Sheet 1, 4 Sheets.

J. W. Cochran.

Sawing Mach.

No. 5,394. Patented Dec. 11, 1847.

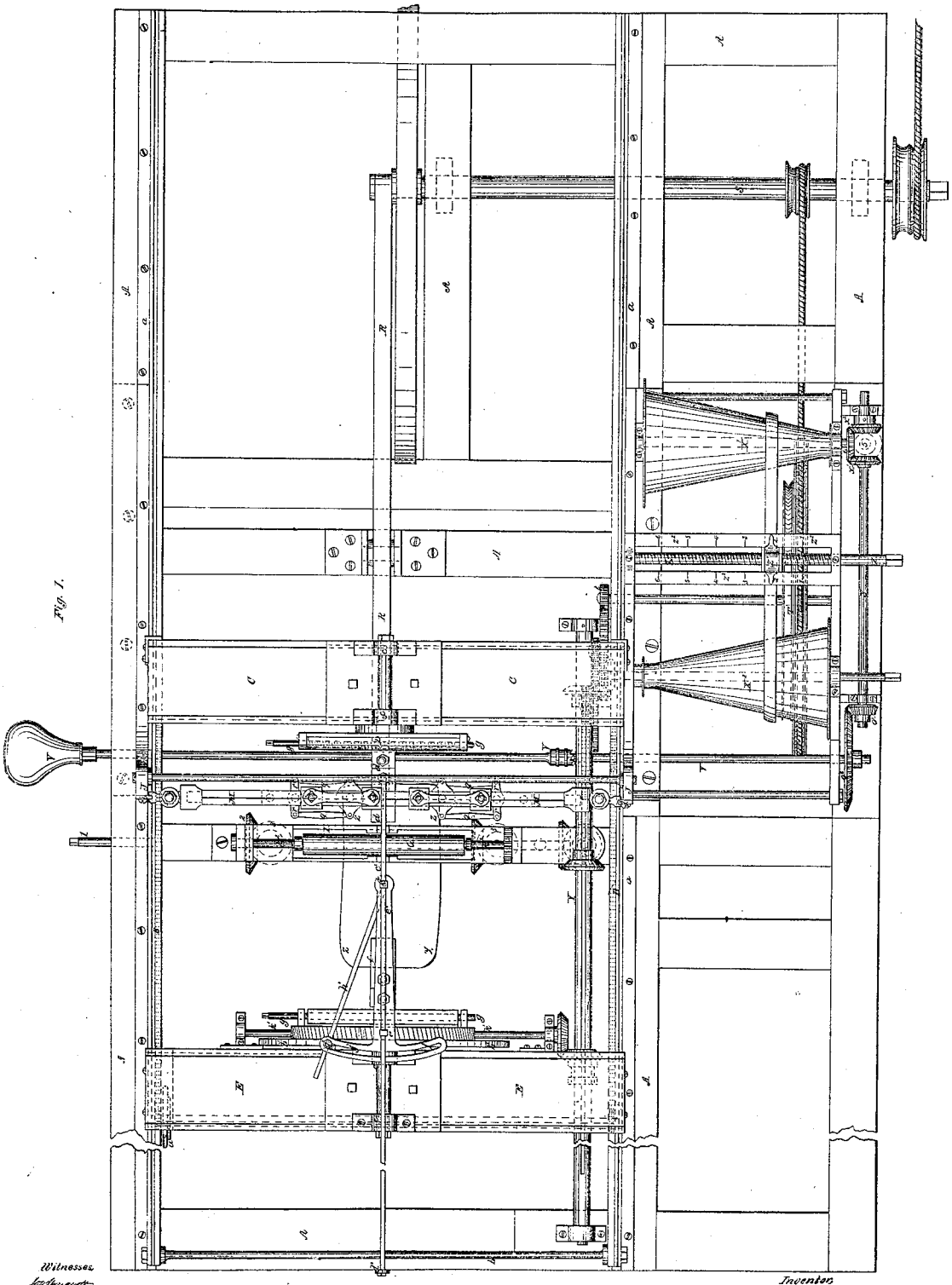

Fig. 1.

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Sheets, 4 Sheets.

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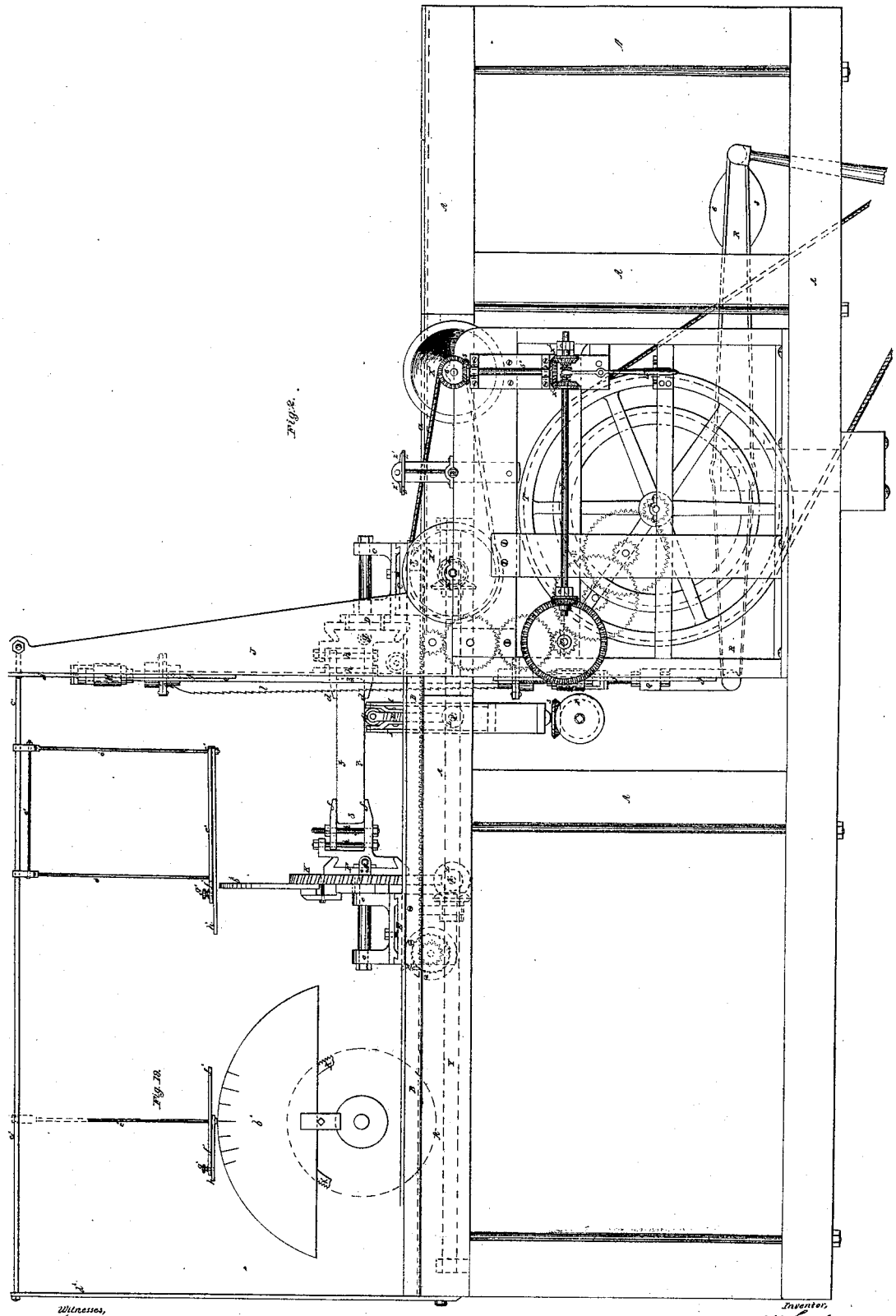

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Sawing Mach.

No. 5,394. Patented Dec. 11, 1847.

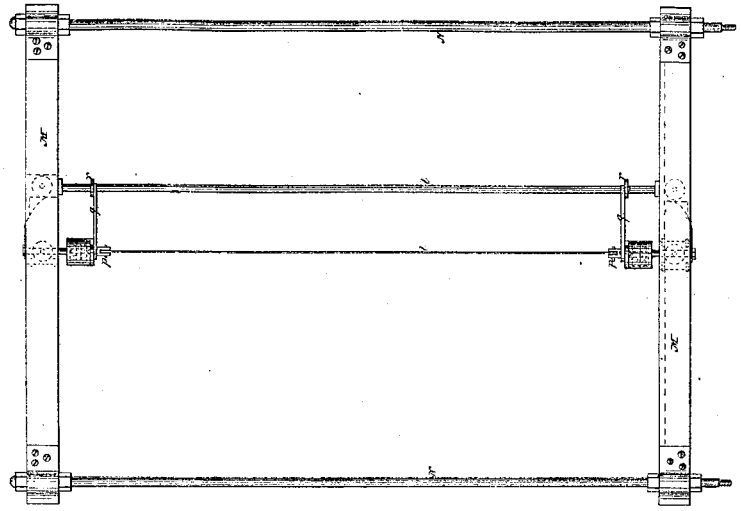

Fig. 2.

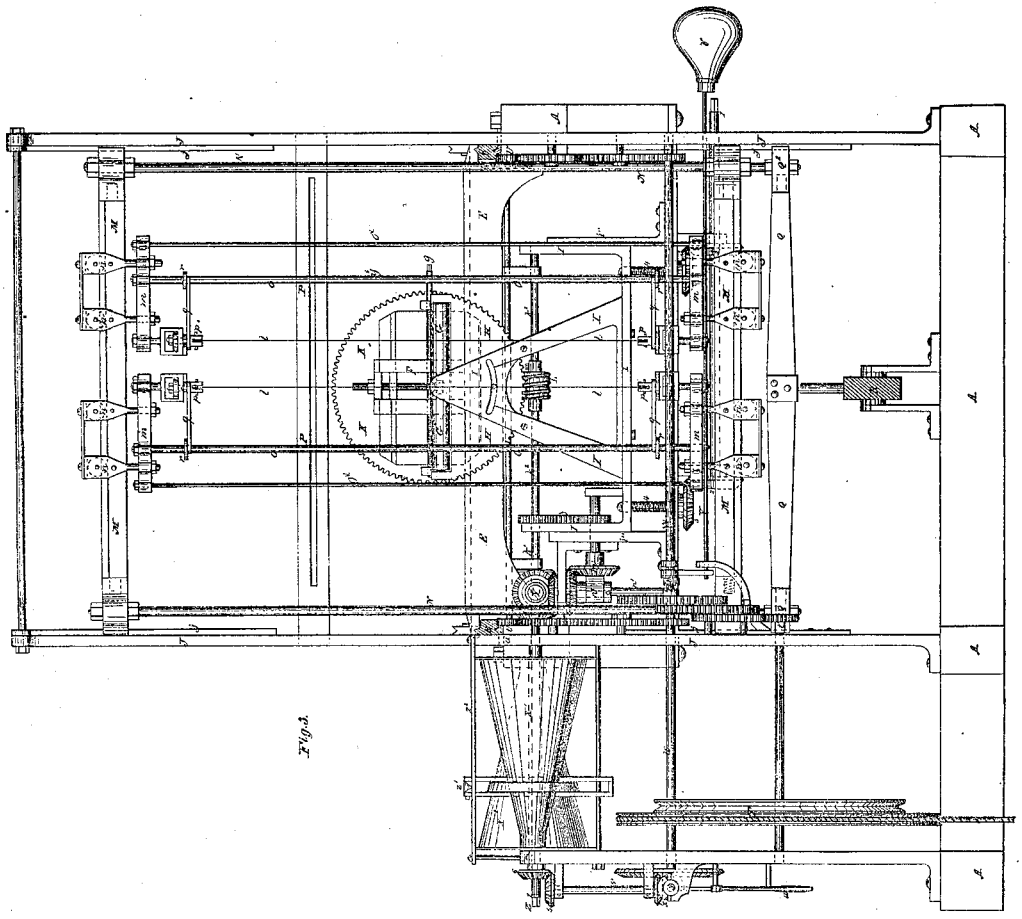

Fig. 3.

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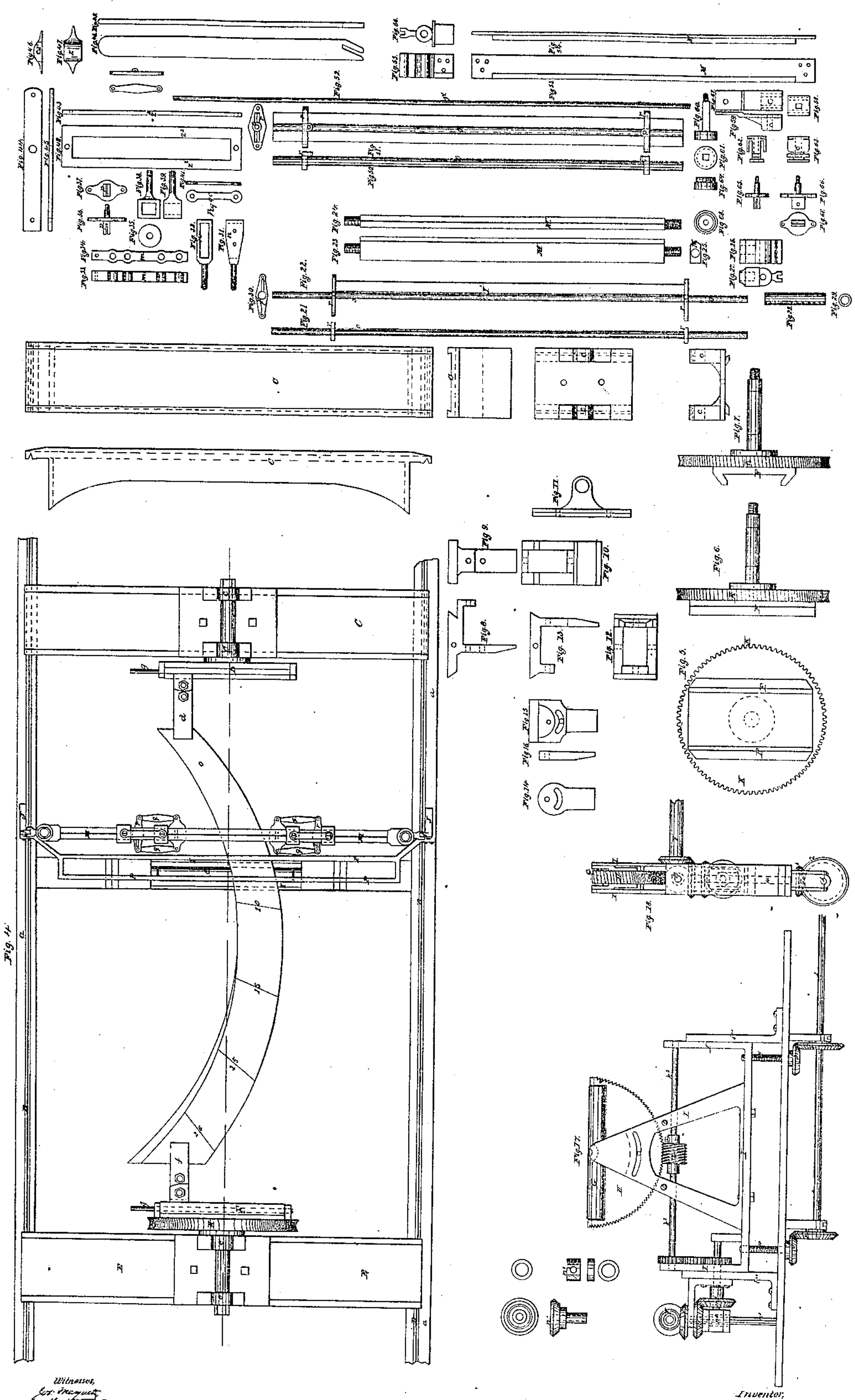
Sawing Mach.

No. 5,394. Patented Dec. 11, 1847



Witnesses,

Inventor,

UNITED STATES PATENT OFFICE.

JOHN W. COCHRAN, OF NEW YORK, N. Y.

MILL FOR SAWING WARPED OR CURVED SURFACES.

Specification of Letters Patent No. 5,394, dated December 11, 1847.

To all whom it may concern:

Be it known that I, JOHN WEBSTER COCHRAN, of New York, N. Y., a citizen of the United States, at present residing in London, in that part of the United Kingdom of Great Britain and Ireland called England, civil engineer, have invented new and useful improvements in machinery or mills for sawing, cutting, or shaping wood, which said invention is called "Improvements in machinery for sawing, cutting, or shaping wood to be used for ship-building or other purposes," and of which same invention the following is a full and exact description.

My said invention consists in certain additions to and variations in the construction and arrangements of the various parts of machinery used for sawing or cutting wood so as to prepare the same of such shapes as may be required for ship building and other purposes.

I will now proceed with the aid of the drawings or figures hereunto annexed (and in which said several drawings or figures similar parts are marked and referred to by similar letters or characters) to describe my said invention in connection with, or as applicable to the construction of a vertical saw mill (or a mill in which the saw or saws thereof move vertically) and for the purpose of more clearly describing the nature of my said invention and the manner of performing or working the same I will describe as well the several parts of an ordinary vertical saw mill as also such additions and variations as aforesaid, and then state those improvements or things which I claim as of my invention; but it must be understood that although I shall describe my said invention in connection or together with a vertical saw mill, my said invention, or the principle thereof, may be applied to the construction of a saw mill working with straight or web saws, whether such saws move or work vertically, horizontally, or in any other manner.

Figure 1, Sheet I, of the said drawings is a plan or bird's eye view of a vertical saw machine or mill with such additions and variations as aforesaid in working order and as the same would appear if viewed from above. Fig. 2, Sheet II of the said drawings is a longitudinal variation of the same machine or mill as the same would appear if viewed from one side. Fig. 3, Sheet III is an elevation of the same mill or machine as the same would appear if viewed from one end, some of the parts of the same machine being removed so as the better to exhibit the remaining parts thereof with such additions and variations as aforesaid. Fig. 4, Sheet IV is a plan or bird's eye view of the sliding carriage of the saw mill separate from the other parts of the machinery of the mill as the same would appear if viewed from above. This carriage (in or upon which is to be placed any piece of wood intended to be cut) is represented in Fig. 4 with the head blocks, chucks, an intermediate roller support and other parts hereinafter described, and having mounted therein a crooked log of wood which has been cut by means of a machine or mill constructed according to my invention.

A A A (Figs. 1, 2 and 3) are the stationary framing or standards upon which the machinery of the mill is mounted. This framing must be firmly fixed in the usual way upon the ground or upon masonry in the building in which the mill is intended to be placed. Two longitudinal rail plates *a*, *a*, (Figs. 1, 2 and 3) of the usual description having V edges on their upper sides are securely fixed upon the upper horizontal and longitudinal rails or beams of the framing, and upon the V edges of which rail plates the sliding carriage is to move in the usual way for the purpose of advancing any piece of wood which it may carry up to the saws in order that it may be cut into the required shape or shapes.

The sliding carriage consists of two longitudinal bars B B (Figs. 1, 2 and 4) (which form the base of the carriage) placed parallel to each other and braced together into the form of a rectangular frame by the transverse rod *b*, and the head block or plate C, C, the construction of which head block is shown in detached figures on Sheet IV of the said drawings.

The undersides of the longitudinal bars B B have each a longitudinal metal groove extending the whole length of the carriage and fitted to the V edges of the rail plates *a*, *a*, so that the carriage may slide easily and securely along in the ordinary way. There are also on the under sides of the longitudinal bars B, B, two toothed racks extending along the whole length of the carriage. These racks are placed within, adjoining to, and parallel with the metal grooves before mentioned and so that a pair of pinions (one of which marked with the

letter U in dotted lines is shown in dotted lines in Fig. 2) may (when a piece of timber is to be cut) move the carriage along upon the rail plates *a*, *a*, by means of trains of wheels connected with the pinions as shown in the drawings, particularly in Fig. 3, and when the piece of timber has been cut, the machinery may be thrown out of gear and the sliding carriage moved back by any of the well known means.

The sliding carriage is kept down in its proper position by two friction rollers, one on each side, and these rollers have their edges fitted to the V rails which are placed along the upper sides of the sliding carriage as hereinafter mentioned. Each of these rollers is attached to the inside of one of the standards within which the saw gate works, and immediately above the sliding carriage, as shown in the drawings.

Upon the head block C, C, is mounted the puppet head *c*, *c*, which is made capable of being moved laterally in a dovetailed groove for the purposes of adjustment. In this puppet head is an axle which carries the chuck plate D, and thus chuck plate is made capable of turning freely upon its axis. This chuck plate has a dovetailed groove extending across the face of it, and having fitted into it the foot of the jaws or clips *d*, *d*, the lower of which is made fixed and the other movable. The movable jaw is kept in its place by two bolts *h*, *h*, and by a nut upon one of these bolts it may be screwed toward the other jaw for the purpose of holding one end of a log of wood or piece of timber firmly in the carriage. And the lower or fixed jaw or clip must be mounted in such manner that the inner surface thereof will at all times coincide with an imaginary line drawn across the face of the chuck plate D and through the center of the axis thereof. These jaws or clips may by means of the screw shaft *g* be moved across the face of the chuck plate in either direction as may be required for the purpose of balancing a log or piece of wood which is to be held between the chuck plates while it is being cut.

The head block E E is mounted upon the side bars B B of the sliding carriage. Along the tops of the side bars B, B, are V edges as shown in the drawings and under and across the ends of the head block E E are grooves fitted to the said last mentioned V edges so that the head block E E when placed across the sliding carriage and with its grooves upon the same V edges may slide easily along above or upon the top of the sliding carriage in the direction which may be required for the purpose of adjustment according to the length of the log or piece of timber to be cut.

The head block E, E, has motion given to it by means of a pair of pinions which are fixed upon a transverse shaft under the head block, and which serve the purpose of keeping the head block down in its proper position on the carriage. This transverse shaft forms the axis of each of the said last mentioned pinions, and the bearings of the shaft (in which it is made to turn by means of a hand wheel or handle) are fastened to the under side of the head block E, E. The last mentioned pinions are placed in such a position that the teeth of these pinions take into the teeth of the toothed rack which is placed upon the under sides of the longitudinal bars B, B, as before mentioned, and as the pinions are turned around in the one direction or the other the head block E, E, will be moved toward the one end of the sliding frame or the other.

Upon the head block E, E, is mounted a puppet head *e*, *e*, which is made capable of being moved laterally in a dovetailed groove for the purposes of adjustment in like manner as the puppet head *c*, *c*, on the head block C, C. In this puppet head *e*, *e*, is an axle which carries a toothed wheel to which is attached the chuck plate F, and this wheel with the chuck plate is made capable of turning upon its axis. This chuck plate has a dovetailed groove extending across the face of it, and having fitted into it the foot of the adjustable jaws or clips *f*, *f*, which are intended to hold the other end of the log of wood or piece of timber placed in the sliding carriage to be cut. These jaws or clips are constructed and placed in or upon the chuck plate F in like manner as the jaws or clips *d*, *d*, are placed in or upon the chuck plate D, D. The chuck plates D and F, with the jaws or clips inserted in them are shown in the drawings.

Detached views of the chuck plate F and wheel K are shown in Figs. 5, 6, and 7, Sheet IV, the dovetailed grooves in the face of the chuck for receiving the foot of the adjustable jaws or clips being seen in Figs. 5 and 7. Detached views of the several parts of the jaws or clips are shown at Figs. 8, 9, 10 and 11. A variation in the construction of the jaws or clips is shown in Figs. 12, 13, 14, 15, and 16, in which the upper and lower jaws of the clips are made with quadrant slots (as shown in Figs. 14 and 15) in order that the upper jaw or clip may be capable of being turned to one side or the other so as the better to grasp and hold any irregular formed end of a piece of timber.

In each of the Figs. 1 and 2, there is represented by dotted lines a log or piece of timber, *z*, *z*, *z*, *z*, held in the sliding carriage by means of the jaws or clips in such a situation as it might occupy if it were about to be submitted to the action of the saws for the purpose of having two of its sides cut so as to make it of the required shape.

In order to place a log or piece of timber in the sliding carriage in a proper position

for being cut, one end of it must be placed between the jaws or clips of the chuck plate D, which is mounted on the fixed head block C, C, and the movable head block E, E, being then moved by turning the hand wheel (*a*) to a proper position for enabling the jaws or clips of the chuck plate F to receive the other end of the log or piece of timber, that end of the log or piece must then be placed between those jaws or clips. The nut of the screw bolt *h* of each pair of jaws or clips is then to be turned so as to bring the movable jaw or clip down upon the log and hold it securely.

In the place of the roller which is ordinarily used in sawing mills or machines for the purpose of supporting a log or piece of wood at an intermediate point between the ends thereof and near to the saws of the mill, I use an oscillating cylindrical roller, or a roller having the axis thereof capable of being deflected from a horizontal position, and this oscillating roller support and the machinery which I deem best adapted for regulating the motions and positions thereof are described as follows. This roller must be placed at a position as near as conveniently may be to the saws of the mill and in front thereof and must be independent of or separate from, but within the frame of the sliding carriage. This roller and the machinery connected therewith may be supported by any framing or other convenient means upon the ground or in connection wth the statonary framing of the mill. A mode of supporting this roller and the machinery connected therewith will be shown in Fig. 3, and the same roller and machinery or parts thereof are also shown in different ways in Figs. 1, 2, 3, 4, and 17.

G (Figs. 1, 2, 3, 4, and 17) represents a cylindrical iron roller mounted upon an axle in a segment piece H. This segment piece is supported by an axle or pin at each side thereof which is mounted in the frame I, I, these axle pins being placed at right angles with the axle of the roller. The segment piece H has the semicircular edge thereof toothed so as to take into the threads of the endless screw L, and the segment piece is held down by a quadrant slot on each side of it and working in the frame I, I, so as to allow of the oscillation of the segment piece for the purpose of varying the deflection of the axis of the roller G in any manner which may be required. The quadrant slot is to be made of a sufficient length to allow of the deflection of the roller support to the extent which may be required. Each side of the frame I, I, is fitted within two upright supporters *i***, *i***, the sides of the frames having longitudinal grooves or slots to receive the ends of pins to be driven through the uprights into the grooves so as to keep the frame I, I, securely within its two uprights and yet allow it to be raised or depressed as may be required. The frame I, I, is supported by two jack screws 4, 4, which are threaded into the lower part of the frame I, I, and the shoulders of these screws work against a stationary rail or bar which is firmly fixed to the stationary framing of the mill as shown in the drawings.

The lower ends of the jack screws are furnished with bevel wheels 3, 3, which respectively take into two bevel wheels 2, 2, and the bevel wheels 2, 2, are fixed upon a transverse shaft 1, which may be turned by a handle or other convenient means. By turning the shaft 1, the bevel wheels will be put in motion and the jack screws turned, and as these screws are turned the one way or the other the frame I, I, may be raised or lowered as may be desired. By these means the frame I, I, and the roller G may be lowered so as to remove the roller G out of the way when desirable so to do, and by raising the frame I, I, and the roller G, the roller may be elevated in such a way as to form an intermediate support to a log or piece of wood while the saws are cutting it. If the pieces of wood intended to be cut in a mill should happen to be of such a description that they will not be held sufficiently steady during the operation of sawing by one intermediate support such as hereinbefore described, the saw mill may be constructed with an additional roller mounted in an oscillating segment piece and capable of being raised and lowered as hereinbefore mentioned to be placed behind the vertical saws or in any other position which may be found desirable for the further or better supporting the pieces of wood to be cut in the mill.

Pieces of wood for ship building and for various other purposes are frequently required to be cut into irregular shapes, and for the purpose of preparing such pieces of wood of the desired shapes it is frequently necessary that one or more of the surfaces thereof should be cut with a varying bevel or surface, or with a surface cut in a twisting or winding manner, the bevel or direction of a cut or cuts constantly varying either regularly or irregular in one or more than one direction as the cutting proceeds. The saws of a vertical saw mill cannot as such mills are constructed be moved out of their perpendicular position to either the one side or the other for the purpose of varying the bevel or surface of a log or piece of timber which they are cutting. This object may however be attained by gradually turning a log or piece of timber which has been placed in a mill to be cut in the requisite direction or directions as the operation of sawing proceeds.

For the purpose of being enabled to turn a log or piece of wood during the cutting

thereof, my improved sawing machine is constructed with revolving chuck plates and an oscillating segment piece with a roller support as hereinbefore described. These chucks and the intermediate roller support or supports may be turned in the manner required by hand or by any convenient machinery for effecting that object such as that I am now about to describe. The teeth of the wheel K behind the chuck plate F take into an endless screw L^1 (as shown in red dotted lines in Fig. 2) which is fixed upon a transverse shaft k^1 (as shown in red dotted lines in Fig. 2) and in like manner the teeth of the oscillating segment piece H take into the endless screw L (as shown in Figs. 3 and 17). The chuck plate D may, if it should be thought desirable, be furnished with a rim of teeth taking into an endless screw in like manner, but a machine will work sufficiently well for all ordinary purposes without this addition to the machine as represented in the drawings.

When a log or piece of wood has been placed with its ends in the jaws or clips of the turning chuck plate the roller support G must be raised until the upper surface thereof at a point immediately above the axis of the segment piece H is upon a level with the centers of the inner faces of the fixed jaws or clips of the chuck plates D and F, and the mill or machinery must be put into gear in such a way that the direction and degree of the inclination (if any) of the axis of the roller support G to the horizon must at all times be the same as that (if any) of the face of the fixed jaw or clip of the chuck plate F. The chuck plate F and the segment piece H must at all times be turned together in the same direction and in the same degree or with the same speed, and the chuck plate D being left free to turn upon its axis, will be turned as the log or piece of wood may be turned. Upon the end of the driving shaft k^1 of the endless screw, taking into the teeth of the chuck wheel K is fixed a bevel wheel taking into another bevel wheel upon the driving shaft Y, which last mentioned wheel is prevented from turning upon the shaft Y by means of a feather or key in the boss of the wheel which takes into a groove along one side of the shaft Y (see Fig. 1).

For the purpose of preventing the shaft Y from springing and also for keeping the said bevel wheel which it turns in gear with the other bevel wheel with which it works, a collar is fitted upon the boss of the bevel wheel (within which collar the boss of the wheel turns freely) and the collar is attached by an arm to the underside of the head block F, as shown in dotted lines in Figs. 1 and 2. The boss of the wheel is kept in its place within the collar by a narrow collar fastened upon the outer end of the boss by a set screw, as shown by dotted red lines in Fig. 2, and as the head block E may happen to be moved along the sliding carriage by the means before described in either direction, the bevel wheel which the shaft Y turns will be moved along at the same time and kept in gear with the other bevel wheel with which it is intended to work.

Upon the end of the driving shaft k^2 of the endless screw taking into the teeth of the segment piece H is fixed a toothed wheel or pinion which takes into the teeth of another similar wheel immediately below it, and the teeth of the second wheel in like manner take into the teeth of a third similar wheel immediately below the second wheel. All these three wheels have their bearings in the movable frame I I with which they must rise and fall. The lowest of the said three last mentioned wheels is fixed upon an axle which passes through a bearing in one side of the frame I I and through the next adjoining upright i^{**} in which a slot is cut so that the axle may pass up and down within the slot as the frame I I rises and falls. The axle of the lowest of the said three wheels has its outer end fitted into a hole or bush in the collar n^2 upon the boss of the wheel n^1 so that the collar n^2 must be raised or lowered in like manner as the end of the axle which works within the said bush or hole.

Upon or near to the end of that axle which is next to the collar n^2 is fixed a bevel wheel m^1 which takes into another similar bevel wheel n^1. The bevel wheel n^1, with its long boss below it, is placed upon an upright driving shaft n^3 which has a groove or key way cut along one side of it to receive a feather placed in the inside of the boss of the bevel wheel n^1, which is made to move freely up and down within the groove. The bevel wheel n^1 and its boss move freely up and down upon the shaft n^3 and the boss of the bevel wheel n^1 which turns freely within the collar n^2 are kept securely within that collar by means of a narrow collar fastened upon the end of the boss by a set screw, as shown in Fig. 3, Sheet III, of the drawings. The bevel wheels m^1 and n^1 are thus at all times kept in gear with each other.

Upon the top of the shaft n^3 is fixed a bevel wheel which takes into another bevel wheel of the same size fixed upon the shaft Y. When the driving shaft Y is left at rest the movable chuck plate F and the segment piece H with the roller G, will also be left in a state of rest, that is, they will not be turned either to one side or the other of the machine. And when it is unnecessary that a log or piece of timber to be cut in one of my machines shown be turned in either direction during the process of cutting for the purpose of producing a piece of wood of the intended shape, then the chuck plates and roller support are to be left in a state

of rest. And if the chuck plates and roller support are turned by such machinery, as shown in the drawings, then also the driving shaft Y and all the machinery connected therewith and hereinbefore described are to be left in a state of rest. But when it is necessary that a log or piece of timber should be turned during the process of cutting in one of my machines, then that may be done by hand as hereinbefore mentioned, or if the machine be such as shown in the drawings, then motion is to be given to the shaft Y, and such motion regulated and (when necessary) accelerated, or retarded by the machinery now to be described. And whenever motion is given by means of the driving shaft Y to the transverse driving shaft k' and the removable chuck plate F, a similar motion will by means of the train of wheels before described be also communicated to the transverse driving shaft k^2 and the segment piece H carrying the roller support G. Upon the driving shaft Y and near to the end of it which is next to the machinery now to be described is fixed a bevel wheel which takes into another bevel wheel fixed upon the end of the axis of the conical pulley or drum X^2 the axis of that pulley or drum being placed at a right angle with the shaft Y, as shown in the drawings. Now to the last mentioned cone pulley or drum is another precisely similar conical pulley or drum X′, the axes of the two pulleys or drums being placed parallel to each other and that end of one conical pulley which is of the greater diameter being placed opposite to that end of the other conical pulley which is of the smallest diameter in the same way as usually adopted in the construction of conical pulleys or drums. These conical pulleys are connected together by maens of a band or belt in the usual way, the position of the band or belt upon the drums being regulated by means of a screw shaft Z and a frame or fork which straddles the band or belt, as shown in the drawing. The screw shaft Z is threaded through a boss or solid piece in the center of the frame which straddles the band or belt and by turning the screw Z the frame and with it the band or belt may be moved upon the cones as may be desired for regulating the motion to be given to the shaft Y and the motion of the machinery connected therewith. At the top of the frame just mentioned is placed a pointer or indicator Z′, which moves along the graduated index plate Z^2, together with the frame according to the position of the frame and the band or belt are altered in the one direction or the other and the person superintending the working of the machine is thus enabled by the screw shaft Z, to move the band or belt into the position which is required for the production of the precise motions which is intended to be communicated to the shaft Y and the machinery connected therewith.

The drum X′ which drives the drum X^2 will give more or less motion to the latter drum according as the belt or band is placed nearer to that end of the conical drum X′ which is of the greater or lesser diameter. Upon the outer end of the axis of the drum X′ is fixed a bevel wheel 6 which takes into a bevel wheel 5 fixed upon the top of the upright driving shaft $5^{\times}$, and at the bottom of the driving shaft $5^{\times}$ is fixed another bevel wheel which takes into the two bevel wheels x^1 and x^2. These wheels are placed upon and near to the end of the driving shaft y and each of them is made to turn freely upon that shaft when not brought into gear by the double clutch which is placed between them upon that shaft. The bevel wheel x' is kept in its proper position by a shoulder behind it, and the bevel wheel x^2 is kept in position by the chair behind it.

The clutch between the wheels x' and x^2 is carried around with the shaft y, by means of a dead key or feather working in a groove in the inside of the clutch in the ordinary way so as to allow of the clutch being moved along the shaft y in either direction when required, so as to be brought into gear with either of the wheels x^1 and x^2 as may be desired. The clutch is moved and kept in either of the three positions in which it may require to be placed by means of a pendant lever w, which at or near to its foot may be placed in either of three notches in a piece of metal according as the clutch may be intended to be out of gear or in gear with either of the bevel wheels x^1 and x^2. Upon the other end of the driving shaft y is fixed a bevel wheel or pinion o^1, which takes into bevel wheel o^2, and the bevel wheel o^2 is fixed upon the outer end of the driving shaft W, by means of which shaft motion is given to the machinery just described.

From the long transverse driving shaft W motion is given to two trains of wheels seen in the drawings, particularly Fig. 3. By these trains of wheels terminated by pinions or wheels taking into the toothed racks on the undersides of the sliding carriage as hereinbefore described the sliding carriage is moved along upon the rail plates a, a, in the manner usually adopted.

Upon the driving shaft W is placed a wheel w^2 which is made to turn around freely upon the shaft when it is not brought into gear by the clutch v. This wheel is kept in its proper position on the shaft in the usual manner. The clutch v has a groove inside of it to receive a dead key or feather let into the shaft upon which it slides in the usual way. This clutch has a collar fitted upon it so as to allow it to turn freely around, and that collar is kept in its place

by means of a narrow collar and set screw. The collar within which the clutch turns around has an arm to which is fastened one end of a rod passing across the machine having at the other end of it a handle V, all which is to be seen in the drawing. By means of the handle V which is connected with the clutch as before described, the clutch may be pushed into or drawn out of gear with the wheel w^2 for the purpose of setting in motion or stopping the mill as may be desired. The wheel w^2 is connected by means of a train of wheels and pinions with the pinion t, fastened upon one end of the shaft or axis of the pulley T, and the pulley T being fastened upon its shaft or axis has motion given to it by a band driven by a pulley upon the main or fly wheel shaft S.

Having described the mode in which motion is given to the sliding carriage and other machinery before described, I will now describe a mode by which I regulate the speed or degree of motion to be given to a sliding carriage during the operation of the machinery in cutting a log or piece of timber. Timber being of various degrees of hardness and the pieces of it to be cut being of variable size and thickness the cutting of pieces of timber may be performed with greater or less speed according as they vary in the respects before mentioned. And when a piece of timber is to be cut into any curved or irregular shape the process of sawing it cannot be safely performed as rapidly as if the saw cuts had to be made in straight lines. For these reasons it is desirable that the person superintending a saw mill should be able from time to time to vary the motion or speed of the sliding carriage carrying the log or piece of timber so as to regulate the speed with which the sawing is to proceed as circumstances may require. The mode in which I accomplish this object is, in place of the pulley T to place a conical drum or pulley upon the shaft of pulley T and place another conical drum or pulley on suitable bearings near to it such second drum receiving motion from the main shaft in any convenient manner. These two conical drums are to be connected with each other by means of a strap or band, the strap or band is also to be moved along the conical drums by a frame or fork (or in any other convenient manner) in the same way as hereinbefore described with reference to the drums X′ and X² and the apparatus connected therewith.

When a saw mill is furnished with a pair of conical drums similar to those just described, the person superintending the mill may by moving the strap along the conical drums from time to time regulate the speed or motion to be communicated to the machinery at pleasure, and by these means he is enabled to increase or diminish the speed with which the sliding carriage is moved and consequently thereby to increase or diminish the feed or motion of the log or piece of timber placed in that carriage toward the saw or saws for the purpose of being cut.

I will now proceed to describe the mode in which I mount and work the saws in a machine or mill made according to my said invention and the construction of the various machinery connected therewith.

J, J; J, J; are two upright metal standards or fender posts bolted or otherwise securely fastened to the foundation of the machine or building. These standards are placed perpendicular and parallel to each other, and they are to be held firmly together at the top by means of a rod, brace or stay, or other convenient means. On the inside of each of these standards are placed two vertical guides j, j, and j, j, upon which slide up and down the saw frame or gate in the usual way. The saw gate or frame consists of two bars M M and M M connected or held firmly together by means of two side or connecting rods N N and N N, as shown in Figs. 1, 3, and 4. The bars and side rods are connected together by lock nuts so that the frame may be lengthened or shortened as may be required for the purpose of taking or holding longer or shorter saws as may be required. To the foot of each of the connecting rods N N and N N is attached an end piece Q′ and Q² each of those end pieces having a groove in its end next the standard so as to work up and down upon one of the guides j. In each of these end pieces is a hole to receive the ends of the cross head Q, Q, to which motion is to be given for the purpose of receiving the saw frame or gate up and down as shown in the drawings.

The upper bar M M has a V edge along so much of the upper side thereof as is necessary to receive the antifriction rollers to be placed upon it as hereinafter described, and the lower bar has a V edge along so much of the lower side of it as is necessary to receive similar antifriction rollers. Within the gate or frame which has just been described are to be placed and held the saw or saws, each saw being separately mounted upon a stretcher or otherwise as hereinafter described. My saw stretcher is made of two end pieces m, m, into each of which is fitted one of the ends of the standard or strut o, and into one end of each piece is fitted a tension rod o^x. At the other end of each cross piece is fixed a swivel having a swivel piece or turning pin p, one end of which is to be held in the swivel box by any of the usual means, and the other end of which swivel piece or pin is constructed with an

opening or chops for receiving a saw in the ordinary manner. Each swivel piece has a flange with ears or arms, the flange being placed between the swivel box and the opening or chops for holding the saw. The swivel piece and flange are both made of one piece of metal, and the flange is placed close to the end of the swivel box so as to prevent any wabbling or shaking in the swivel joint.

Upon or near to each end of the upright standards O, O, and opposite each of the flanges which have just been described, is placed a link or piece of metal *r*, which is made to turn freely upon that part of the standard. Between the links or pieces of metal (just described) when put into their proper places upon one of the standards O, O, is to be placed a feather or rib Y* parallel to the standard but so as not to touch it in order that the feather or rib may turn freely without being impeded by friction against the standard. This feather or rib is to be inserted and firmly fixed in a mortise in each of the links between which it is placed, and so that the feather and two links or pieces to which it is attached may move together around or upon the standard as far as may be required.

The ears of the flanges before described and the ends of the links *r* which have also been described, are then to be connected together by movable cross or parallel arms so as to obtain what is commonly called parallel motion (as seen in the drawings) and so that by means of such parallel motion when the feather or rib is turned in either direction the saw may without applying any force thereto, except at the ends thereof, be then turned in a similar direction. When the machine is in action a saw may be turned in either direction as required by means of a key applied to the feather or rib and without touching the saw with the key. A drawing of a key proper for this purpose is to be seen at Figs. 48 and 49 in the drawings.

For the purpose of cutting pieces of timber into curved or irregular shapes, particularly if there should be any sharp or quick turns to be made in any of the cuts, required, the saw blade or blades to be mounted in one of my machines should be narrow, and if made with thin backs they will turn and cut so much the better. The end pieces of a stretcher being put upon the standard O, the saw—*l*,—fastened into the chops of the swivel pieces in the ordinary manner, the ends of the flanges and links being connected by means of the parallel arms as hereinbefore described, and the tension rod $o^{\times}$ being by means of its nuts at each end screwed sufficiently tight the saw will be stretched to its proper tension for sawing and the saw with its stretcher will be ready for being mounted within the saw gate or frame.

Each saw together with its stretcher is to be mounted in the saw gate or frame in such a manner that it may be moved laterally within the saw gate or frame, and when there are two saws mounted, the saws with their stretchers ought to be mounted so that the saws may be placed toward the center of the frame and the tension rods toward the outside of the frame in order that the saws may be capable of being brought near together when required for the purpose of cutting a piece of wood into any required shape.

For the purpose of mounting the stretchers and their saws within the frame or saw gate, I use sliders *n*, *n*, which are fitted upon the upper and lower bars M M and M M, and have friction rollers working within them upon the V edges of the bars. One end of each of these sliders is made in the form of a stem or bolt which is to be passed through a hole made for that purpose in the end piece of a stretcher and secured by means of a nut. I use four of these sliders for the purpose of mounting each saw and stretcher, two at each end, and the nuts upon the ends of the stretchers are to be screwed sufficiently tight to hold the saws and stretchers securely within the gate or frame and yet allow them to move freely in a lateral direction as may be required. Each pair of sliders is to be held firmly together by means of a cross bar fixed to the outer end of each slider, and each slider should be furnished with a set screw so that all or any or either of the saws may when required be fixed in any particular position for making a straight cut or cuts, and so that if any or either of the saws should happen not to be required for the sawing any particular piece or pieces of timber, they may be fastened at one side of the saw gate and out of the way.

Various parts of the saw gate or frame, saw stretchers, standards, swivels and apparatus connected therewith which have been hereinbefore described are to be seen in detached figures in Sheet IV, and are respectively numbered from 21 to 47, both inclusive. A different mode of mounting a saw blade in a peculiarly constructed saw frame is shown at Fig. 20 Sheet III, the various pieces of which frame and the mode of mounting the saw therein are shown in detail in various detached figures in Sheet IV, are respectively numbered from 50 to 68 both inclusive. The peculiarity of the construction of this frame or gate is, that its top and bottom bars are made of pairs of rails connected together leaving open slots between them in which the standard and bracing of the saw is enabled to slide laterally py means

of rollers running upon or along flanges in the inner sides of the rails. The saw blade which turns by swivels is moved by links and arms as before described the links being connected to wings or feathers extending from a tube which turns upon the standard rod. This is for turning the saw by means of a key to be passed through slots in the frame P, as shown at Figs. 3 and 4, in Sheets III and IV of the drawings.

In Fig. 20 is shown two of my improved saw swivels to which the saw in that figure is shown to be attached. The various parts of the same swivel are also shown in the several figures respectively numbered from 60 to 68 (both inclusive) in the fourth sheet of the said drawings. This swivel is constructed so as to turn around upon friction balls or spherical rollers placed within the swivel box or cylinders. In front of or behind the saw gate I place a cross frame extending from side to side of the machine and attached to the standards or fender posts J, J, as shown in Figs. 3 and 4, it being there seen and shown placed in front of the saw gate. This cross frame is composed of two thin metal rails or plates placed a proper distance apart for the purpose of balancing or holding the key or fork to be used for turning the feathers or ribs. In each of these rails or plates is cut a longitudinal slot extending nearly the whole length of this cross frame, these slots being cut of such a diameter as to admit the key or fork to be introduced with facility into it. The key or fork may then be introduced between the slots of the cross frame and after having been applied to a feather or rib for the purpose of turning it together with the saw attached thereto in the required direction the key may be allowed to remain in the slots of the cross frame and it will be retained there and be prevented by the two narrow rails above and below it from falling or being shaken out, and will thus be at all times ready for instant use when required.

The alternating vertical movements of the saw frame or gate are effected as follows. The cross head Q, Q, (see Fig. 3) is attached by means of a rod to the vibrating beam R R, and that beam is connected by means of another rod to a crank on the fly wheel shaft or first mover S of the machine, and when the fly wheel shaft is put in motion the crank gives a vibrating motion to the vibrating beam with which it is connected and the vibrating action of the beam R R gives the requisite alternating vertical movements to the saw frame or gate in the usual way.

In order to balance the weight of the saw gate or frame, I attach a sufficient counterbalance weight to the end of the beam R, R, which is opposite to that connected with the saw gate. I balance the weight of the saw gate in this manner in preference to placing a counterbalance weight on the fly wheel as usual because I find that the weight of the saw gate is as effectually counterbalanced by the mode I adopt, and by adopting that mode the motion of the fly wheel is equalized and the strain upon parts of the machinery diminished.

A sawing machine constructed as aforesaid or otherwise according to my invention may be used for the purpose of cutting logs or pieces of timber by one and the same operation into many shapes which could not be effected by other machines without a plurality of operations. Thus if both or either of the sides of a log should be intended to be cut in a curved or irregular line that object may be attained by turning from time to time the feather of each or either of the stretchers of the saws and with it the saw in the required direction, and when simultaneously making two cuts in a log by my machine it is not at all necessary that the cuts should be made parallel with each other, for the lateral movements of the saw stretchers within the saw gate being perfectly independent of each other, each saw may be turned in the required direction for the purpose of making the intended cut in the line desired, however much the two lines to be cut by the two saws may vary from each other.

It is not necessary that two saws should be actually used for the purpose of cutting timber in one of my machines, although two saws upon their stretchers may be mounted in the saw gate, for the peculiar construction of my sawing machine may be made available for the purpose of making single as well as double cuts. And if it should happen that the shape into which a piece of timber is intended to be cut requires the adoption of such a mode of proceeding, I can enter one of the saws and commence cutting a piece of timber with it, and after the cutting with one saw has been proceeded the requisite distance I can then enter the other saw also, so that both saws may then proceed with the cutting of the log, or the cutting with either or both of the saws alternately or simultaneously may be varied time to time as may be required for the purpose of cutting the piece of timber into the required shape.

Although my machine will make cuts along pieces of timber in irregular lines as hereinbefore described yet it must be understood that my said machine is capable of making any cut or cuts in a straight line or lines and is also capable of making either of two cuts in a straight line whether the other of the two cuts it is making is or is not straight. If the face of a cut or cuts to be made by one of my machines should happen not to be required to be made winding

or to be made with a varying bevel or bevels the turning chuck and roller support or supports must not be turned by hand or otherwise during the operation of sawing, and if the machine is constructed like that hereinbefore described the machinery hereinbefore described for turning the chuck plates and roller support must not be brought into action, but the saw or saws having been properly entered in such a case the cut or cuts of the required shape may be made as hereinbefore described the chuck plates and roller support remaining at rest within the sliding cariage during the whole operation. But when it is intended that the face of the cut or cuts to be made by my machine shall wind or vary in the bevel thereof the chuck plates and roller support or supports must be turned by hand or otherwise in the requisite manner, and if the machine is made as hereinbefore described, then the machinery hereinbefore described for turning the chuck plates and roller support must be put in motion by turning the pendant lever or handle *w* in the proper direction according to the direction in which the face of the cut or cuts to be made shall be required to wind or vary in the bevel thereof, and the direction in which the face of cuts may be made to wind or vary in the bevel thereof may be changed from time to time as required by reversing the action of the machinery by means of the pendant lever or handle *w*.

By means of the inverted conical drums hereinbefore described I am also enabled by one of my machines constructed in manner aforesaid from time to time to vary the degree or amount of the winding or variation in the bevel of the face of any cut or cuts to be made by the saws and in order to effect this object by means of the screw shaft Z, I shift the position of the connecting band or belt of the conical drums X^1 and X^2 so as to increase or diminish the driving speed of the conical drum X^2 and thus vary the rotatory movement of the log.

The graduated index plate already described is to be marked in such a way as to show the degree of rotary motion which any particular position of the band or belt upon the conical drums will give to a log relatively to the longitudinal motion of the log during the process of cutting. And the angles or degrees of the bevel or bevels being marked upon any log to be cut (as shown by way of example in Fig. 4) the person having the direction of the machine will be enabled by means of the graduated index scale the index or indicator, the screw shaft Z and machinery connected therewith to regulate the rotary motion of the log in the manner which may be necessary for producing the required effect. When I effect such bevel cutting of a log as aforesaid by turning the log (during the process of cutting) either by hand or by any other means except such self acting machinery as hereinbefore described as applicable for that purpose, I employ an apparatus which I am now about to describe for the purpose of enabling me the better to regulate the turning of the log as well as to dispense with marking the log with indicative figures for representing the bevel or bevels to be cut.

This apparatus is shown in connection with my said sawing machine in Figs. 1 and 2, and also in Fig. 19. This apparatus consists of a graduated semi-circular board *b**, *b**, marked with the angular lines or degrees denoting the angles or bevels to which the sides of the log are required to be cut for any particular distance. I attach this board *b**, *b**, firmly to the back part of the chuck wheel K by means of a bracket and screw or other fastening. Upon a longitudinal bar *c**, *c**, extending along the middle of the machine from the transverse tension rod of the standards J, J, to an end standard *d**, I mount a sliding frame *e** *e**. The end of this frame has a segmental piece *f** with a quadrant or segmental slot formed in it which receives a screw *g** inserted into a radial arm *h** movable upon a center at *i**.

In commencing the operation of cutting the log I fix the sliding frame *e**, *e**, and place the radial arm *h** at an angle corresponding with the bevel to be cut. The arm in starting must be fixed to the segment piece *f** standing over a certain mark upon the board *b**, which shall indicate the angle of the bevel to be cut, and as the carriage with the chucks advances, the rotary motion of the log upon the centers of the chucks must be so arranged as to keep the said mark upon the board *b** always immediately under the edge of the radial arm. When the mark upon the log indicating that the bevel of cutting is to be altered has arrived at the saws, the corresponding mark upon the board *b** will have come under the center *i**. The frame *e**, *e** must then be slid forward upon the bar *c**, *c** and again fixed; the radial arm *h** being adjusted to the required angle of bevel and its edge brought over the corresponding mark upon the board *b**, the operation goes on as before, and by so adjusting the parts as described from time to time to suit the required bevels to be cut on the sides of the log the operation is perfected.

In order to balance a crooked piece of timber in the holding chucks when submitted to the operation of the saws I slide the holding jaws D and F laterally in the dovetailed grooves of the chucks D, F, by which their positions will become eccentric as seen in Fig. 4. By these means the weight of a crooked piece of timber may be equally di-

vided or balanced so that its center of gravity or axis shall be brought as nearly as possible into the axis of rotary motion, that is, the centers of the chucks. This will afford greater steadiness to the log under operation and prevent the saws being subjected to lateral strain, and the necessity for a counterbalance weight to balance the log will also be thus obviated.

Having now described the nature of my said invention and the manner in which the same is to be performed in manner aforesaid, I hereby declare that I claim as of my said invention for which I am desirous of securing Letters Patent—

1. The mode of constructing saw mills or machines, with revolving or turning chuck plates and oscillating or turning intermediate roller supports for the purpose of holding sustaining or supporting logs or pieces of timber while being cut, such chuck plates and supports being made capable of being turned by the machine itself or by hand for the purpose of varying (when necessary) the bevels of the cuts to be made by the mills or machines for the purpose of producing pieces of timber of the required shapes.

2. The mode of giving the motions to determine the curves and to move the supports of saw mills as aforesaid by means of a pair of conical drums connected by belts or bands and furnished with graduated scales for the purpose of enabling the attendant workmen to regulate the motions of the parts that hold and support the pieces of timber so that the bevels or curves of the cuts to be made in such pieces of timber may be varied in the manner necessary for cutting such pieces into the regular shape.

3. The mode of constructing such chuck plates as aforesaid with the jaws or clips thereof mounted upon an eccentric motion, that is to say, upon a foot or piece fitted into a groove so as to be capable of sliding laterally therein from the center of the chuck plate for the purpose of bringing the centers of gravity of logs or pieces of wood of irregular shapes within a center line drawn between the centers of the chuck plates for the balancing of such logs or pieces while they are being cut or shaped in mill.

4. The mode of constructing the jaws or clips of such chuck plates as aforesaid with quadrant slots, and so that one of the jaws or clips thereof may be turned toward either side for the purpose of better and more securely holding logs or pieces of timber of crooked or irregular forms while being cut or shaped in the mill as hereinbefore described.

5. The mode of mounting saws in stretchers as hereinbefore described in combination with the mode hereinbefore described of mounting such saws with their stretchers within a saw gate or frame, so as to be capable of sliding laterally in either direction within the saw gate or frame.

In testimony whereof I the said JOHN WEBSTER COCHRAN hereto subscribe my name in the presence of the witnesses whose names are hereto subscribed on the twenty eighth day of November (in the year of our Lord one thousand eight hundred and forty six.)

J. W. COCHRAN.

Witnesses:
JOSEPH MARQUETTE,
WILLIAM EWING.