March 3, 1959 A. WOODRUFF 2,875,795

SINGLE SASH GANG SAWMILL

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FIG. 2.

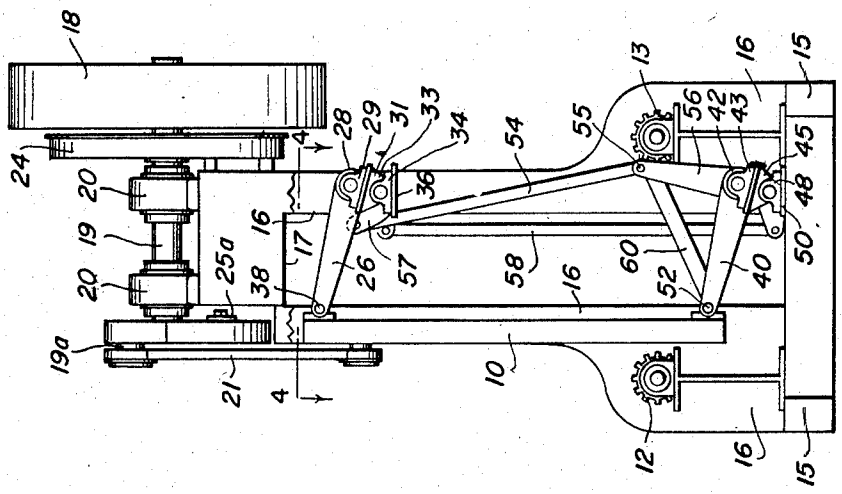
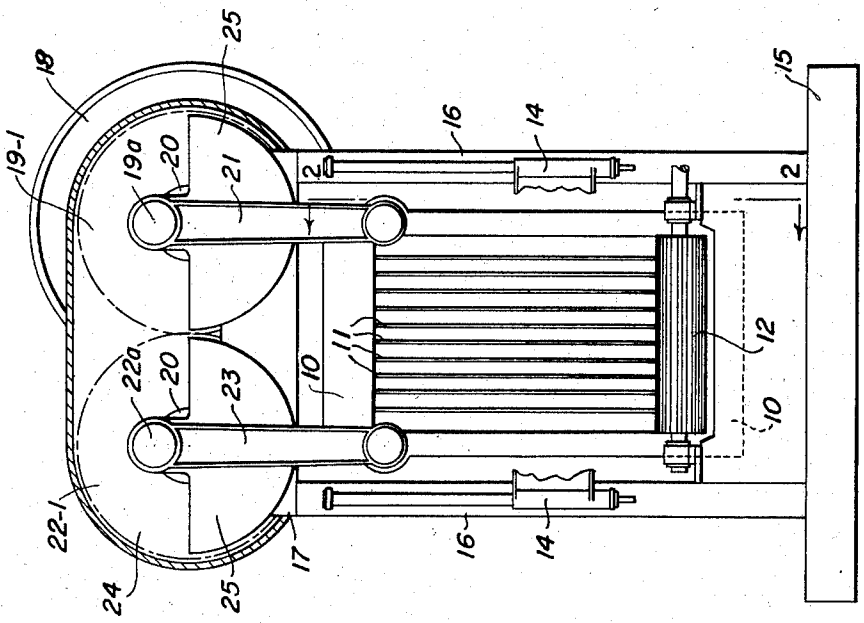



FIG. 1.




Inventor:
ALVIN WOODRUFF,

By D. Mallinckrodt and Philip A. Mallinckrodt,
Attorneys.

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FIG. 5.

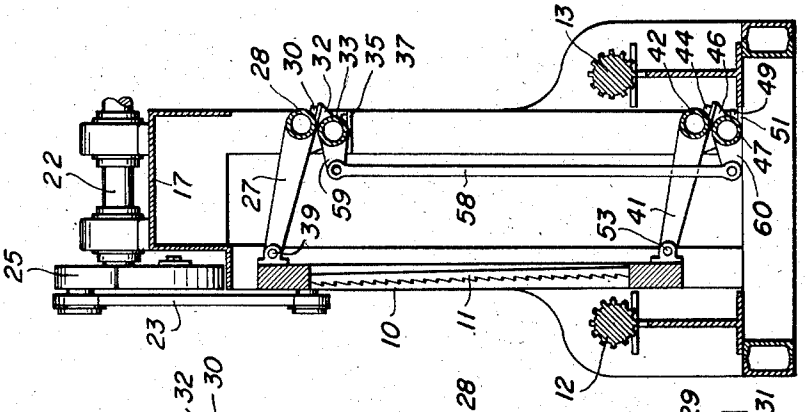



FIG. 4.

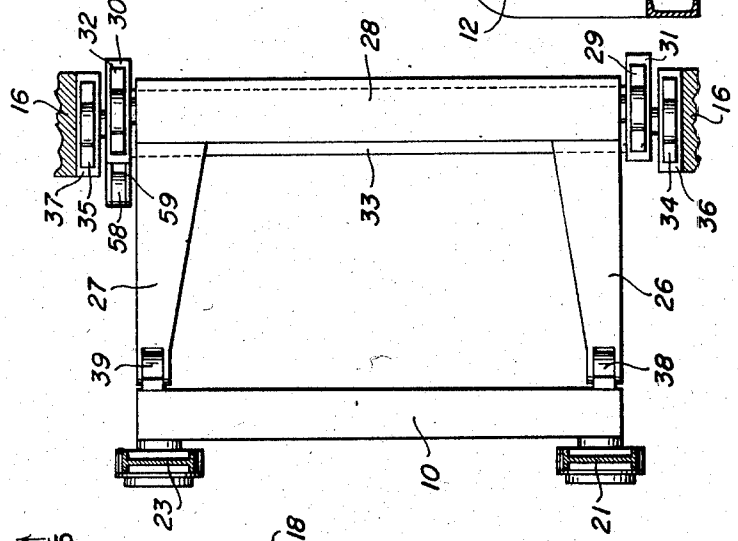
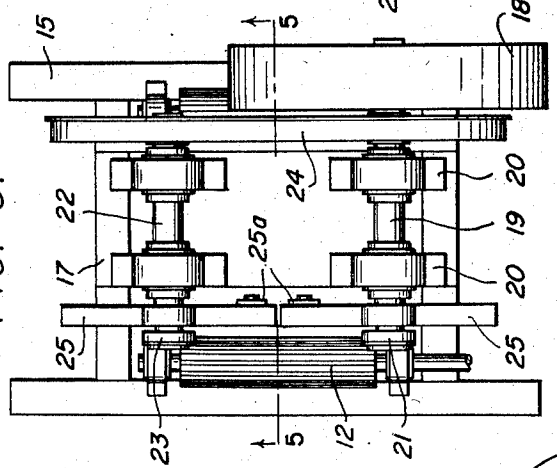



FIG. 3.

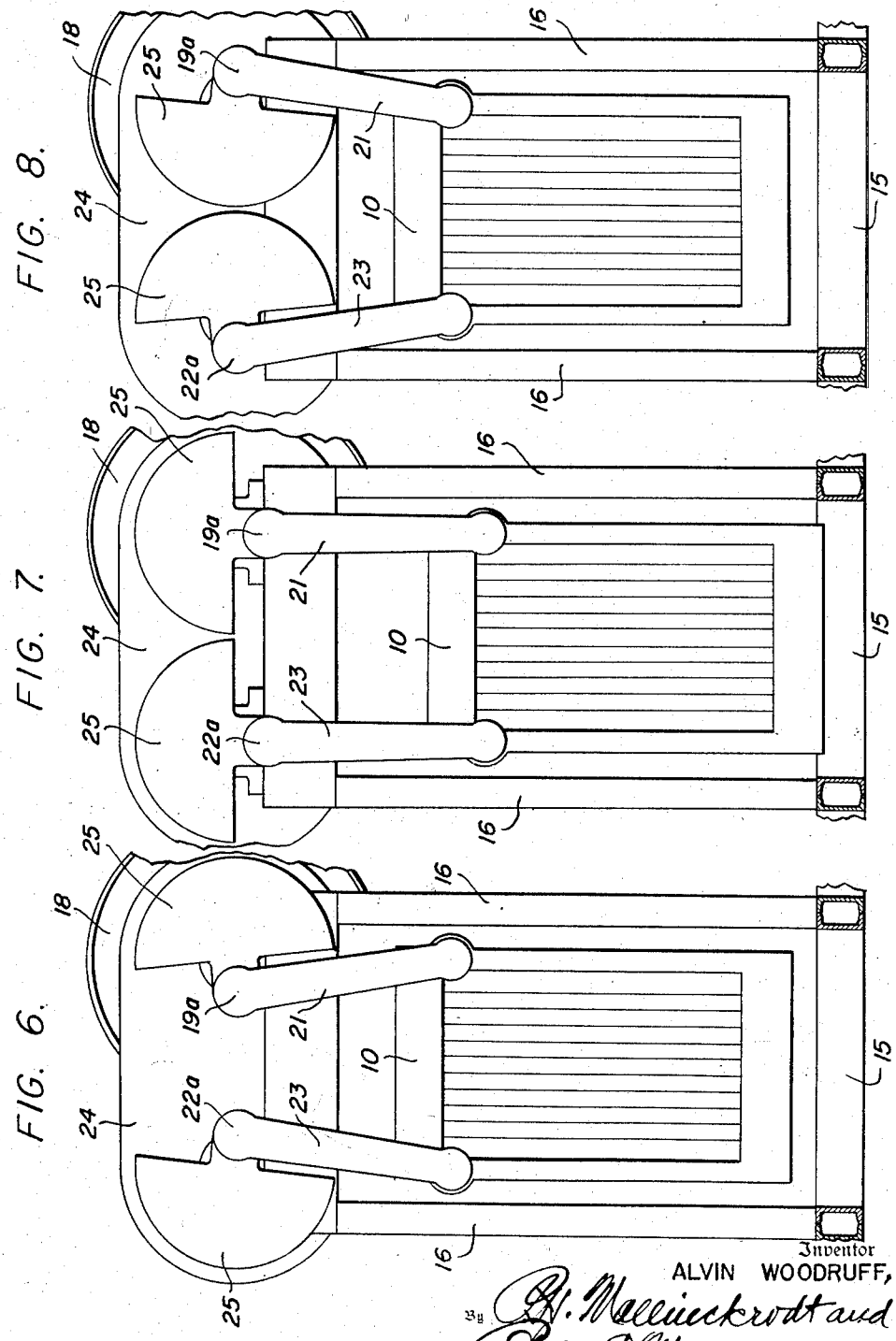



Inventor:
ALVIN WOODRUFF,
By R. Mallinckrodt and Philip A. Mallinckrodt
Attorneys.

March 3, 1959 A. WOODRUFF 2,875,795

SINGLE SASH GANG SAWMILL

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Inventor
ALVIN WOODRUFF,
By W. Macklinckrodt and Philip P. Macklinckrodt.
Attorneys.

March 3, 1959 A. WOODRUFF 2,875,795

SINGLE SASH GANG SAWMILL

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FIG. 10.

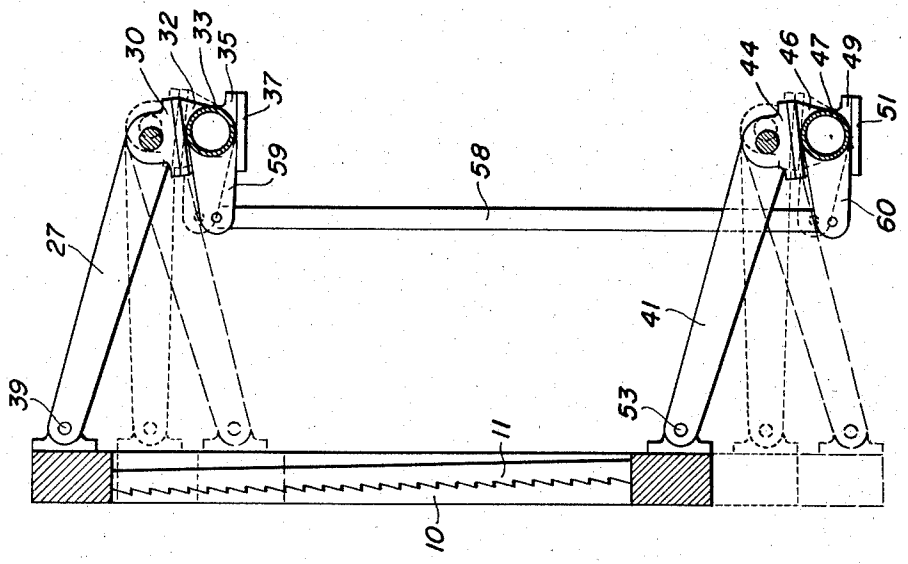



FIG. 9.

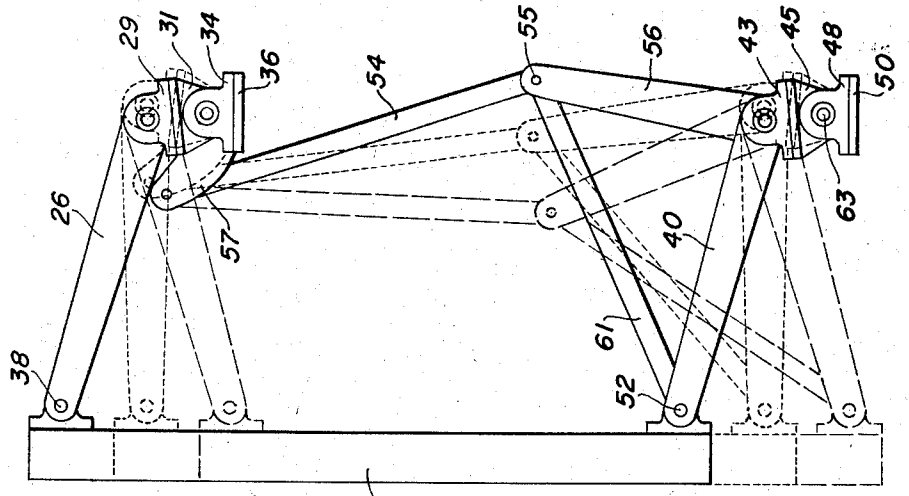
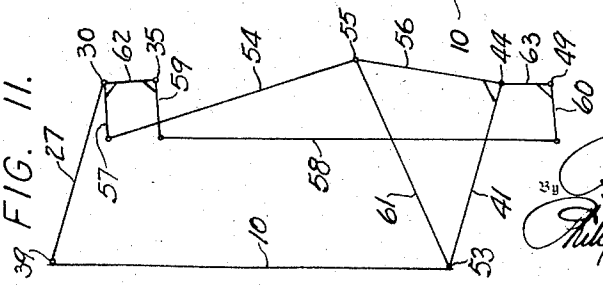



FIG. 11.




Inventor:
ALVIN WOODRUFF,
By A. H. Mallinckrodt, and
Philip H. Mallinckrodt.
Attorneys

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2,875,795

# SINGLE SASH GANG SAWMILL

Alvin Woodruff, Dallas, Oreg.

Application August 31, 1954, Serial No. 453,290

3 Claims. (Cl. 143—60)

This invention relates to sawmills of reciprocative gang saw type, and is concerned particularly with providing an improved single sash gang sawmill for heavy lumbering operations.

Conventional sawmills of this type require anchoring to a massive concrete foundation, and, even then, often vibrate so violently as to make for very considerable operative difficulties.

One object of the present invention is to largely eliminate vibration, so that the machine may be operated with little or no anchorage, and so that there is a substantial increase in cutting smoothness and efficiency.

Another object is to eliminate the principal source of friction accompanying operation of conventional sawmills, specifically the rubbing friction encountered in reciprocation of the saw sash within conventional slideway guides.

As presently constructed, sawmills of the type concerned are exceedingly costly to build and are expensive to maintain in efficient operating condition. Accordingly, it is also an object of the invention to greatly reduce initial construction and installation costs, and to largely eliminate expensive maintenance and repairs.

Vibration is almost entirely eliminated and smoothness and efficiency of cut greatly enhanced in my new sawmill by reason of an improved system of counterbalances for the reciprocating saw sash. Additional cutting smoothness and efficiency are attained and construction costs considerably reduced by a combination of such counterbalancing system with a unique mounting for the saw sash, which mounting is of pivotal character and constrains movement of the sash to a truly rectilinear reciprocative path, without the necessity of slideway guides and unaccompanied by side thrust, despite transmission of motion by an arrangement based on the conventional crank and connecting rod.

A feature of the pivotal mounting for the saw sash is the provision of an assembly of rigid suspension arms pivotally securing the saw sash to respective floating pivots, which are, in turn, rigidly connected to respective suspension pivots fixed to the structural framework of the sawmill. Linkage, which articulates transversely of the plane of the saw sash, interconnects floating pivots at one side of the saw sash through lever arms rigid with a corresponding suspension arm and with one of the floating pivots, respectively, while synchronizing linkage, which is non-articulative, interconnects floating pivots at the opposite side of the saw sash through lever arms rigid with the respective floating pivots.

Further objects and features of the invention will become apparent from the following detailed description of the preferred specific construction illustrated by way of example in the accompanying drawings.

In the drawings:

Fig. 1 represents a front elevation of a typical sawmill embodying the invention and shown with the saw sash at the upper limit of its reciprocative stroke, various conventional parts being broken out or eliminated entirely for convenience of illustration and clarity of explanation;



Fig. 2, a side elevation viewed from the right in Fig. 1, the drive mechanism for the feed rolls and portions of the supporting frame being broken out to reveal the saw sash and its pivotal mounting from the viewpoint of the line 2—2 of Fig. 1;

Fig. 3, a top plan taken from the standpoint of Fig. 2;

Fig. 4, a horizontal section taken on the line 4—4 of Fig. 2, showing the saw sash and its pivotal mounting in top plan and over a considerably enlarged scale;

Fig. 5, a vertical section taken on the line 5—5 of Fig. 3;

Fig. 6, a diagrammatic representation corresponding to Fig. 1, but showing the positions of the counterweights at approximately the mid position of the reciprocative downstroke of the saw sash;

Fig. 7, a similar view, but taken at the lower limit of the reciprocative stroke of the saw sash;

Fig. 8, a similar view, but taken at approximately the mid position of the reciprocative upstroke of the saw sash;

Fig. 9, a motion diagram showing, in side elevation, the saw sash and the articulative linkage portion of its pivotal mounting in various positions assumed during operation;

Fig. 10, a corresponding motion diagram in opposite side elevation, showing the saw sash and the non-articulative, synchronizing linkage portion of its pivotal mounting; and

Fig. 11, a geometric representation of the saw sash and pivotal mounting of Figs. 9 and 10.

Referring now to the drawings:

The illustrated sawmill, which embodies a presently preferred form of the invention, utilizes conventional mechanism for feeding the logs or cants into and for advancing them through a reciprocating saw sash **10** equipped with a plurality of rectilinear saw blades **11** disposed in side by side, gang formation. Such mechanism includes lower feed rolls **12** and **13** of conventional fluted formation disposed at front and rear of the saw sash, and upper feed rolls (not shown) of similar formation and similarly disposed. The front and rear set of rolls are mounted in respective, preferably hydraulically-actuated gates of conventional type, as indicated fragmentarily at **14**.

The operating mechanism of the sawmill is carried by a structural framework, made up in this instance of a structural base **15** and of upright end frames **16**, which are spaced apart laterally of and rigidly secured to the base. The end frames are rigidly connected across their upper ends by a top structure **17**.

The saw sash **10** is mounted in upright position between the respective sets of feed rolls for vertical rectilinear reciprocation across the path of travel through the mill of the logs or cants. It is generally desirable to provide oscillating mechanism of conventional type (not shown) in operative connection with the saw sash, for slightly moving the bottom of such sash backwardly immediately prior to commencing each upstroke, so advance of the log or cant through the mill will be smooth.

The saw sash mounting is of unique pivotal construction, and will be described in detail hereinafter.

Saw sash **10** is reciprocated by means of a crank and connecting rod type of drive connection with any suitable source of power. Ordinarily, the source of power will be an engine (not shown) belted to a drive pulley, such as that shown at **18**, which is secured on a crankshaft having a connecting rod drive connection with one side of the saw sash, and which is intergeared with a

second crankshaft having a similar drive connection with the opposite side of the saw sash. The pair of mutually opposed counterweights are associated with the respective crankshafts in fixed relationship with the shaft portions thereof, for rotation therewith in counterbalancing relation to the reciprocative load. Preferably, such counterweights are formed integrally with the crankshafts in a manner contributing to the formation of the cranks thereof.

In the illustrated preferred construction, the drive pulley **18** is fixed on one end of a crankshaft **19**, which is journaled in spaced bearings **20** upon the upper frame structure **17** of the supporting framework of the machine. A crank **19***a* is formed at the opposite end of the crankshaft **19**, and is connected in reciprocating drive relationship with one side of the saw sash **10** by means of a connecting rod **21**.

A second crankshaft **22**, see especially Fig. 3, is similarly journaled for rotation upon the upper frame structure **17**, and is connected to the opposite side of saw sash **10**, in similar reciprocative drive relationship, by means of a connecting rod **23** attached to crank **22***a*.

The crankshaft **19** is intergeared with the crankshaft **22** by intermeshing spur gears **19–1** and **22–1**, Fig. 1, of equal size, fixed to the respective crankshafts and enclosed by an oil-retaining housing **24**. Thus, the two crankshafts are smoothly driven in opposite directions at the same speed.

Mutually similar counterweights **25** are respectively and correspondingly incorporated in the respective crankshafts, as by welding in the manner shown, to facilitate formation of the cranks **19***a* and **22***a*. Thus, they are affixed to such crankshafts, for rotation therewith in mutually opposed relationship and in counterbalancing relationship with respect to the saw sash **10**.

For best results, each counterweight **25** has a weight which is somewhat greater than the combined weight of the saw sash **10** and several saw blades **11**. For example, a typical sawmill of the invention is equipped with a saw sash and saw blades weighing 600 pounds. Each of the counterweights **25** should weigh approximately 650 pounds. The exact weight of the counterweights is not critical, and is determined for each different size of sawmill by actually testing for best results in the elimination of vibration. Inasmuch as individual saw blades are often added or taken away for particular instances of use of any given sawmill, it is preferred that the counterweights have provision, for example, as indicated at **25***a*, Figs. 2 and 3, for the addition or subtraction of weight in relatively small increments. As illustrated, the additional weight **25***a* may be in the form of properly sized plates bolted to the counterweights.

From the above, it can be seen that the saw sash and contained saw blades are almost perfectly counterbalanced in their reciprocative strokes during operation of the sawmill. The relative positions of the counterweights and of the saw sash during a complete 360° rotation of the crankshafts are indicated in Figs. 1, 6, 7, and 8. Fig. 1 shows these relative positions at the upper termination of a reciprocative stroke; Fig. 6, at a point approximately midway between the upper and lower terminations of a reciprocative stroke during the downstroke in the particular sawmill concerned; Fig. 7, at the lower termination of a reciprocative stroke; and Fig. 8, approximately midway of a reciprocative stroke during the upstroke of the particular sawmill concerned.

It has been found in actual practice, that this counterbalancing system enables a sawmill to be operated substantially without vibration, and enables the base of the structural supporting frame, here the slab base **15**, to serve in many instances as a foundation, in place of the massive and costly reinforced concrete foundations customarily used for the anchoring of conventional sawmills.

While it is possible to utilize the present counterbalancing system in sawmills employing conventional slideway guides for the saw sash, I have provided a unique pivotal mounting for the saw sash. Such mounting enhances the operative effectiveness of the counterbalancing system, and, in turn, is rendered simpler and less costly in construction by reason of such counterbalancing system.

The pivotal mounting system induces the reciprocated sash to travel in true rectilinear fashion throughout both upward and downward strokes, without slideway guides of any kind. Thus, the usual rubbing friction accompanying reciprocation within a conventional slideway guide arrangement is completely eliminated. Reciprocation of the saw sash is easier and smoother, enabling my counterbalancing system to perform with highest efficiency.

From a generalized standpoint, the pivotal mounting which induces the saw sash to execute strictly straight-line reciprocation comprises a linkage system having a pair of upper suspension arms and a pair of lower suspension arms, the respective suspension arms of each pair being spaced apart laterally of the saw sash and pivotally connected thereto. Opposite ends of such suspension arms have individual, floating, pivotal connecttions with respective pivotal points of suspension which are fixed relative to the structural framework of the machine.

The sets of upper and lower fixed points of suspension are spaced apart by a distance equal to that by which the sets of upper and lower pivotal connections of suspension arms to saw sash are spaced apart. The sets of upper and lower floating pivotal connections are similarly spaced apart.

Corresponding, floating, pivotal connections of the upper and lower sets are interconnected by a linkage system having a lever arm connection with one of the suspension arms of the mounting.

As illustrated, a pair of upper suspension arms **26** and **27**, Fig. 4, are rigidly affixed to opposite ends of a shaft **28** having stub ends journaled in respective journal boxes **29** and **30**. The latter are rigid on respective brackets **31** and **32**, which, in turn, are rigidly attached to respectively opposite ends of a shaft **33** having stub ends journaled in respective journal boxes **34** and **35**, the latter being rigidly attached to the respective end frames **16** of the structural framework of the machine, as by means of brackets **36** and **37**. Such suspension arms **26** and **27** are pivotally attached to the upper end of the saw sash **10**, at opposite lateral sides thereof, as indicated at **38** and **39**, respectively.

A pair of lower suspension arms **40** and **41**, Figs. 2 and 5, are rigidly affixed to opposite ends of a shaft **42** having stub ends journaled in respective journal boxes **43** and **44**. The latter are rigid on respective brackets **45** and **46**, which, in turn, are rigidly attached to respectively opposite ends of a shaft **47** having stub ends journaled in respective journal boxes **48** and **49**, the latter being rigidly attached to the respective end frames **16** of the structural framework of the machine, as by means of brackets **50** and **51**, all in a manner similar to the pivotal mounting of the upper suspension arms. Similarly, also, the lower suspension arms **40** and **41** are pivotally attached to the lower end of the saw sash **10**, at opposite lateral sides thereof, as indicated at **52** and **53**, respectively.

The floating upper journals **29**, **30** and the floating lower journals **43**, **44** constitute the sets of upper and lower floating pivotal connections, respectively, for the respective pairs of upper and lower suspension arms **26**, **27** and **40**, **41**; while the fixed upper journals **34**, **35** and the fixed lower journals **48**, **49** constitute the sets of upper and lower fixed points of suspension for such sets of upper and lower floating pivotal connections.

The lateral spacing of the paired pivotal connections is equivalent in the several upper and lower sets, and the spacing between corresponding sets considered longitudinally of the saw sash is likewise equivalent, thereby producing a symmetrical, four-point, suspension system. While it is preferred that the said lateral spacing of upper

sets of paired pivotal connections **38**, **39** and **29**, **30** and of lower sets of paired pivotal connections **52**, **53** and **43**, **44** be approximately equal to the width of the saw sash, and, similarly, that the said longitudinal spacing between corresponding sets of pivotal connections be approximately equal to the length of the saw sash, to provide the firmest possible mounting from a practical standpoint, it should be realized that these spacings are not critical, and may be varied without disturbing the operation of the suspension system as such.

As mentioned hereinbefore, the upper and lower sets of floating pivots are interconnected for synchronous movement by linkage, which has a rigid lever arm connection with one of the suspension arms and a corresponding provision for idling oscillation to accommodate arcuate travel of the suspension arms as the saw sash reciprocates.

In the form illustrated, an articulative link is provided at one side of the saw sash by a rod **54** pivotally connected at **55** to an arm **56**, the pivot axis extending parallel with the plane of the saw sash so that articulation of the link is perpendicular to such saw sash. The opposite end of rod **54** is pivotally connected to a relatively short lever arm **57**, which extends rigidly from shaft **33** so as to be, in effect, rigid with the upper set of floating pivots. The opposite end of arm **56** is rigidly connected to shaft **42**, so as to be, in effect, rigidly connected to lower suspension arms **40** and **41** and to provide therewith one of the lever arms of a bell crank.

A non-articulative, synchronizing link is provided at the opposite side of the saw sash by a rod **58**, pivotally connected at its upper end to a relatively short lever arm **59**, and at its lower end to a similar lever arm **60**. The lever arm **59** extends from rigid connection with shaft **33**, and, thus, in effect, with floating journal box bracket **32** and the pivotal mounting for floating shaft **28**, while the lever arm **60** extends from rigid connection with shaft **47**, and, thus, in effect, with floating journal box bracket **46** and the pivotal mounting for floating shaft **42**.

It is desirable that a brace **61**, Fig. 9, rigidly connect the outer ends of the arms **40** and **56**, which are component to the bell crank formation referred to above.

In operation, my counterbalancing system for the reciprocating saw sash largely eliminates the side thrust ordinarily accompanying saw sash reciprocation of conventional sawmills, thereby making it possible for my pivotal mounting system to be of considerably lighter construction than would otherwise be the case. Furthermore, with my pivotal mounting saw sash reciprocation is as truly rectilinear as could be desired for practical purposes.

It can be seen from Figs. 9 and 10, where the motion is graphically depicted, that in this instance the articulative link, as made up of rod **54** and lever arm **56**, articulates in a plane which is perpendicular to the plane of the saw sash **10**, the articulative pivot **55** thereof oscillating along a path of variable radius due to the floating nature of the end pivots. Meanwhile, the floating pivots provided by journal boxes **29**, **30**, **43**, and **44** oscillate in respective arcs about the pivot axes of their respective fixed points of suspension. The full lines represent the relative positions of the several parts at the upper termination of a reciprocative stroke of the saw sash **10**, the dotted lines represent the relative positions approximately midway between the upper and lower terminations of a reciprocative stroke, and the broken lines represent the relative positions at the lower termination of a reciprocative stroke.

It should be noted that, for any given variation in length of the suspension arms, where no equivalent variation is made in the pivotal mounting system as a whole, the length of the lever arm **56** will vary to an extent necessary to maintain oscillatory travel of the pivot axis **55** along a substantially similar path of variable radius. The proper length of arm **56** may be determined in any



given instance by physically constraining the saw sash to reciprocate rectilinearly, and by testing, during reciprocation thereof, for the position for pivot axis **55** which gives substantially a minimum longitudinal component for the oscillatory travel of pivot axis **55**.

As a guide to the particular path of variable radius found by applicant to give very satisfactory results in practice, a typical sawmill of the invention embodies a saw sash wherein the distance between the attachment pivots **38** and **52** or the attachment pivots **39** and **53** of the respective paired sets thereof is fifty-eight inches, the respective suspension arms are twenty-eight inches long between pivot centers, the arm **56** is twenty-two inches long between pivot centers, the rod **54** is thirty-six and three-fourths inches long between pivot centers, the effective length of arm **57** as measured directly between pivot centers is eight and nine-sixteenths inches, the link **58** is fifty-eight inches long between pivot centers, arms **59** and **60** are each seven inches long, and the distances between the axes of journal boxes **44** and **47**, on the one hand, and journal boxes **30** and **35**, on the other hand, are each five and one-half inches.

The pivotal mounting system for the saw sash is diagrammatically illustrated in Fig. 11 from the standpoint of its status herein as a subcombination representing a mechanical movement, as such. There, single pivots **35** and **49** represent the paired sets of fixed journal boxes **34**, **48** and **35**, **49**, respectively, and constitute the fixed pivot axes of a paired set of bell cranks. The pivots designated **30** and **44** represent the pivotal attachment of the suspension arms to the respective paired sets of floating journal boxes **29**, **43** and **30**, **44**. The pair of upper suspension arms **26** and **27** are represented by the single line designated **27**, and the pair of lower suspension arms **40** and **41** are represented by the single line **41**. The saw sash or any other body to be reciprocated is designated **10**, and the pair of upper pivots **38**, **39** is represented by the single pivot **39**, while the pair of lower pivots **52**, **53** is represented by the single pivot **53**. The rigid link **58** is designated such, as are the component elements **54** and **56** and the pivot **55** of the articulative link. Also, the arms **57**, **59**, and **60** and the brace **61** are designated as such. The distances between journal centers are represented by the single lines **62** and **63**.

Thus, in effect, the system embodies a paired set of bell cranks having the arms **59**, **62** and **60**, **63**, respectively, and the fixed pivot axes **35** and **49**, respectively. The arm **57** extends rigidly from the bell crank arm **62**.

Whereas this invention is here illustrated and described with respect to a particular preferred construction, it should be realized that various changes therein and that various different constructions may be made on the basis of the teachings hereof, by those skilled in the art, without departing from the scope of the claims which here follow.

I claim:

1. In a single sash, gang sawmill, comprising an upright frame having a transverse top frame member; a saw sash equipped with a plurality of saw blades disposed in side by side gang formation within said frame; means mounting said saw sash for rectilinear reciprocation; and means for feeding work into and through the reciprocating saw sash, the combination of a pair of crankshafts spaced apart laterally of the saw sash above said top frame member and extending transversely of the plane of said saw sash, each crankshaft having a single crank at one end thereof projecting beyond said top frame member; bearing means superimposed upon and supported by said top frame member, said crankshafts being journaled by said bearing means intermediate their ends, respectively; a pair of connecting rods pivotally connecting the cranks of said crankshafts to one face of the saw sash at opposite lateral sides and at the upper end thereof; a pair of counterweights secured to the respective crankshafts in opposition to the cranks thereof for

mutually opposed rotation with said crankshafts, said counterweights each having a weight in excess of the weight of the saw sash; a pair of intermeshed and similar spur gears rigidly affixed to the respective crankshafts at the ends thereof opposite the said cranks and beyond the said top frame member; and means connected to one of said crankshafts for rotating the same.

2. The combination recited in claim 1, wherein the counterweights are formed integrally with the cranks of the respective crankshafts.

3. The combination recited in claim 1, wherein a lubricant-tight housing encompasses the spur gears.

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