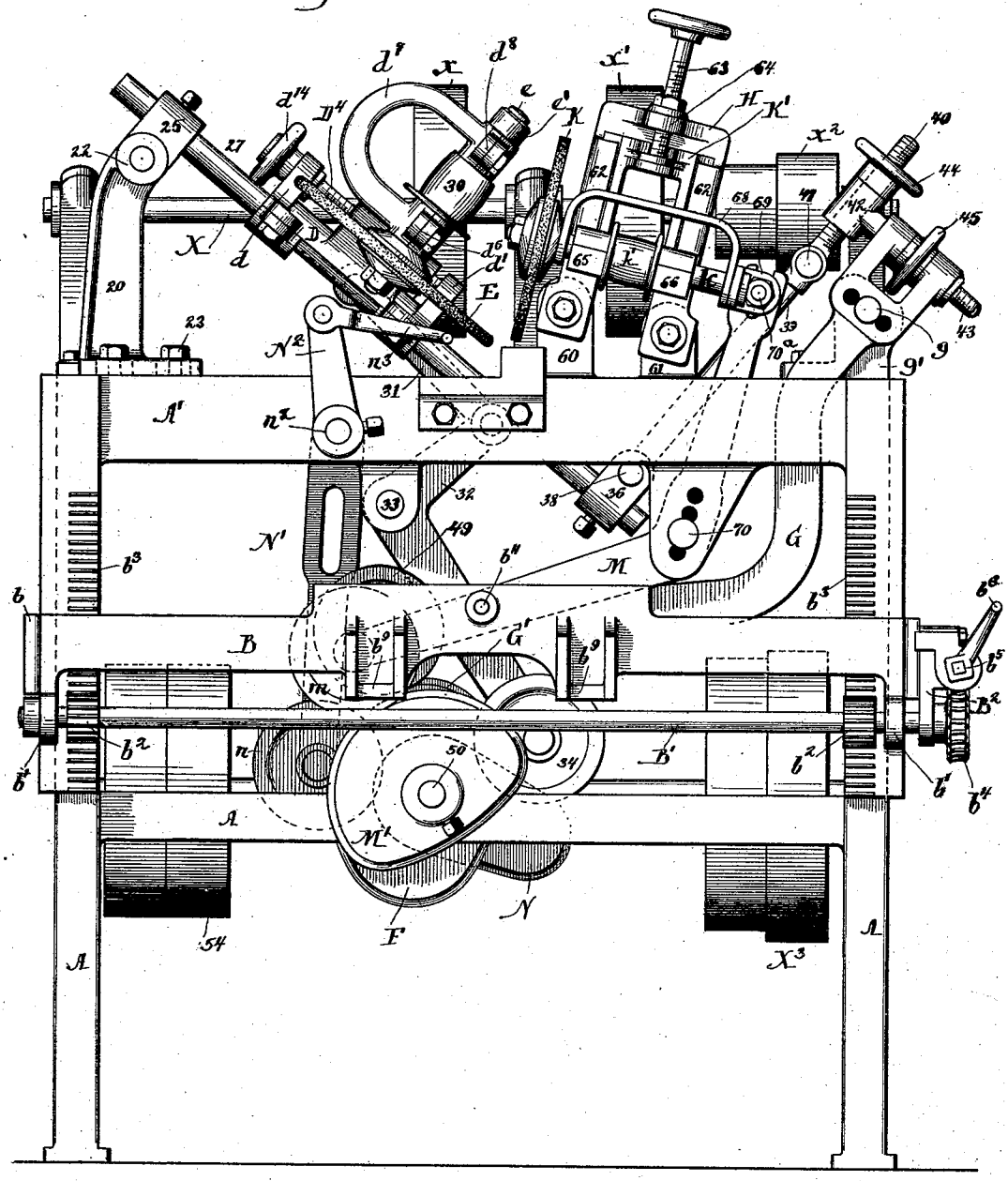
(No Model.) 8 Sheets—Sheet 1.

S. H. HOLLEY & S. V. RAWLINGS.

SAW SHARPENING MACHINE.

No. 570,929. Patented Nov. 10, 1896.

Fig. 1.



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(No Model.) 8 Sheets—Sheet 2.

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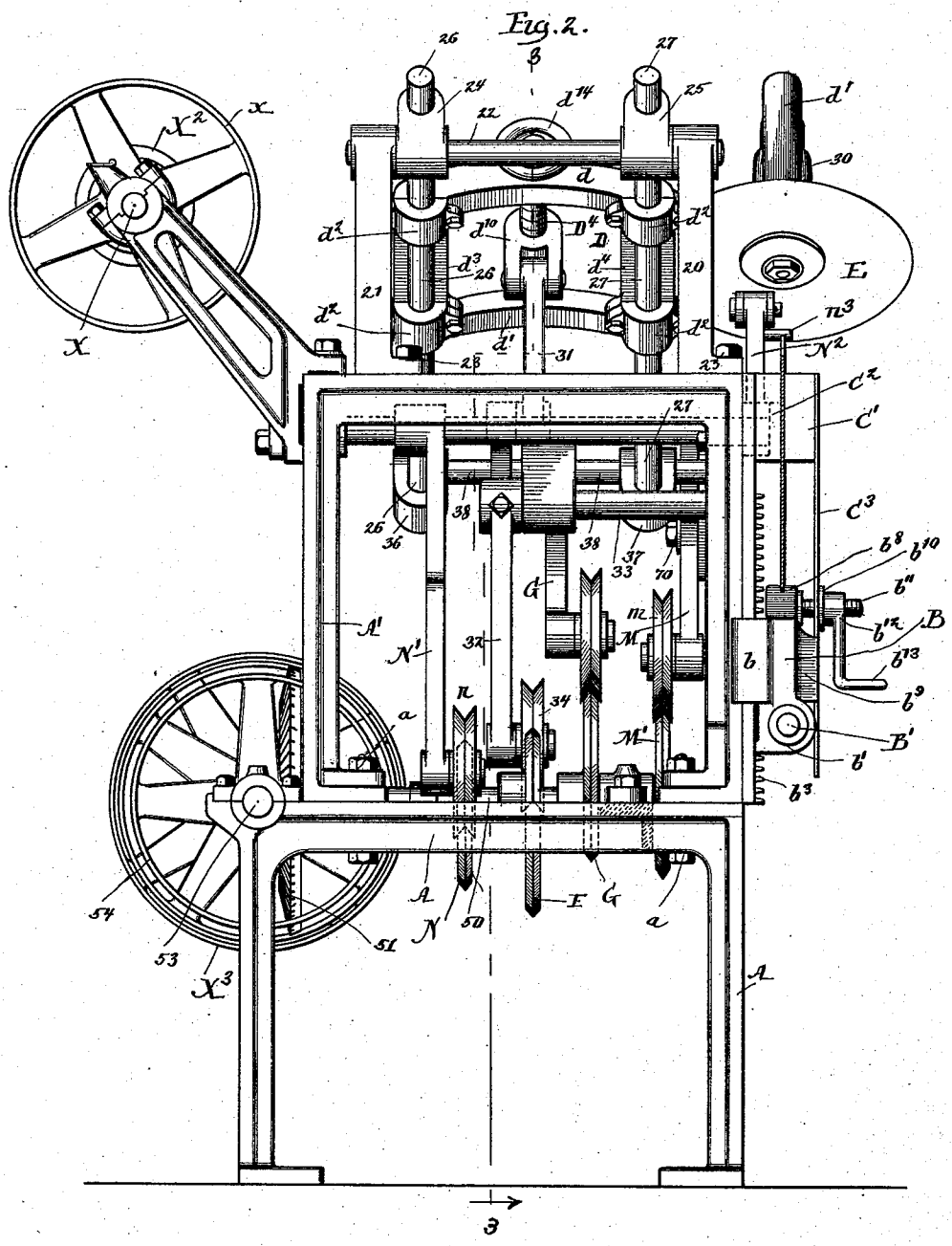
Fig. 2.



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SAW SHARPENING MACHINE.

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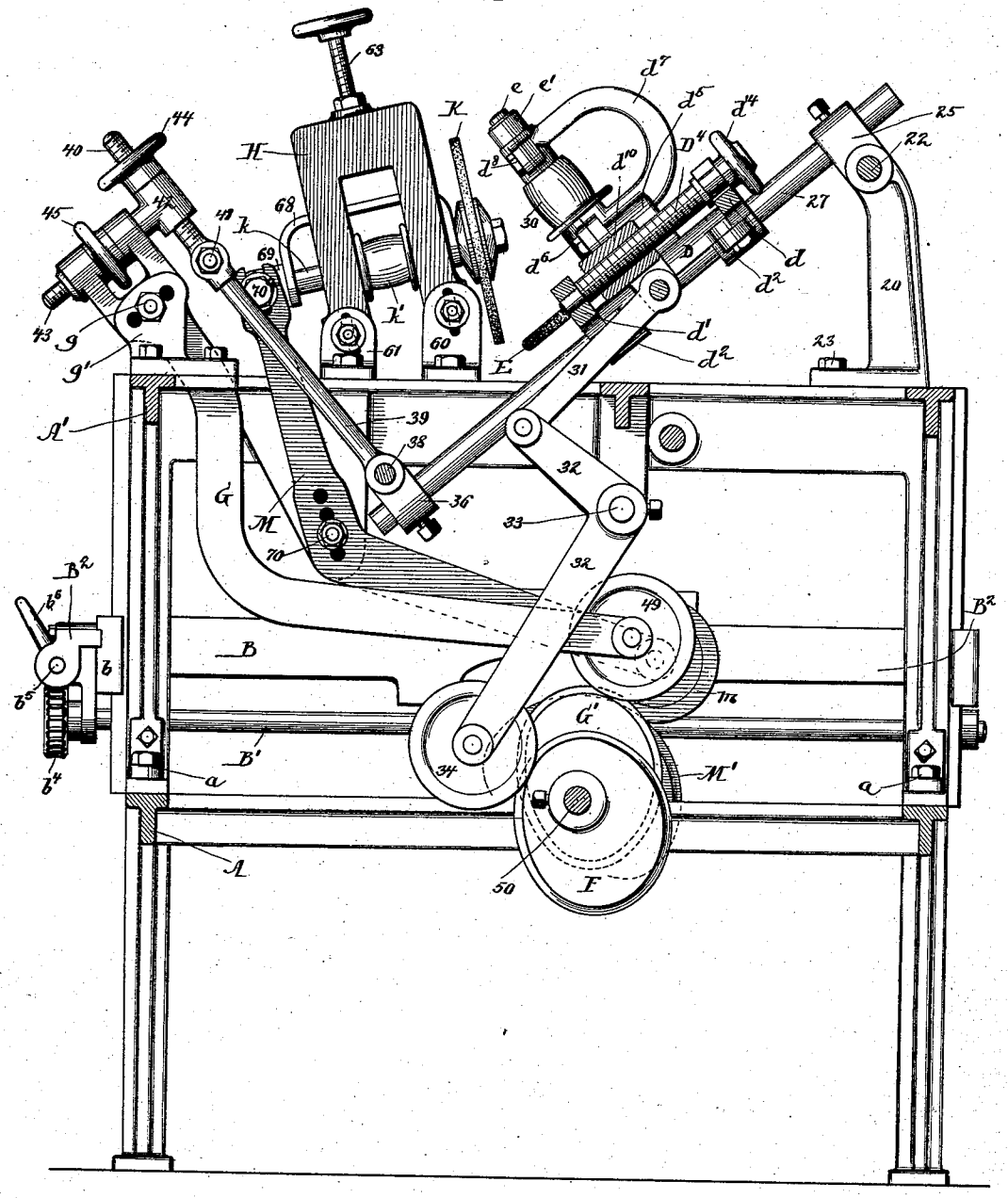
Fig. 3.



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SAW SHARPENING MACHINE.

No. 570,929. Patented Nov. 10, 1896.

Fig. 4.

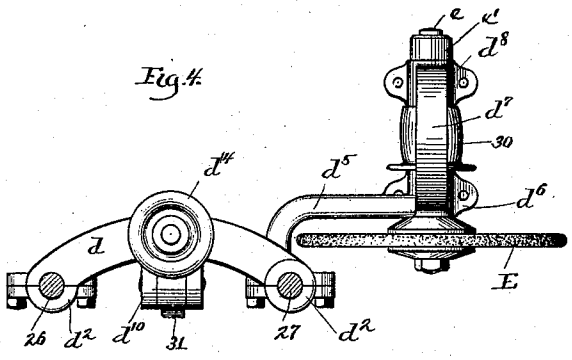
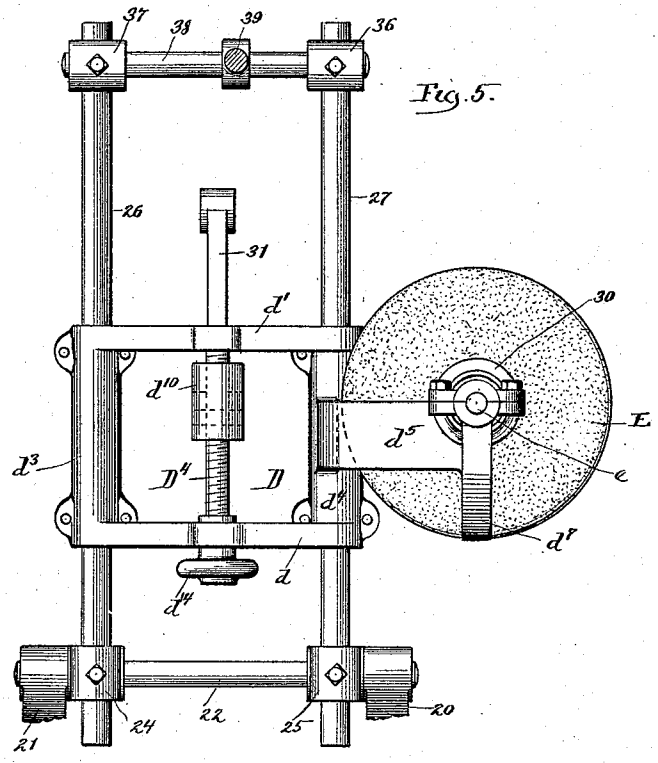


Fig. 5.



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SAW SHARPENING MACHINE.

No. 570,929. Patented Nov. 10, 1896.

Fig. 8.

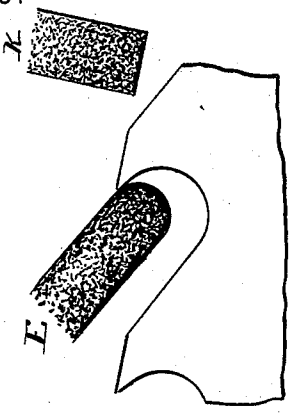


Fig. 11.

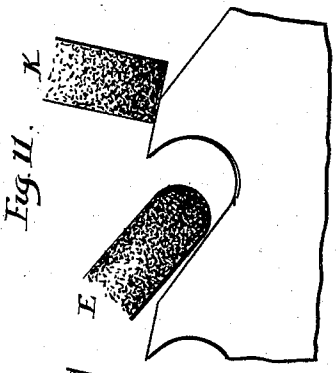


Fig. 7.

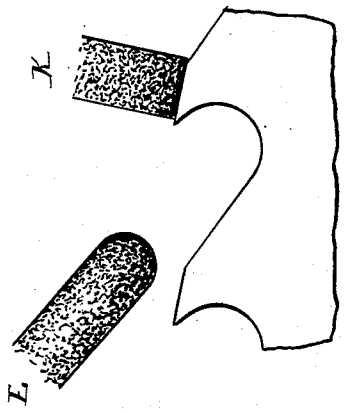


Fig. 10.

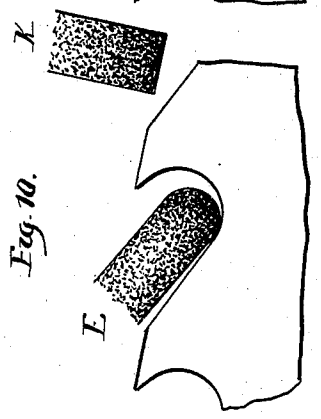


Fig. 6.

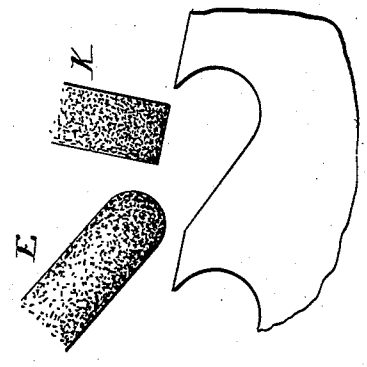
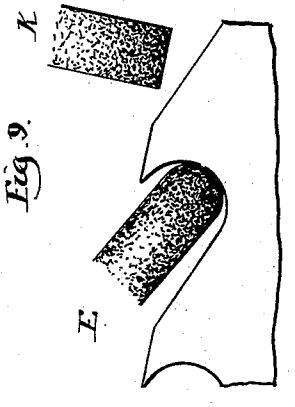


Fig. 9.



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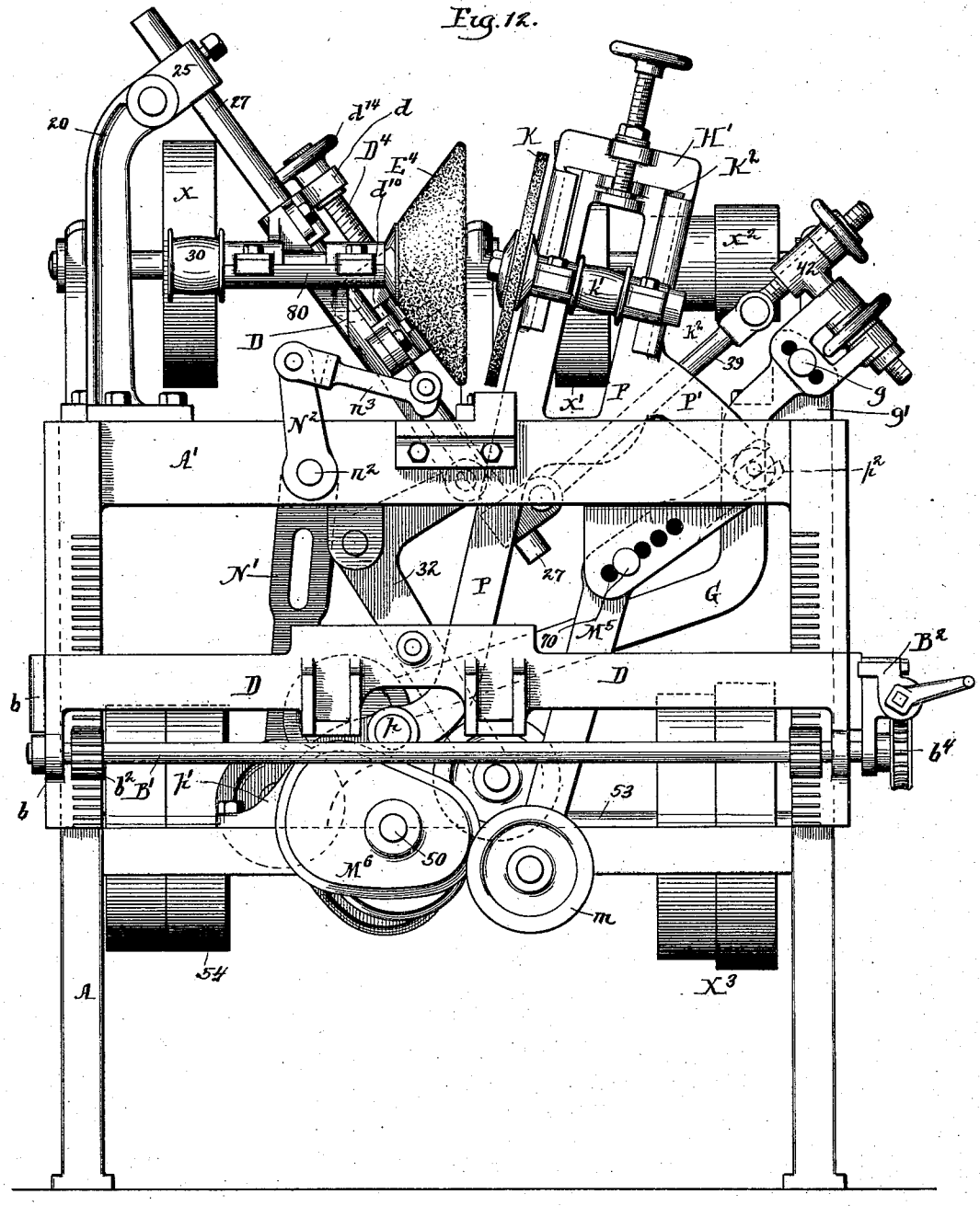
SAW SHARPENING MACHINE.

No. 570,929. Patented Nov. 10, 1896.

Fig. 12.



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(No Model.) 8 Sheets—Sheet 7.

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SAW SHARPENING MACHINE.

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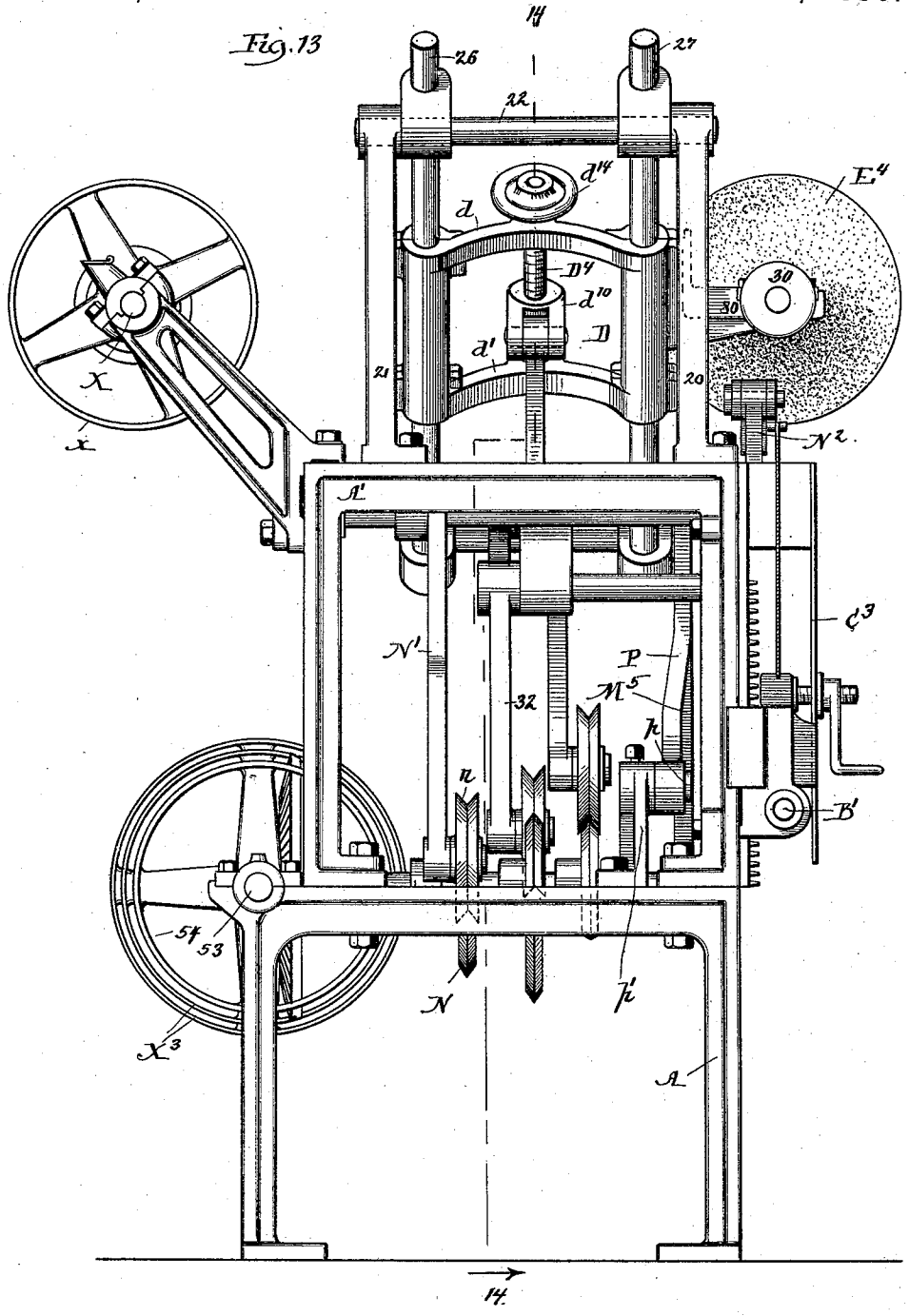
Fig. 13



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(No Model.) 8 Sheets—Sheet 8.

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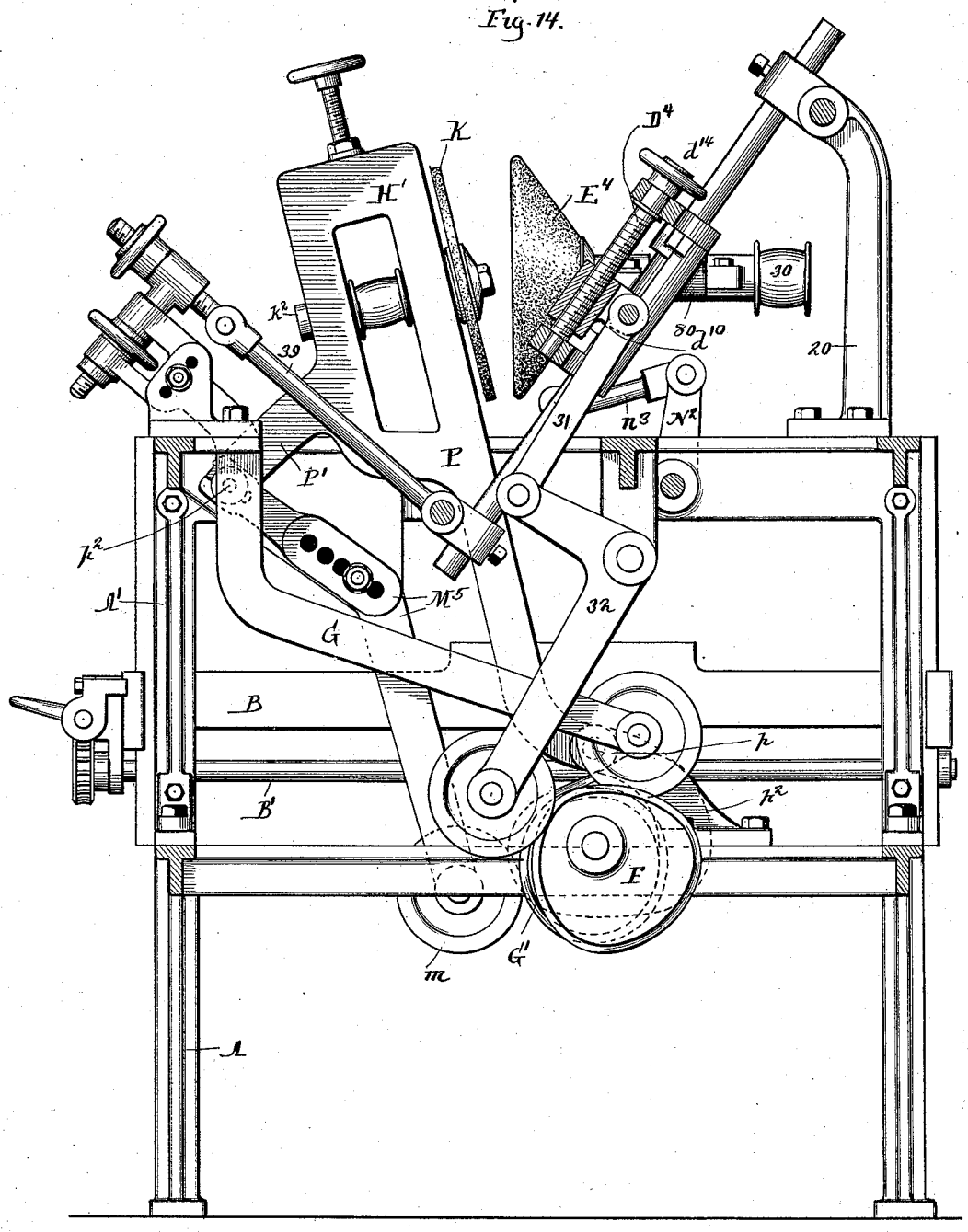
SAW SHARPENING MACHINE.

No. 570,929. Patented Nov. 10, 1896.

Fig. 14.



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UNITED STATES PATENT OFFICE.

SEYMOUR H. HOLLEY AND SAMUEL V. RAWLINGS, OF MARQUETTE, MICHIGAN.

SAW-SHARPENING MACHINE.

SPECIFICATION forming part of Letters Patent No. 570,929, dated November 10, 1896.

Application filed June 19, 1895. Serial No. 553,315. (No model.)

To all whom it may concern:

Be it known that we, SEYMOUR H. HOLLEY and SAMUEL V. RAWLINGS, citizens of the United States, and residents of Marquette, in the county of Marquette, State of Michigan, have invented certain new and useful Improvements in Saw-Sharpening Machines, of which we do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our present invention has relation more particularly to that class of saw-sharpening machines in which two grinding-wheels are employed, one serving to cut out the throats or spaces between the saw-teeth and the other serving to grind the backs of the teeth. In this class of machines it has been heretofore proposed to employ separate grinding-wheels for the purposes above stated, but these wheels have been so mounted that it was impossible for the two wheels to act upon the same tooth between the successive movements of the saw. That is to say, the throat-grinding wheel in such prior machines was located at such distance from the back-grinding wheel that with ordinary saws some eight or ten teeth intervened between the wheels. This prior arrangement of the grinding-wheels has been found to be a source of great delay and inconvenience on account of the necessity of readjusting the mechanism owing to the irregularity in the spaces between the teeth of the saws, and with such prior machines, when constructed for the grinding of gang or band saws, it has been found impossible to use them for the purpose of circular saws.

One of the main objects of our present invention is to provide a saw-sharpening machine of the character described in which the two grinding-wheels are mounted in such manner that they can both act upon the same tooth between the movements of the saw, in order that an accurate grinding of the teeth may be effected, regardless of the precise shape of teeth or of the spaces between the teeth.

Our invention has also for its object to improve in various particulars hereinafter set forth the saw-sharpening machine of the character stated; and with these objects in view our invention consists in the various novel features of construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the claims at the end of this specification.

Figure 1 is a front view of one form of saw-sharpening machine embodying our invention. Fig. 2 is a view in end elevation. Fig. 3 is a view in vertical longitudinal section mainly on line 3 3 of Fig. 2. Figs. 4 and 5 are respectively end and plan views of the frame for carrying the throat-grinding wheel. Figs. 6, 7, 8, 9, 10, and 11 are diagrammatic views showing successive and relative positions assumed by the grinding-wheels. Figs. 12 and 13 are respectively views in front and side elevation of a modified form of the invention. Fig. 14 is a view in vertical longitudinal section on line 14 14 of Fig. 13.

The main frame of our machine is preferably formed of two sections A and A′, suitably bolted together, as at a, the castings comprising these sections of the main frame being by preference of T shape in cross-section, as shown. While our machine is suitable for the grinding of either band, gang, or circular saws, we have shown it as fitted with mechanism more particularly adapted for sustaining a band or gang saw in position to be sharpened. This mechanism for sustaining the band-saw consists of a transverse bar B, that extends across the front of the machine, the ends of the bar being provided with flanges b to engage the edges of the front posts of the main frame A′. The ends of the bar B have downwardly-extending portions b', through which pass the ends of the adjusting-shaft B′, that carries pinions b^2, engaging with vertical rack-bars b^3 on the front posts of the main frame. To one end of the bar B is bolted a block or casting B^2, through the lower part of which extends a shaft b^5, the outer end of this shaft being provided with a worm-wheel b^4, that is engaged by a worm-shaft b^5, journaled in the casting B^2 and operated by a crank-handle b^6 at its outer end. The transverse bar B is preferably provided in its upper edge with a slot b^8 to receive the back edge of the saw C and in order to hold the saw in place we employ the usual clamping-bars C′ and C^2, arranged one on each side of the saw. The clamping-bar C′

has spring-bars C^3 attached thereto and held against the offsets b^9 of the bar B by means of a cross-bar b^{10}, through which passes a screw-threaded rod b^{11}, carrying an adjusting-nut b^{12}, controlled by the crank b^{13}. It will thus be seen that when the band or gang saw is placed in position upon the transverse bar B it can be raised or lowered to proper position by turning the crank b^6 of the worm-wheel b^5, this worm-wheel serving to impart rotation to the shaft B′ and its pinions b^2, and thus raise or lower the bar B and bring the teeth of the saw into proper position to be acted upon by the grinding-wheels.

Upon the top section A′ of the main frame are mounted the brackets 20 and 21, the upper ends of which carry the transverse rod or shaft 22. The brackets 20 and 21 are held in position by suitable bolts 23, that pass through long slots in the base-flanges of the brackets, and thus allow the brackets to be adjusted toward and from the center of the machine for the purpose to be presently stated. Upon the cross-rod 22, between the upper ends of the brackets 20 and 21, are mounted the swivel-blocks 24 and 25, through which pass the guide-bars 26 and 27, that form the support for the frame D of the throat-grinding wheel E. This frame D is shown as composed of cross-bars d and d', held upon the rods 26 and 27 in manner free to slide by means of the cap-plates d^2, (see Figs. 2 and 4,) and the upper and lower bars d and d' of the frame D are united by the bars d^3 and d^4. From the bar d^4 extends upwardly and toward the front the arm d^5, the outer end of which is provided with a bearing d^6 for the arbor e of the throat-grinding wheel. From the bearing d^6, and preferably cast therewith, extends the yoke-shaped bar d^7, the upper end of which is furnished with a similar bearing d^8 for the upper end of the arbor e, and between these bearings d^6 and d^8 the arbor e is fitted with a pulley 30, whereby the grinding-wheel E will be driven by means of a belt extending to a pulley x, mounted upon the shaft X at the back of the main frame.

The wheel E is held upon the lower end of the arbor e by clamping-disks of usual or suitable construction, and the upper end of the arbor e is retained in place by a collar e'. In the cross-bars d and d' of the sustaining-frame D is mounted a screw-rod D^4, controlled by a hand-wheel d^{14} and passing through a screw-threaded collar d^{10}, to which is pivotally connected the upper end of a link 31, the lower end of this link being pivotally connected to the upper arm of the elbow-lever 32. The lever 32 is pivotally sustained, as at 33, by hangers from the top of the main frame, (see Fig. 3,) and the lower end of the elbow-lever carries a roller 34, that engages with the periphery of a cam F, whereby motion is imparted to the elbow-lever. Preferably the periphery of the wheel 34 is furnished with a V-shaped groove to receive the correspondingly-shaped edge of the cam F. The lower ends of the guide-bars 26 and 27 pass through holes formed in the blocks 36 and 37, that are united together by the cross-rod 38, (see Fig. 2,) the ends of which are pivotally held in the blocks 36 and 37, and from the rod 38 extends the rod 39, the upper end of this rod being yoke-shaped to receive the lower end of a screw-rod 40, that is pivotally connected, as at 41, to the upper end of the rod 39. The screw-rod 40 passes through a boss 42 on the inner end of the screw-rod 43, and the position of the rod 40 within the boss 42 can be adjusted by means of a threaded hand-nut 44. The screw-rod 43 extends through the yoke-shaped end of the lever G, that is provided, preferably, with a series of holes to receive a bolt g, whereby this lever is pivotally connected to a bracket g', having corresponding pivot-holes and bolted to the top of the main frame of the machine. (See Fig. 3.) Between the arms at the upper end of the lever G is the threaded adjusting nut or wheel 45, whereby the position of the screw-rod 43 with respect to the lever G can be accurately determined. The lower end of the lever G is provided with a roller 49, having, preferably, a V-shaped periphery to engage the cam G′, whereby this lever is operated. The cam G′ and as well also the cam F, hereinbefore described, are mounted upon the cross-shaft 50, that is journaled in the main frame and is provided at its rear end with a crown-wheel 51, engaging a pinion (not shown) upon the main shaft 53, to which motion is imparted from the source of power by a suitable belt-pulley 54.

From the construction of parts as thus far defined it will be seen that if a saw mounted upon the transverse bar B has its toothed edge brought in proper position to be operated upon by the grinding-wheel E, the throats or spaces between the teeth of the saw will be cut out by the wheel E in the manner next to be described. Power being transmitted from the main shaft 53 to the cross-shaft 50, the cams F and G′ will have revolution imparted thereto. The cam F, engaging the roller 34, will cause the elbow-lever 32 to turn about its pivotal point, while at the same time the cam G′ as it revolves will cause a swinging movement of the lever G about its center of oscillation g. The oscillation of the elbow-lever 32, owing to the peculiar shape of the cam F, tends to produce a reciprocating movement of the sustaining-frame D and the grinding-wheel E along the guide-rods 26 and 27, and the oscillation of the lever G, incident to the revolution of the cam G′, tends to vibrate the guide-rods 26 and 27, the sustaining-frame D, and the grinding-wheel E about the rod 22 at the top of the brackets 23. Inasmuch, however, as the movements of the cams F and G′ are synchronous, the movements due to these cams are in a measure compounded, and the result is that the sustaining-frame D, and consequently the grinding-wheel E,

has, during a portion of the revolution of the cam F, a reciprocating movement at the time that the roller 49 at the end of the lever G is coincident with the concentric portion of the cam G′, but while the roller 49 is coincident with the eccentric portion of the cam G′ and the roller 34 is opposite the eccentric portion of the cam F, the movements due to the two cams being thus compounded serve to vibrate and at the same time advance the frame D and the grinding-wheel E. The purpose of this movement will be readily apparent to those familiar with this class of apparatus. The throats or spaces between the teeth of saws are of curved or circular outline, as indicated in Figs. 6 to 11, and by thus giving a compound reciprocating and vibratory movement to the grinding-wheel as it advances into the throat the cutting away of the throat in the desired manner is insured, and the withdrawal of the wheel from the throats between the teeth is effected to permit the intermittent advancement of the saw.

In Figs. 6 to 11 of the drawings we have illustrated in diagrammatic manner the movements of the grinding-wheels, and by reference to these figures it will be seen that the wheel E first descends in a substantially straight line from position 1 toward the throat between the saw-teeth, this movement being due mainly to the action of the cam F. As the cutting edge of the wheel E approaches the throat the cutting edge of the wheel is, by reason of the cam G′ and intermediate mechanism, caused to raise toward the point of the tooth to position, Fig. 8, and the movements of the cams F and G′ being compounded so as to vibrate the frame D at the same time that it is reciprocated. The cutting edge of the wheel E will pass to the positions shown in Figs. 9 and 10, after which the cam F will reciprocate the frame D, causing the wheel E to return to the position Fig. 6.

Our purpose in providing the hand-wheel d^{14} at the end of the screw-rod D^4 is to compensate for the decrease in the diameter of the wheel E incident to wear. The purpose of adjusting the hand-wheel 44 upon the screw-rod 40 is to determine the extent of cut in either direction, *i. e.*, either upward or downward, of the grinding-wheel E, while the extent of throw for interdental throats of different diameters is varied by changing the position of the pin *g*, whereon the lever G is pivotally sustained. In order to secure greater accuracy of adjustment, the hand-wheel 45 will be shifted upon the rod 43. It will thus be seen that by means of the wheel E, operated by the mechanism hereinbefore described, the interdental throats of the saw-blade will be ground, and by the adjusting mechanism described the position and movements of the wheel E can be varied to suit teeth of variable pitches or shapes.

In order to grind the backs of the teeth, we prefer to employ the mechanism next to be described.

Upon suitable standards 60 and 61 on the top of the main frame is mounted a yoke-shaped frame H, the lower ends of this frame being adjustably connected to the standards 60 and 61 in such manner that the inclination of the frame H can be varied, in order to determine the angle or pitch of the grinding-wheel K. This grinding-wheel K is carried upon an arbor *k*, mounted in bearings on the sliding frame or sash K′, the edges of which work in guides 62 of the yoke H. The frame or sash K′ has connected thereto an adjusting-screw 63, that passes through a threaded opening in the flange 64 on the top of the yoke H, and by means of this screw 63 the frame K′ can be raised or lowered, in order to compensate for the reduction in the diameter of the wheel K incident to wear. Between the journal-bearings 65 and 66 and upon the arbor *k* is fixed a pulley *k′*, whereby the arbor is driven, the belt from this pulley *k′* leading to a pulley *x′*, that is mounted upon the shaft X. This shaft X is furnished with pulleys X^2, whereby movement is transmitted to the shaft from the pulleys X^3, mounted upon the main drive-shaft 53. From the inner clamp-plate of the grinding-wheel K and the opposite end of the arbor *k* extends a yoke 68, that is provided with a boss, through which passes the end of the arbor *k*, and this boss is formed with an extension 69, through which passes a bolt 70^a, that is engaged by the forked upper end of the lever M, the purpose of this lever being to reciprocate the arbor *k* and the grinding-wheel K back and forth, as will presently more fully appear. The lever M is sustained by a pivot-pin 70, passing through a suitable hanger of the main frame, and the lever is furnished, as shown, with a series of holes for the pivot-pin 70, in order to vary the throw of the lever, and consequently the extent of reciprocation of the grinding-wheel K. The lower end of the lever M carries a roller *m*, the V-shaped periphery of which engages the cam M′, that is mounted upon the cross-shaft 50. From the foregoing description it will be seen that as the cam M′ is revolved the lever M, is vibrated, and by means of this lever a reciprocating movement is imparted to the grinding-wheel K, whereby the backs of the saw-teeth will be ground.

It will be understood, of course, that the several cams mounted upon the shaft 50 will be of such shape and their relative positions upon the shaft will be such that the movements of the grinding-wheels E and K will be properly timed with respect to each other. In Figs. 6 to 11 of the drawings is illustrated in diagrammatic manner the positions of the grinding-wheel K. Thus the wheel travels from position shown in Fig. 6 to the position shown in Fig. 8, thereby cutting away the back of the tooth, and is thereafter returned to position shown in Figs. 9, 10, and 11 to the

position shown in Fig. 6, these movements of the wheel being due to the mechanism hereinbefore described.

It is manifest that by the adjusting mechanism above set forth not only can the wheel K be lowered from time to time to compensate for wear, but the angle of inclination of this wheel can be varied in order to enable it to properly work upon teeth of different pitch and to give the desired shape to the backs of the teeth.

It will be understood, of course, that the wheel K begins its movement from position Fig. 6 before movement is imparted to the wheel E, and while the wheels are above the saw-teeth, but after the wheel K has begun its work upon the back of the tooth, the wheel E will be advanced in manner hereinbefore set forth.

From the foregoing description it will be seen that by our improved mechanism we are enabled to grind both the throat and back of the same saw-tooth between the movements of the saw, so that an accurate grinding of the teeth will be had irrespective of any variations that may exist in the spaces between the teeth.

In order to intermittently advance the saw-blade, so as to successively bring the teeth in position to be acted upon by the grinding mechanism, we employ the means next to be described. Upon the cross-shaft 50 is mounted a cam N, the V-shaped periphery of which engages a roller n at the lower end of a feed-lever N′, that is pivoted to the main frame, as at n^2. The upper end of the feed-lever N′ has pivotally connected thereto a feed-arm N^2, carrying at its free end a laterally-projecting feed-finger n^3, adapted to enter the spaces between the teeth of the saw-blade. It will be understood, of course, that the cam N will be of such shape that no movement will be imparted to the lever N′ during the time that the grinding-wheels are performing their work, but when these wheels have been raised above the saw-teeth, the cam N will shift the lever N′ and cause the feed-finger n^3 to advance the saw-blade the distance of one tooth, in order to bring the next tooth in position to be acted upon by the grinding-wheels.

In Figs. 12 to 14 of the drawings is illustrated a somewhat modified embodiment of our invention. In the machine shown in these views the throat-grinding wheel is shown as a conical wheel E^4, and the arbor that sustains this wheel is arranged in horizontal position in order to better enable its pulley 30 to be conected directly with the pulley x without the necessity of twisting the belt. Manifestly, however, the conical shape of the wheel E^4 causes its grinding edge to properly enter the throats between the teeth of the saw. The arbor of the wheel E^4 is journaled in a bearing-arm 80, that approaches toward the front of the machine from the front side bar of the sustaining-frame D. The mechanism whereby the sustaining-frame D is operated and adjusted is practically the same as that hereinbefore described, and its construction and mode of operation need not, therefore, be more particularly set forth. So also in the form of the invention illustrated in Figs. 12 to 14, instead of mounting the grinding-wheel K upon a sliding shaft or arbor the arbor k^2 of this wheel is sustained in a vertically-adjustable gate or sash K^2, that is adjustable as in the construction hereinbefore described, but the yoke-shaped frame H′, that carries this gate or sash, is formed at the upper end of a lever P, that is pivoted, as at p, to a suitable standard p', rising from the lower part of the main frame of the machine and bolted thereto. The upper part of the lower lever P is formed with a laterally-projecting arm P′, carrying at its outer end a pin p^2, that is engaged by the forked upper end of the operating-lever M^5, that is pivoted by a pin 70 to a suitable hanger, as in the construction before set forth. The lower end of the lever M^5 carries a wheel m, that engages the periphery of the cam M^6, similar in shape to the cam M′ in the construction hereinbefore set forth and serving to perform the same function. It will thus be seen that as the cross-shaft 50 is revolved the cam M^6 will operate the lever M^5, causing this lever to vibrate the lever P and the grinding-wheel K carried thereby. By this means the grinding-wheel will be caused to travel over the backs of the saw-teeth in order to grind the same. Inasmuch as the lever P, that carries the wheel K, is pivoted a considerable distance below the top of the main frame, the arc of the circle through which the cutting edge of the grinding-wheel K is vibrated is so great that the backs of the saw-teeth can be cut as effectually as when the wheel K is mounted for straight-line movement.

It is manifest that the details of construction above set out may be varied within wide limits without departing from the spirit of the invention, and that features of the invention may be employed without its adoption as an entirety. Thus, for example, the throat-grinding wheel illustrated in Fig. 1 of the drawings might be used in connection with the wheel K and its operating mechanism, (shown in Fig. 12,) or the mechanism for operating the wheel K (shown in Fig. 12) might be employed in connection with the throat-grinding wheel and operating mechanism illustrated in Fig. 1 of the drawings.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a saw-grinding machine, the combination with suitable mechanism for advancing and holding the saw to be ground, of a throat-grinding wheel and mechanism for operating the same, and an independent wheel for grinding the backs of the saw-teeth and mechanism for operating the same, and suitable mechanism for sustaining said wheels in close proximity and means whereby said wheels are caused to conjointly act upon the same tooth between

the movements of the saw necessary to bring successive teeth in position to be ground.

2. In a saw-grinding machine, the combination with a throat-grinding wheel and with a sustaining-frame for said wheel, of pivoted levers for reciprocating and vibrating said sustaining-frame, cams for operating said pivoted levers, a second wheel for grinding the backs of the saw-teeth and arranged in close proximity to the throat-grinding wheel, mechanism for sustaining said grinding-wheels so placed and whereby they are permitted to act upon the same tooth to be ground between the movements of the saw, a lever for effecting the shift of said second grinding-wheel and a cam for operating said lever, and a shaft whereon said several cams are mounted.

3. In a saw-grinding machine, the combination with a throat-grinding wheel, of a reciprocating frame for sustaining said wheel, said frame extending transversely of the machine, suitable guide mechanism whereon said frame is mounted in manner free to slide, a pivotal support for said guide mechanism and mechanism for vibrating said guide mechanism and for reciprocating said frame.

4. In a saw-grinding machine, the combination with a throat-grinding wheel, of a sustaining-frame for said wheel extending transversely of the machine, suitable guide mechanism for said sustaining-frame, a pivotal support for said guide mechanism, adjustable brackets to which said pivotal support is connected and mechanism connected to said sustaining-frame and its guide mechanism and serving to reciprocate and vibrate said frame.

5. In a saw-grinding machine, the combination with a throat-grinding wheel, of a frame for sustaining said wheel, said frame extending transversely of the machine, mechanism for vibrating and reciprocating said frame and a forwardly-projecting extension upon said frame whereby the arbor of the grinding-wheel is sustained.

6. In a saw-grinding machine, the combination with a throat-grinding wheel, of a frame D for sustaining said wheel, suitable guides 26 and 27 whereon said frame is mounted in manner free to slide, pivoted supports 24 and 25 for the outer ends of said guides, and suitable mechanism for reciprocating said frame D and for vibrating said guides.

7. In a saw-grinding machine, the combination with a throat-grinding wheel E, a sustaining-frame D for said wheel, guides 26 and 27 whereon said frame is mounted in manner free to slide, pivoted supports 24 and 25 for said guides and brackets 20 and 21 whereby said supports are carried.

8. In a saw-grinding machine, the combination with a throat-grinding wheel E and with a reciprocating and vibratory frame for sustaining said wheel and suitable guide mechanism whereon said frame is mounted, of mechanism for operating said frame comprising a pivoted lever connected with said frame for reciprocating the same, a cam for operating said lever, a pivoted lever connected with the guide mechanism of said frame and serving to vibrate the same and a cam for operating said last-mentioned lever.

9. In a saw-grinding machine, the combination with a throat-grinding wheel and with a reciprocating and vibratory frame for sustaining said wheel, and with guide mechanism for said frame, of means for reciprocating said sustaining-frame and means for vibrating said guide mechanism comprising a pivoted adjustable lever G suitably connected with said guide mechanism.

10. In a saw-grinding machine, the combination with a throat-grinding wheel and with a reciprocating and vibratory frame for sustaining said wheel, of suitable means for reciprocating said sustaining-frame and means for vibrating said sustaining-frame comprising a pivoted lever G, an adjustable rod 43 connected to said lever G at its upper end and an adjustable rod 39 connecting said rod 43 with said guide mechanism.

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