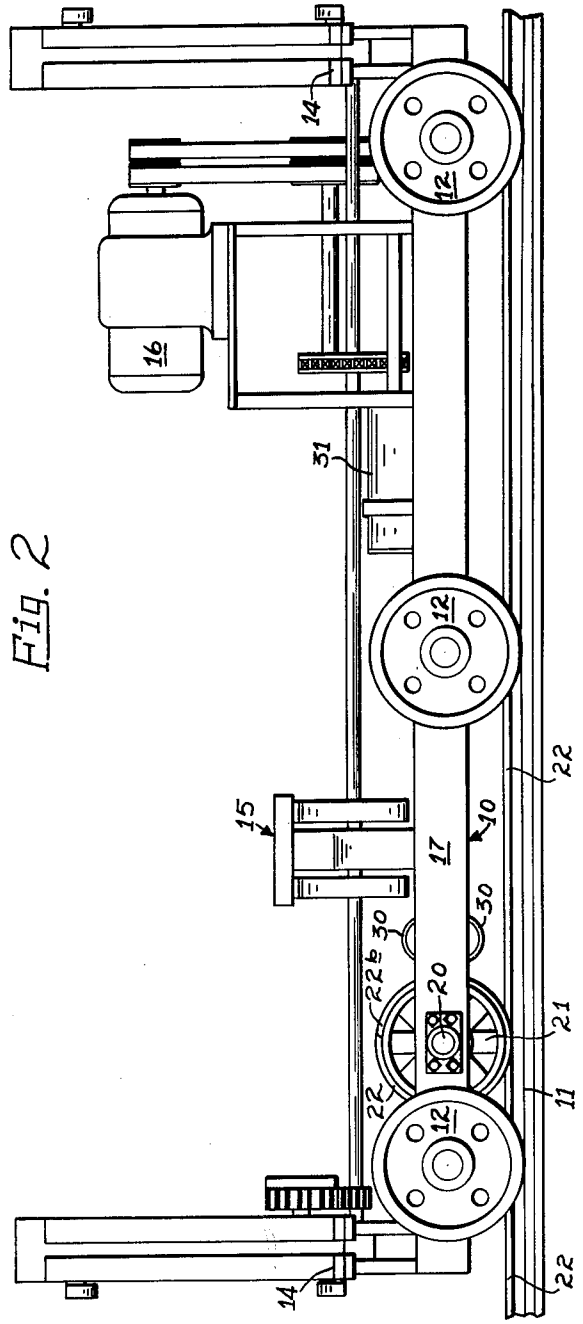


Fig. 2



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DECELERATION AND ACCELERATION DEVICE FOR A SAWMILL CARRIAGE

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Fig. 4

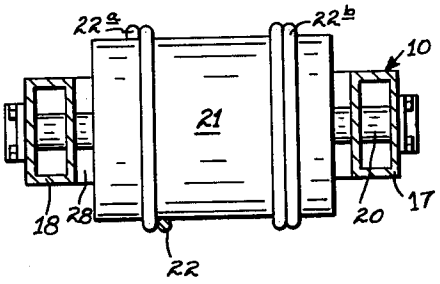


Fig. 5

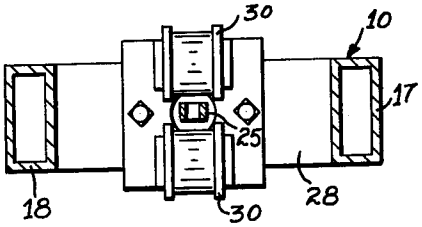


Fig. 6

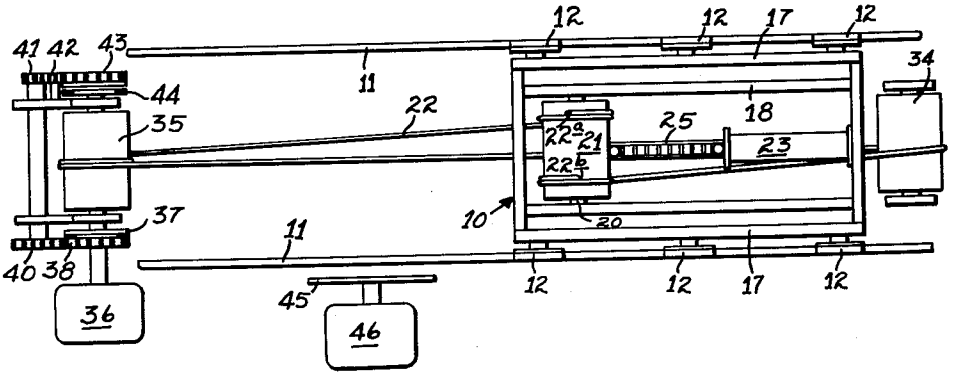
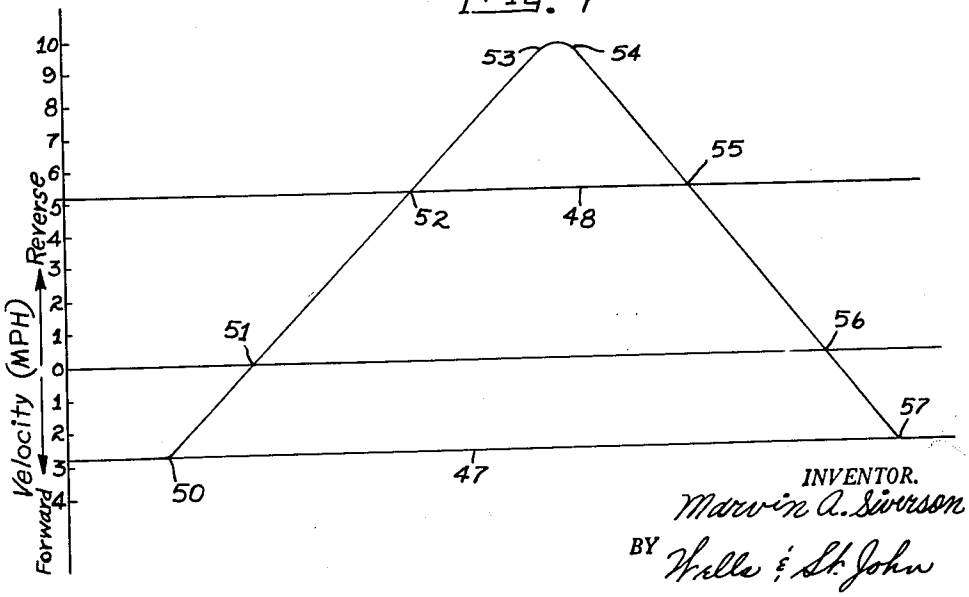


Fig. 7



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Fig. 8

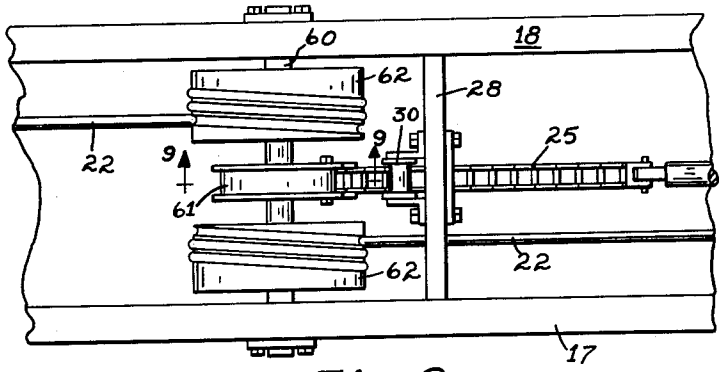


Fig. 9

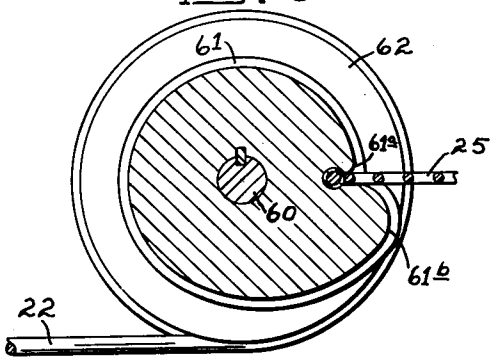
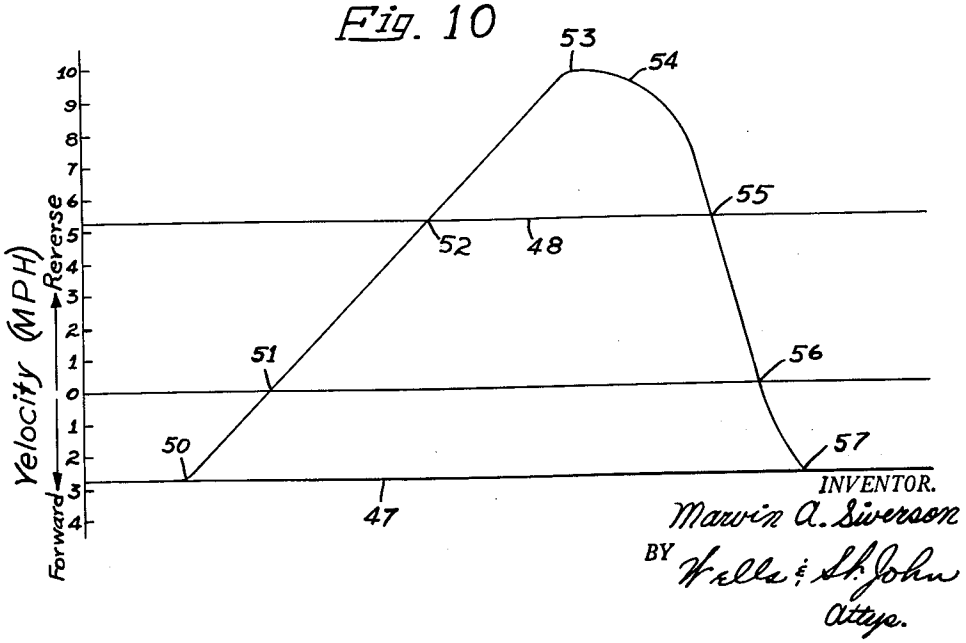


Fig. 10



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3,084,725

DECELERATION AND ACCELERATION DEVICE FOR A SAWMILL CARRIAGE

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Filed Oct. 13, 1961, Ser. No. 144,984
7 Claims. (Cl. 143—108)

This invention relates to a novel drive apparatus for use in conjunction with a sawmill carriage.

Sawmill practice involves the use of a reciprocating carriage upon which raw logs are mounted, the carriage being utilized to carry the logs back and forth past a vertical saw blade during which time the log is cut into slabs of the desired thickness. The mechanisms used to reciprocate the carriage vary in many details. In many cases a simple cable arrangement is utilized whereby the front end of the cable pulls the carriage in a forward direction and the rear end of the cable pulls the carriage in the reverse direction. Each end of the cable is normally fixed directly to the carriage frame and an intermediate driving mechanism is used to exert a pulling force on one or the other of the two ends. This driving mechanism conventionally utilizes no brake but relies solely upon some type of clutch arrangement to effect the reversing motion of the carriage. This type of arrangement is utilized to provide a quick reversing action of the carriage assembly which attains a high degree of momentum and involves a high inertial force. The present invention attempts to soften the jarring reaction encountered by the clutches and the carriage during reversal of the carriage motion. This is accomplished by a simple attachment mounted on the carriage frame. The attachment serves both as a shock absorber and an accelerator in bringing the carriage quickly to a suitable high rate of speed during a reverse motion of the carriage frame while the log is being reset for the next cut.

It is then a first object of this invention to provide a simple attachment by which undue wear on the reversing clutches of a sawmill carriage drive assembly may be eliminated. The attachment utilizes readily available components and involves no high degree of mechanical skill for installation.

It is another object of this invention to provide a shock absorbing apparatus on the carriage frame which is capable of storing the energy that is otherwise wasted in frictional resistance to the reversing action and to enable this energy to be utilized to further accelerate the carriage during its reversing motion.

These objects and others will be evident from a study of the following description showing the instant invention as applied to a typical sawmill carriage assembly. The details of the carriage assembly itself are immaterial to the instant application and will vary from one installation to another since most sawmill installations are custom designed for the particular purpose to which they are being applied. Thus the description which follows is intended to be purely exemplary and is not intended in any manner to limit or define the invention except as it is set out in the claims which follow.

In the drawings:

FIGURE 1 is a top plan view of a typical sawmill carriage equipped with the instant invention;

FIGURE 2 is a side view of the carriage shown in FIGURE 1, looking toward the bottom side of the carriage as illustrated in said figure;

FIGURE 3 is a fragmentary view of the pertinent portions of the carriage as seen along line 3—3 in FIGURE 1;

FIGURE 4 is a sectional view of the drum assembly as seen along line 4—4 in FIGURE 1;

FIGURE 5 is a sectional view of the chain guide as seen along line 5—5 in FIGURE 1;

FIGURE 6 is a schematic view of the sawmill assembly in which the instant invention is to be utilized, showing the application of the instant invention;

FIGURE 7 is a graph showing the relation of the carriage velocity to elapsed time during the reversing cycle of motion;

FIGURE 8 is a fragmentary top view of an assembly utilizing a modified drum structure;

FIGURE 9 is an enlarged sectional view taken along line 9—9 in FIGURE 8; and

FIGURE 10 is a graph showing the performance of the assembly illustrated in FIGURES 8 and 9.

In most small sawmills, and in many larger installations as well, the sawmill carriage, on which logs are carried past a vertical rotary saw for cutting into slabs, is propelled by a cable or cables, fixed to each longitudinal end of the carriage. These cables are alternately pulled to thereby reciprocate the carriage and log past the rotating saws. In effecting this motion, it is necessary to provide a relatively slow forward speed during the cutting action of the saws. For the idle reversing movement of the carriage it is normally advisable to utilize as high a reverse speed as is practical in each installation. Thus a drive mechanism is connected to the pulling cables which will effect such motion of the carriage. Conventionally such a drive mechanism utilizes no braking elements since the time involved in braking the carriage to a stop and then overcoming its inertial forces would result in undue loss of working time. For this reason reversal of the carriage is normally effected by a clutch mechanism which, when directly connected to the carriage, involves a loss of energy, due to frictional resistance which is dissipated as heat. The instant invention is particularly adapted for use on sawmill carriages and is designed to eliminate frictional wear of the driving clutches and to utilize this previously lost energy as an additional boosting force to propel the carriage during its reverse motion.

As seen in the drawings, the instant invention is designed to be utilized on a carriage frame **10**. The carriage frame **10** is a rigid structure mounted on a fixed foundation having a pair of spaced rails **11**. The carriage frame **10** is designed to be reciprocated along the length of rails **11** by means of supporting wheels **12** which are idly carried by the frame **10**. The carriage frame **10** is designed to carry a log at one side, shown at the bottom in FIGURE 1. The log is adapted to rest upon spaced supports **14** and is gripped by suitable dogs mounted on the supports **14**. The supports **14** are controlled by any conventional set works mechanism, generally shown at **15**. The set works mechanism **15** is driven by a suitable motor **16**. The details of this carriage frame **10**, and its associated mechanisms, are unimportant in their relation to the instant invention and are merely shown generally in the drawings for purposes of reference.

The carriage frame **10** includes longitudinal side members **17** and an intermediate longitudinal member **18**, all of which are rigidly formed as integral portions of the frame assembly. Rotatably mounted between one of the side members **17** and the intermediate longitudinal member **18** is a drum axle **20**, which carries a cylindrical drum **21**. The driving cable **22**, which is the conventional cable used to propel such carriages, has a front end **22***a* fixed to the periphery of the drum **21** and a rear end **22***b*, also fixed to the periphery of drum **21**. The ends **22***a* and **22***b* are wrapped about the periphery of drum **21** in opposite directions. Thus pulling end **22***a* will tend to wrap end **22***b* about the drum **21**. Pulling end **22***b* will effect the opposite result relative to the end **22***a*.

The drum **21** is maintained in a stable angular position,

illustrated in the drawings, by means of a pneumatic cylinder 23, fixed between a pair of transverse braces 26 and 27, which form a rigid part of the carriage frame 10. The cylinder 23 is provided with a conventional sliding piston mounted within it, and having a piston rod 24 extending outwardly toward the drum 21. The axis of the piston rod 24 and cylinder 23 is positioned perpendicular to the axis of drum 21. Fixed to the outer end of the piston rod 24 is a chain 25, whose remaining end is fixed to the central periphery of drum 21. The length of the chain 25 and piston rod 24 is such that the piston within cylinder 23 cannot abut the end of cylinder 23 opposite to drum 21. Thus pressure within the cylinder 23 will exert a continuous force upon chain 25 to thereby bias drum 21 to the stable angular position shown in the drawings. The end of chain 25, adjacent drum 21, is vertically supported by a pair of vertically spaced guide rollers 30. The guide rollers 30 are mounted on a front transverse brace 28 suitably apertured to receive the chain 25. The rollers 30 contact the chain 25 when it is wrapped about drum 21 to thereby lessen frictional drag on the chain 25 and to prevent the chain 25 from whipping about when released by movement of drum 21.

Also mounted on the carriage frame 10 is a pneumatic reservoir 31. The volume of reservoir 31 is substantially greater than the interior volume of cylinder 23. The purpose of reservoir 31 is to add to the volume of cylinder 23 a sufficient supply of compressed air to insure constant pressure operation of the device. Reservoir 31 is connected to the end of cylinder 23 adjacent to drum 21 by means of a suitable pipe 29.

Air is supplied to reservoir 31 by means of a flexible hose 33 connected to a suitable stationary compressor (not shown). Hose 33 is provided with a pressure regulator valve 32. Valve 32 maintains a constant air pressure within reservoir 31 and prevents the escape of air through hose 33 from the interior of reservoir 31.

In FIGURE 6 is illustrated a typical sawmill arrangement in which the instant invention would be utilized. This arrangement utilizes a rear idler drum 34 over which the intermediate length of cable 22 extending rearwardly from frame 10 is entrained. At the front end of the assembly is the driving drum 35 about which the forward intermediate portions of cable 22 are wrapped. The cable 22 thus extends rearwardly from the drum 35 over the idler drum 34 and to the carriage frame 10. The driving apparatus which turns drum 35 is schematically illustrated and includes a suitable motor 36 directly connectable to drum 35 by means of a forward clutch 37. In order to effect reversible movement of drum 35 a gearing system is utilized consisting of gears 38, 40, 41, 42 and 43. The gear frame involved would normally be designed to effect a higher rotation of speed of drum 35 in reverse than forward drive. A reverse clutch 44 is provided to complete the gear train. Also shown in FIGURE 6 is a schematic illustration of a fixed position saw 45, driven by means of a motor 46. Thus the logs which are to be carried by frame 10 are carried past the saw 45 by forward movement of frame 10 when the forward clutch 37 is engaged. At the end of the cut desired the motion of the frame 10 is reversed by releasing clutch 37 and engaging clutch 44. This is the conventional manner by which frame 10 would be moved were the ends of cable 22 secured directly to the respective ends of frame 10. In effecting this reverse motion, the inertia of frame 10 must be overcome by frictional losses in the clutches 37 and 44.

The operation of the present invention involves several distinct steps which can best be understood in conjunction with the graph shown in FIGURE 7. The normal forward velocity of frame 10 is illustrated by the lower horizontal line designated by the numeral 47. The normal reverse cable speed is designated by the upper horizontal line designated by the numeral 48. The time elapsed is shown from the left hand side of FIGURE 7 and progresses to

the right hand side. The numerical values given in this graph are merely illustrative and may be varied to suit each particular installation. In any event the forward cable speed is that desired for the frame 10 and is shown starting at the left hand side of FIGURE 7. The end of the cutting operation is shown at point 50. At this time the elements of the instant invention are maintained in the positions illustrated in FIGURES 1 through 4. In other words, the drum 21 is maintained in its stable angular position by the action of the piston rod 24 and chain 25. At point 50 the sawyer, who controls the operation of carriage frame 10, releases the forward clutch 37 and engages the reverse clutch 44. This results in a greater force being exerted upon end 22*b* of cable 22. This unbalanced force on drum 21 will cause the end 22*b* to unwind and the end 22*a* and chain 25 to wind about the periphery of drum 21. As the chain 25 wraps about drum 21, it pulls the piston rod 24 toward the drum 21. This compresses the air trapped at the forward end of cylinder 23, thereby resisting further motion of the chain 25. Thus the action of cable 22 results in the gradual slowing of carriage frame 10 through its position of zero velocity (designated as 51) and when the cylinder 23 results in the prevention of further motion of drum 21, the frame 10 will gradually accelerate in a reverse direction until it reaches the cable speed at the point 52. When this reverse cable speed has been attained, the forces on drum 21 will be in balance and the pneumatic force exerted upon piston rod 24 will be added to that exerted upon the cable end 22*b*. This will cause the drum 21 to rotate about its axis as the chain 25 unwinds from its periphery. Thus the chain 25 will result in end 22*b* being again wrapped about the periphery of drum 21 until the stable angular position of drum 21 is again achieved. During the unwinding of chain 25 the energy stored within cylinder 23 during the reversing of the carriage will thus be utilized to further accelerate the frame 10 until it achieves the peak speed designated at 53 in FIGURE 7. At this time the sawyer should release the reverse clutch 44, and if further reverse movement is necessary, the frame 10 should be allowed to coast at this peak speed. When the momentum of frame 10 must be slowed to again begin the forward motion thereof, the sawyer engages the reverse clutch 44 at the point 54 in FIGURE 7. Since the frame 10 is travelling at a speed greater than the return cable speed, the pull exerted in this instance will be exerted on the end 22*a* which will tend to slow the speed of frame 10. In doing so the end 22*a* will unwind from drum 21 and chain 25 will be wrapped about the drum periphery in a direction opposite to that previously described. At 55 the reverse clutch 44 is released, allowing the drum 21 to again return to its stable angular position after releasing the energy stored within cylinder 23. This release of clutch 44 may be very brief since the return of drum 21 to this stable position is practically instantaneous. The sawyer then instantly engages the forward clutch 37. The clutch 37 will again exert a force upon the end 22*a* and cause the chain 25 to wrap about drum 21. The wrapping action of chain 25 is again resisted by the air within cylinder 23. The frame 10 thus is gradually slowed in its reverse direction until it passes through zero velocity at 56 and begins to accelerate in a forward direction. This will be maintained until the cable end 22*a* and chain 25 reach equilibrium, at which time the frame 10 will be travelling in a forward speed at the normal forward cable speed. This will be evident at 57. When this cable speed is reached, the forward clutch 37 is momentarily released, thereby allowing drum 21 to again attain its stable angular position under the action of chain 25 and cylinders 23.

The purpose of reservoir 31 is to provide a relatively large supply of air to the interior of cylinder 23 so as to enable cylinder 23 to be operated at a near constant pressure during each cycle of operation. The hose 33 provides air to make up for the small losses which accom-

pany expansion and contraction of cylinder **23**. It is advisable to provide an air cushion at the end of cylinder **23** adjacent drum **21** in order to slow the moving piston at its outer limit.

In FIGURES 8 and 9 is illustrated a modified drum arrangement. The drum **21** has been replaced by a four piece unit including a rotatable shaft **60**, a central pulley **61** and two side pulleys **62**. The three pulleys **61**, **62** are splined or keyed to shaft **60** so as to rotate together about the shaft axis. Each pulley **62** is grooved to receive the respective ends of cable **22**. The central pulley **61** has a cross sectional configuration as seen in FIGURE 9. It includes a recessed anchor **61***a* for chain **25**. The peripheral surface of pulley **61** has rounded corners adjacent the anchor **61***a*. These corners lead to an area of decreasing radius in a clockwise direction as seen in FIGURE 9 (indicated at **61***b*) which terminates a continuous radius for the remainder of the pulley **61**.

The area of decreasing radius **61***b* extends from the normal chain position, as illustrated, to the tangential connection of the end of cable **22** leading rearwardly. Thus tension on the forward end of cable **22** will be resisted by a larger radius acting against the chain **25** than will be exerted by tension on the rear end of cable **22**. This prevents the pulleys **61**, **62** from turning during the sawing operation and insures a constant carriage velocity at cable speed.

The deceleration of the carriage will be more rapid in this second embodiment, due also to the increased radius of area **61***b*. Acceleration in the reverse direction will be slower—however this can be compensated by utilizing a higher pressure in reservoir **31** to make up for the smaller accelerating radius.

The operation of this second embodiment is identical to that previously described. The speed curve is shown in FIGURE 10 at the same scale as in FIGURE 7. The steeper deceleration curve between points **55** and **56** provides for less lost time and more efficient use of the sawmill equipment.

The specific operation of the carriage frame and the specific details of the apparatus may be varied, depending upon the individual installation in which they are applied. The drum **21** and the associated cylinder **23** act both as a shock absorber apparatus and as an accelerator in both directions of pull on cable **22**. It is obvious that the energy stored within the cylinder **23** may be utilized to further accelerate the frame **10** in a forward direction as well as in a reverse direction if such acceleration is desirable. Thus the above description is intended to be illustrative but is not intended to exhaust the structural or functional possibilities of the instant invention. The concepts embodied in this invention are fully defined in the following claims.

Having thus described my invention, I claim:

1. An attachment adapted for use on a carriage assembly including a rigid frame mounted for reciprocal motion relative to a fixed foundation and a remote driving apparatus having a reciprocal member adapted to propel the carriage, comprising:

a drum assembly rotatably mounted on the rigid frame for rotation about a fixed axis;

a first flexible member wrapped about the drum assembly and having one end fixed thereto, the remaining end of said first flexible member being operatively connected to the remote driving apparatus;

a second flexible member having one end secured to said drum at the periphery thereof;

and biasing means operatively connecting the remaining end of said second flexible member and the rigid frame of the carriage adapted to exert tension on said second flexible member.

2. An attachment as defined in claim 1 wherein said biasing means comprises:

a pneumatic cylinder mounted on the rigid frame and having a movable piston therein operatively connected to said second flexible member;

a pneumatic reservoir mounted on said rigid frame having a volume substantially larger than the cylinder volume;

and a pneumatic connection between the interior of said reservoir and the end of said cylinder in which air is compressed by tension on said second flexible member.

3. A carriage assembly drive comprising:

a fixed foundation;

a rigid frame mounted on said fixed foundation for reciprocal motion relative thereto;

remote drive means mounted on said foundation;

a drum rotatably mounted on said rigid frame for rotation about an axis fixed relative to said frame;

flexible means having one end secured to the periphery of said drum and having its remaining end controlled by said drive means;

and biasing means operatively connected to said drum and frame adapted to urge said drum to a stable rotative position relative to said rigid frame, said flexible means being partially wrapped about the periphery of said drum when said drum is in its stable rotative position.

4. A carriage assembly drive comprising:

a fixed foundation;

a rigid frame mounted on said fixed foundation for reciprocal motion relative thereto;

a drum rotatably mounted on said rigid frame for rotation about an axis fixed relative to said frame;

biasing means operatively connected to said drum and frame adapted to urge said drum to a stable angular position;

a driving cable extending longitudinally outward from each end of said frame in its direction of travel, the two ends of said cable being fixedly secured to the periphery of said drum, the ends of said cable being partially wrapped in opposite directions about the drum periphery in tangential contact therewith when said drum attains said stable angular position;

supporting means mounted on said foundation outwardly from each end of said frame adapted to carry the intermediate lengths of said cable;

and reversible drive means operatively connected to said cable intermediate its ends adapted to selectively exert a pulling force upon one or the other end of said cable to thereby effect reciprocation of said carriage.

5. A device as defined in claim 4 wherein said biasing means comprises:

an enclosed pneumatic cylinder mounted on said frame with its longitudinal axis perpendicular to the rotational axis of said drum;

a piston slidably mounted in said cylinder and having an integral piston rod extending outwardly therefrom in the direction of said drum;

and a flexible member having one end fixed to said drum at its periphery and its remaining end fixed to said piston rod.

6. A device as defined in claim 4 wherein said biasing means comprises:

an enclosed pneumatic cylinder mounted on said frame with its longitudinal axis perpendicular to the rotational axis of said drum;

a piston slidably mounted in said cylinder and having an integral piston rod extending outwardly therefrom in the direction of said drum;

a flexible member having one end fixed to said drum at its periphery and its remaining end fixed to said piston rod, the total length of the connection be-

tween said piston and said drum being such that said piston cannot abut the end of said cylinder opposite said drum;

a pneumatic reservoir fixed to said frame having a volume substantially greater than that of said cylinder;

means operatively connected to said reservoir adapted to supply air thereto at a constant pressure;

and connecting means pneumatically opening to said reservoir of the end of said cylinder adjacent said drum, said connecting means including a check valve adapted to prevent escape of air from said cylinder to said reservoir.

7. A device as defined in claim 4 wherein said biasing means comprises:

an enclosed pneumatic cylinder mounted on said frame with its longitudinal axis perpendicular to the rotational axis of said drum;

a piston slidably mounted in said cylinder and having an integral piston rod extending outwardly therefrom in the direction of said drum;

and a flexible member having one end fixed to said drum at its periphery and its remaining end fixed to said piston rod;

the peripheral cross section of that portion of said drum contacted by said flexible member having a decreasing radius extending circumferentially opposite to the tangential contact of the end of said cable utilized to effect normal constant speed travel to said carriage.

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