5 Sheets—Sheet 1.

F. MILLWARD.

BAND SAWING MACHINE.

No. 192,810. Patented July 3, 1877.

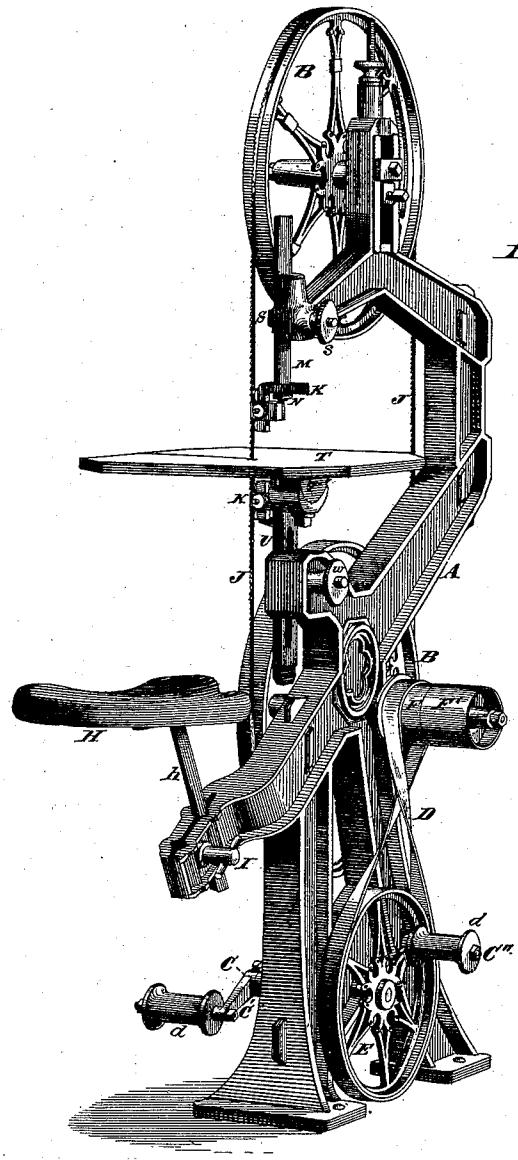


Fig. 1.

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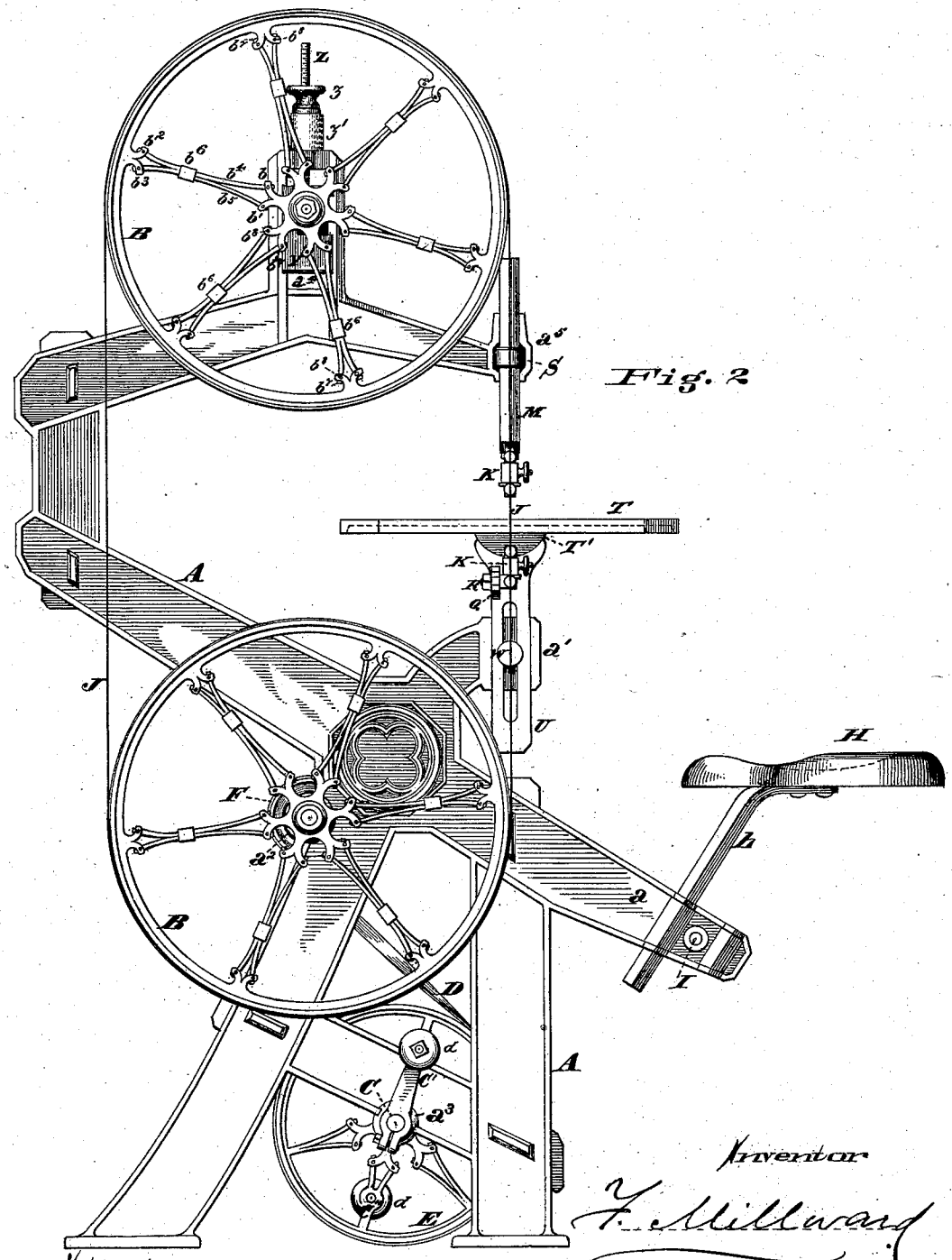


Fig. 2

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BAND SAWING MACHINE.

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Fig. 3

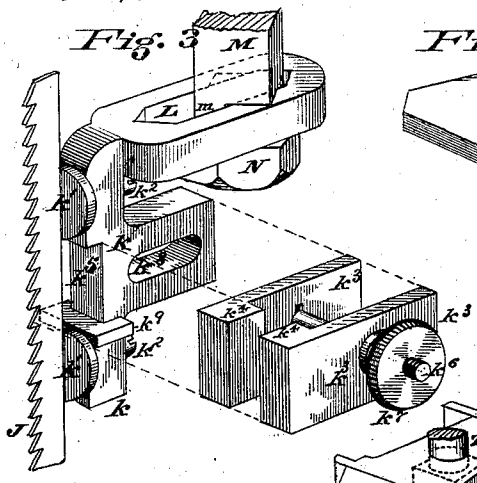


Fig. 5

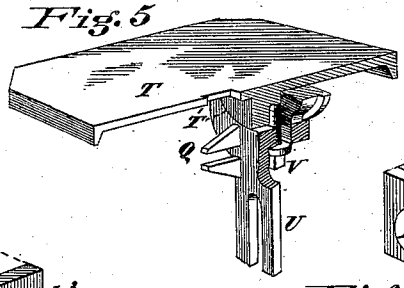


Fig. 4

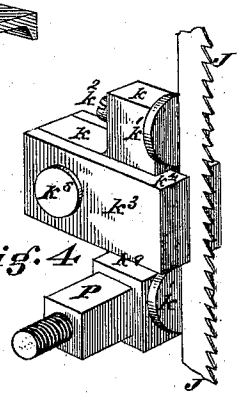


Fig. 6

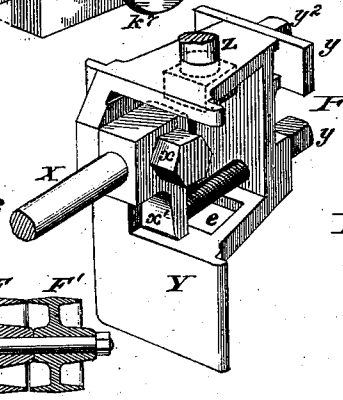


Fig. 8

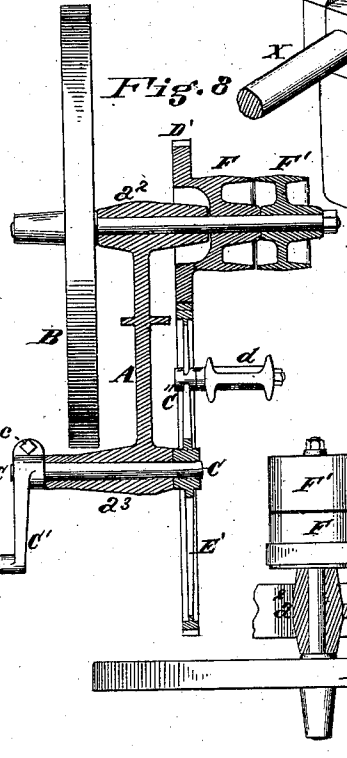


Fig. 7

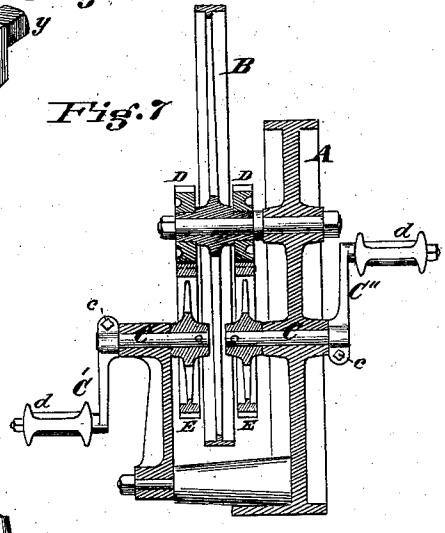
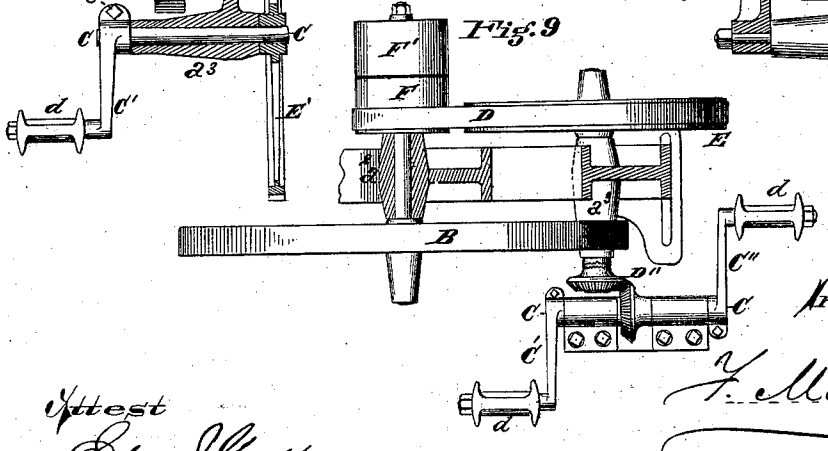


Fig. 9



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BAND SAWING MACHINE.

No. 192,810. Patented July 3, 1877.

Fig. 11.

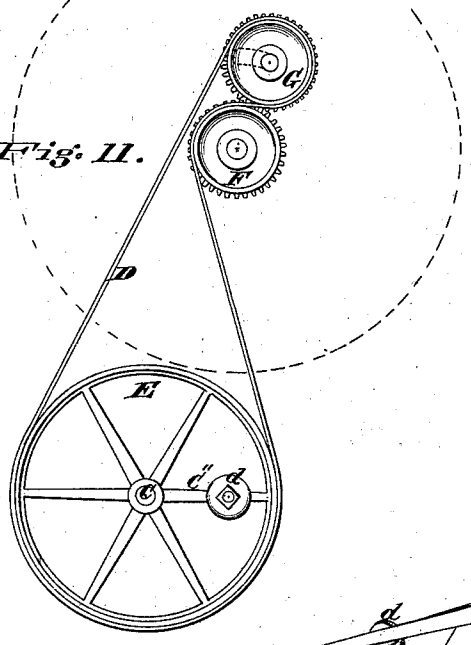


Fig. 10.

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Fig. 12

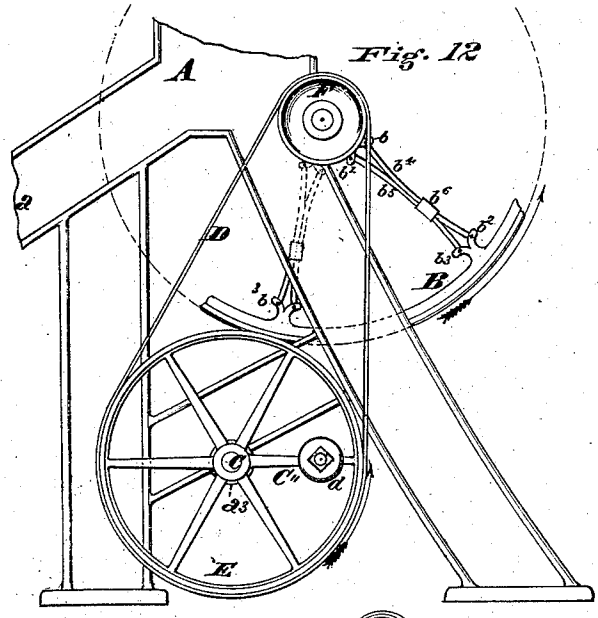


Fig. 13

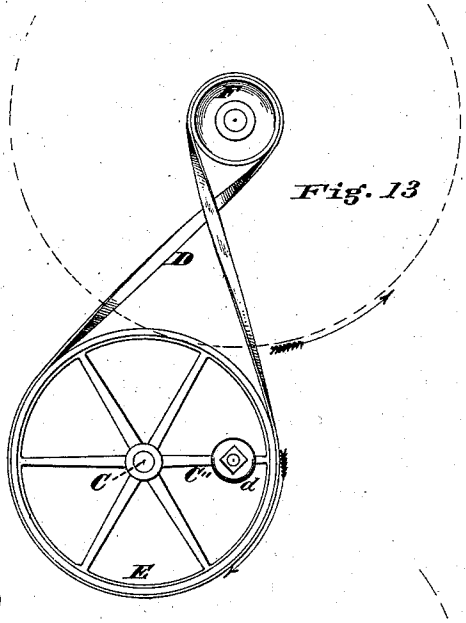


Fig. 14

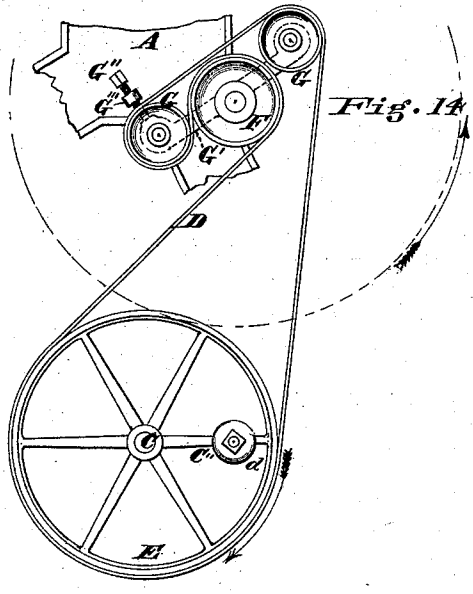
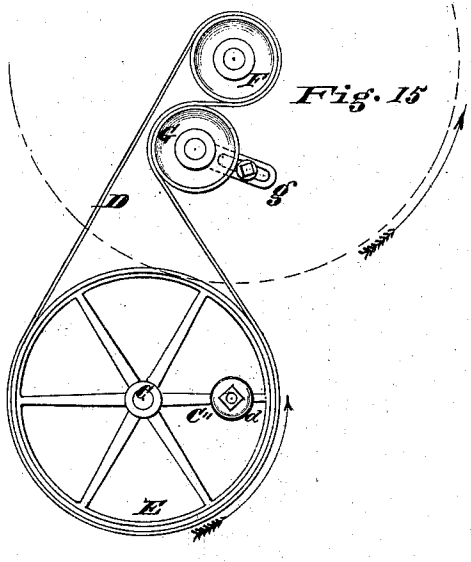


Fig. 15



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UNITED STATES PATENT OFFICE.

FRANK MILLWARD, OF CINCINNATI, OHIO.

IMPROVEMENT IN BAND SAWING MACHINES.

Specification forming part of Letters Patent No. **192,810**, dated July 3, 1877; application filed March 31, 1877.

To all whom it may concern:

Be it known that I, FRANK MILLWARD, of Cincinnati, Hamilton county, State of Ohio, have invented an Improvement in Band Sawing Machines, of which the following is a specification:

The object of my invention, in addition to improvements in details, as compared with steam band-saws in use, is the construction of a band-saw which can be conveniently operated by foot-power without the use of reciprocating treadles or the employment of that almost universal accompaniment of a foot-power, viz., a fly-wheel, which is especially objectionable in a band-saw; and my invention consists, first, in connection with the band-wheels and endless saw of a band-saw, of a shaft connected (by gearing, belting, or other well-known means of transmitting rotary motion) with the lower band-wheel, and fitted at the ends with opposite foot-cranks to directly receive the feet of the operator, so that not only are the opposite foot-cranks advantageously applied to the propulsion of a band-saw so as to render a fly-wheel unnecessary, but provision is made by which the saw-wheels may run at a different velocity to the foot-crank shaft, and the line of the saw be sufficiently removed from the body of the operator; and these advantages are attained by me whether the foot-crank shaft is arranged parallel with the axes of the band-wheels or crosswise; second, as a special feature of arrangement in locating the foot-crank shaft crosswise with relation to the axes of the band-wheels, so that the operator is enabled to rotate the cranks while facing the teeth of the saw; third, in the arrangement of the gearing mechanism by which the foot-cranks may be propelled forward velocipede style, and the cutting side of the saw be made to run downward; fourth, in the provision in the frame of the machine of a socket or sockets, within which the shank of a seat may slide to enable the operator to adjust his position with relation to the table or cranks; fifth, in the provision in the frame of a socket or seat, in which a sliding table-support is arranged to move vertically for adjustability, so that the table may not only be raised and lowered to suit different-sized persons while sitting, but may be one of the features by which the machine may be converted from a foot-power machine with a sitting operator to a steam-power machine with a standing operator; sixth, in transmitting the motion of the driving-wheel of the foot-crank shaft to the tight pulley of a pair of tight and loose pulleys on the lower band-wheel shaft, so that the machine may be convertible from foot-power to steam-power by the simple act of throwing off the belt of the foot-power or disconnecting its gear; seventh, in a certain construction of the band-wheels by which not only great beauty is attained and perfect adaptability for the pleasing effects of painting, but the wheel is adapted to cool after casting without the fracture of its light arms; eighth, in a peculiar construction of the slide and spindle which carries the upper wheel; ninth, in a new and improved means for securing and adjusting the upright rod which carries the upper saw-guide; tenth, in a new and improved construction of the saw-guides, by which great simplicity is attained, with convenient adjustability; eleventh, in a peculiar means of attachment of the lower guide, by which different widths of saws are provided for, and general adjustability of the saw on the face of its wheels.

Figure 1 is a perspective view of a convertible steam-power and foot-power band-saw embracing all of my improvements, except the special arrangement of driving-shaft specified herein as the second part of my invention. Fig. 2 is a side elevation of this machine. Fig. 3 is a detailed perspective view of the upper saw-guide. Fig. 4 is a perspective view of the lower saw-guide. Fig. 5 is a perspective view, partly sectioned, of the saw-table and its sliding support. Fig. 6 is a perspective view of the sliding box and stud, which carries the upper band-wheel. Fig. 7 is a section, showing a way of transmitting the motion of the foot-crank shaft to the lower band-wheel shaft by gearing of small diameter, where belting is undesirable. Fig. 8 is a similar section, showing a direct gearing connection with a single pair of wheels, this method requiring a greater distance between centers of driving and driven shafts than in the method shown in Fig. 7. These sections, Figs. 7 and 8, are taken on an

angular plane, the driving-shaft being lower than the band-wheel shaft, but not so much so as where a belt is used to drive, as in Figs. 1 and 2. Fig. 9 is a plan of the lower part of my machine, the frame being partly sectioned, showing the foot-crank shaft located crosswise of the lower band-wheel shaft, so that the operator may sit and face the teeth of the saw. Fig. 10 illustrates, in perspective, a means of attaining the same end by a single belt. Fig. 11 illustrates, in elevation, a modification in the means for transmitting the motion and power from the foot-crank shaft shown in Figs. 1 and 2 to the band-wheel shaft, which will dispense with the crossing of the belt, while it preserves the same direction of motion as if the belt was crossed as it is in Figs. 1 and 2, and affords means for tightening the belt. Fig. 12 illustrates the machine shown in Figs. 1 and 2 when a straight belt is used. This requires the foot-cranks to be operated the reverse way. Fig. 13 is an elevation of the method of belting shown in Figs. 1 and 2. Fig. 14 is an elevation of a method of belting by means of double idlers on a tilting adjustable bar, which dispenses with the crossing of the belt, while it preserves the proper direction of motion and affords means for tightening the belt. Fig. 15 illustrates a straight belt, with an adjustable idler-pulley for tightening, this method, like that in Fig. 12, requiring the foot-cranks to be turned backward.

The frame: The frame A of the machine is designed after the Eastlake style of furniture. It is cast in one piece with imitation tenons and keys, and while it is exceedingly attractive in appearance it is of a character which dispenses with line striping in painting, and gives its own outlines for defining the limits of the different colors employed—as, for example, the tenons and keys and the edge of the ribs of the frame may be one color, the central web another, and sides of the ribs another.

This frame A is formed with a projecting arm, a, through which the seat for the operator slides for adjustment, a planed seat or bed, a', for the table to slide in, and bearings a'' a^3, babbitted or otherwise, for the lower band-wheel shaft and foot-crank shaft to revolve in, an elongated opening, a^4, for the box which carries the upper spindle to slide in, and an open-sided socket, a^5, for the shank of the upper saw-guide to slide in.

The band-wheels: These wheels, upper and lower, are designated by the letter B. They are peculiarly constructed as follows: Although each wheel is cast in one piece, its hub has a series of double-curved branches, b b^1, and its rim double-curved branches b^2 b^3. To the branches the arms of the wheel, which are double curves b^4 b^5 with opposing convexities, are connected, the members of each arm being surrounded near the middle with an enlargement, b^6, in imitation of a shrunk band. The connections, or rather imitation connections, at the ends of the arms are tenons b^7 and pins b^8, so that the wheel, when painted, looks as if made with iron rim and iron hub, with branches and wooden arms banded together in the middle, a very pretty conceit, that gives attractive appearance, while it gives a formation of casting by reason of the balanced curved surfaces b b^1 b^2 b^3 and b^4 b^5, which cools without fracture, although exceeding light. The wheels are faced with rubber in the usual way, and the upper one runs on a stud, while the lower one, in order that the machine may be convertible from foot to steam, is (except when geared as in Fig. 7 for foot-power only) secured to a spindle running in bearing a^2.

The foot-crank shaft and connections: This shaft is marked C. It is preferably so removed from the line of the axis of the lower band-wheel in the direction of the operator that its center may in the first place be nearer the ground than the center of the lower band-wheel; and, in the second place, that the saw may not run too close to the operator; and, in the third place, that convenient means may be afforded for running the foot-cranks forward and the saw downward. This shaft runs in bearing a^3, and is in one piece, except in Fig. 7, where, although it runs as if in one piece, it is divided to permit the passage of the arms of the band-wheel across it. In this Fig. 7 it is connected to the band-wheel by double spur-gear E D; in Fig. 8, to the band-wheel shaft by single spur-gear E′ D′; in Fig. 9, by miter-gear D″, pulley E and belt D, and in all the other figures by a single belt, D, over the driving-pulley E and driven pulley F. In Fig. 10 the shaft C is located at right angles to the axes of the band-wheels by using the idlers G to change direction, in the manner shown.

The pulley F in Fig. 11 may be geared at the side near the frame to the idler-pulley G, so that the belt D may drive through the idler, and by the wrapping on pulley F.

The idler G used in Fig. 15 is carried on an adjustable arm, g, to permit the tightening of the belt, and the idlers G used in Fig. 14 revolve on studs fixed to a pivoted arm, G′, which can be adjusted to stretch the belt by set-screw G″ in a lug, G‴, on the frame A. The foot-cranks on shaft C are at opposite points velocipede style, and fitted with reels d, upon which the feet of the operator press, and the length of cranks may either be variable by adjustment, as in some velocipedes, or unalterably fixed in first construction.

Beside the pulley F on the lower band-wheel shaft I provide a loose pulley, F′, as shown, so that the machine may be converted from a foot-power machine to a steam-machine, this conversion simply requiring the throwing off of the belt D and the use of a power-belt on the same pulley F, the loose pulley allowing the machine to be stopped when necessary by a shifter.

The cranks may be split at the socket and secured on the shaft by clamping-screw c.

When the pulley E or gear-wheel on that side is used, the crank-wrist may be inserted directly in it, as shown.

The seat: The seat H is turned out of a flat slab of wood, hollowing, like the seat of an office-stool, and cut at the front side, by scroll-sawing and frizzing, to saddle shape, and it is provided with a shank, *h*, of iron, square in cross-section, which fits through a hole corresponding in shape in the arm *a*, so that it cannot be displaced by twisting.

I prefer to split the arm *a* in casting, as shown in Fig. 1, and provide it with two holes for the reception of the shank *h*, and tighten up the two sides of the arm by a screw, I, so that the shank may be held in any desired position thereby, and may be moved from one to the other of the two holes to suit the requirements of the operator.

The saw-guides: The band or endless saw J runs (as is customary in steam-machines) between upper and lower guides. The guides are designated by the letter K. They are alike with reference to the formation of the surface against which the back of the saw runs, and the construction and means of adjustment of the side guides.

This construction is as follows: The guide is formed with a vertical central web, *k*. The front edge of this web may be hardened, and the back of the saw work directly against it; but I prefer to make the faces k^1 by separate steelings, and secure them so that they can be adjusted circularly when worn, and present a new surface to the back of the saw, and to this end I make the steelings circular and perforate them centrally, and secure them by tightening-screws k^2. The side guides k^3 are thin, and have lips k^4 on, which are hardened, and meet the sides of the saw, the lips fitting a notch, k^5, in the web *k*, to prevent displacement. A bolt, k^6, is secured in one of the side guides, and passes loosely through the other, its outer end being fitted with a thumb-nut, k^7, the bolt passing through a slot, k^8, in the web *k*. The little lips k^9 on the web *k* may be used to assist in supporting the side guides.

By the slacking of the nut k^7 the side guides may be moved simultaneously to suit different widths of saws, and both secured firmly by the same nut.

Saws will not differ materially in thickness for this machine, but if they should, thin detachable strips of paper may be used as liners between the side guides and the web *k*. The upper guide moves for adjustment of saw on band-wheels in a slot, L, on the flattened end *m* of the guide-rod M, being secured by the nut N. The lower guide has a lateral shank, P, which shoulders against the slotted projection Q of the table-support U, a nut, R, serving to secure the guide in any position to suit different widths of saws, or to enable the band to be run at a different place on the band-wheels.

Other details: The guide-rod M is square in cross-section, so that the saw may be preserved in proper line, and runs through an eyebolt, S, whose nut or hand-wheel *s* serves to draw the rod up closely against the open-sided socket, a^5, and hold it at any point of vertical adjustment. The table T has a semicircular projection, T′, which fits a corresponding depression in the top of the sliding table-support U. A set-screw bolt, V, passes through a slot in the curved projection from this support, and is tapped into the projection T′. This bolt prevents the table from moving laterally during adjustment, while it secures it when set at a level, or at any angle within its range for bevel sawing.

The support U slides snugly in the bed or seat *a′*, and is slotted, as shown, a bolt, W, passing through it and the frame, fitted with a hand-wheel, *w*, which serves to secure the table at any desired point of vertical adjustment.

This adjustment of the table enables the height to be changed to suit different sitting operators, and enables it to be raised to a convenient height for a standing operator when steam-power is used.

X is the stud on which the upper band-wheel runs. A bolt, *x*, secures it to the box Y, so that it is permitted to pivot or swing on said bolt. This box is open entirely on one side, so as to permit the convenient reception and attachment of the bolt and stud. The box is fitted with a set-screw, *y*, which presses against the heel *x′* of the stud X. By the adjustment of this set-screw the upper wheel may be tilted as required in band-saws to enable the saw to track properly on the wheels B, and, when required, press hard at the back against the guides K for fine sawing. The box Y is finished to slide on and between the planed ways on the frame A, and is held in place by cross-plate y^1 and bolt y^2, the cross-plate resting firmly in the middle on a finished surface on the back of the box and at the overhanging sides on the finished surfaces on the back of this frame A.

A bolt, Z, which passes into place through a cored hole, *e*, in the bottom of the box Y, and a hole in the top of the frame A, sustains the box Y, its nut or hand-wheel *z* resting on the frame A or on an interposed spring, *z′*. By the adjustment of wheel *z* the band-saw may be tightened to suit the user, and longer and shorter saws provided for, the spring allowing a little "give" to the saw, which will compensate for any unevennesses or presence of sawdust on the hand-wheels. But the spring *z′* may be dispensed with, as the rubber on the band-wheels is regarded as offering sufficient elasticity. Although I prefer to use a seat, H, attached to the machine, a separate stool may be used, and when the operator sits and faces the teeth of the saw, as in Figs. 9 and 10, he may also use a separate stool or a seat attached to the machine.

The shank *h* of the seat may have an adjustable collar secured to it above the arm *a*, so that by its presence and adjustment the

seat may be supported and adjusted without the necessity of splitting the arm *a* or using the screw I.

To convert the machine from foot-power to steam-power when the method of gearing shown in Fig. 8 is used, the clamping-screw *c* of the crank C′ may be loosened and the shaft C drawn out altogether, or the foot-crank shaft may remain connected and revolve with the pulley F, the latter being driven by a power-belt.

In place of using a nut, k^7, on the bolt k^6 of the saw-guides, I may, of course, use a bolt alone with a milled or other shaped head, and tap its end into the opposite side guide.

I claim—

1. A sawing-machine embracing, in combination, a stationary frame, upper and lower band-wheels mounted thereon, an endless saw running over said wheels, and a foot-power driving-shaft having suitable driving-connection with the saw band wheels, and fitted with opposite foot-cranks adapted to directly receive the feet of an operator seated on or near the machine, substantially as and for the purpose specified.

2. In combination with the saw band wheels B of a band-saw machine, the foot-crank shaft C having a driving-connection therewith, and arranged crosswise of the axes of the band-wheels, substantially as and for the purpose set forth.

3. In combination with the saw band wheels B of a band-saw machine, the foot-crank shaft C having driving-connection therewith, operating to rotate the band-wheels in the opposite direction to the direction of rotation of the shaft C, substantially as and for the purpose specified.

4. The frame A of a band-saw, having a projecting socket-arm, *a*, in combination with the seat H and shank *h*, substantially as and for the purpose set forth.

5. The frame A, having an open-sided seat or socket, a^1, for the reception of the adjustable supporting column of the work-table, substantially as and for the purpose specified.

6. The combination of band-wheels B, foot-crank shaft C, driving-connections E D, and fast and loose pulleys F F′, substantially as and for the purposes specified.

7. The band-wheel B, cast in one piece, with branches *b* b^1, branches b^2 b^3, and arms b^4 b^5, substantially as and for the purpose specified.

8. The combination of the open-sided box Y, the tilting stud X *x′* pivoted thereto, and adjusting-screw *y*, substantially as and for the purpose specified.

9. The combination of the open-sided socket or seat a^5 of frame A, eyebolt S, hand-wheel *s*, and sliding guide-rod M, substantially as and for the purpose specified.

10. The saw-guide K, having notched web *k* k^1 k^5, side guides k^3 k^4, and bolt k^6, substantially as and for the purpose specified.

11. The combination of table-column U, having slotted projection Q, and lower guide K having lateral shank P and nut R, substantially as and for the purpose specified.

In testimony of which invention I hereunto set my hand.

FRANK MILLWARD.

Witnesses:
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EDGAR J. GROSS.