No. 722,810. PATENTED MAR. 17, 1903.

J. E. CARTER & S. A. WRIGHT.

COLD IRON SAWING MACHINE.

APPLICATION FILED MAY 10, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

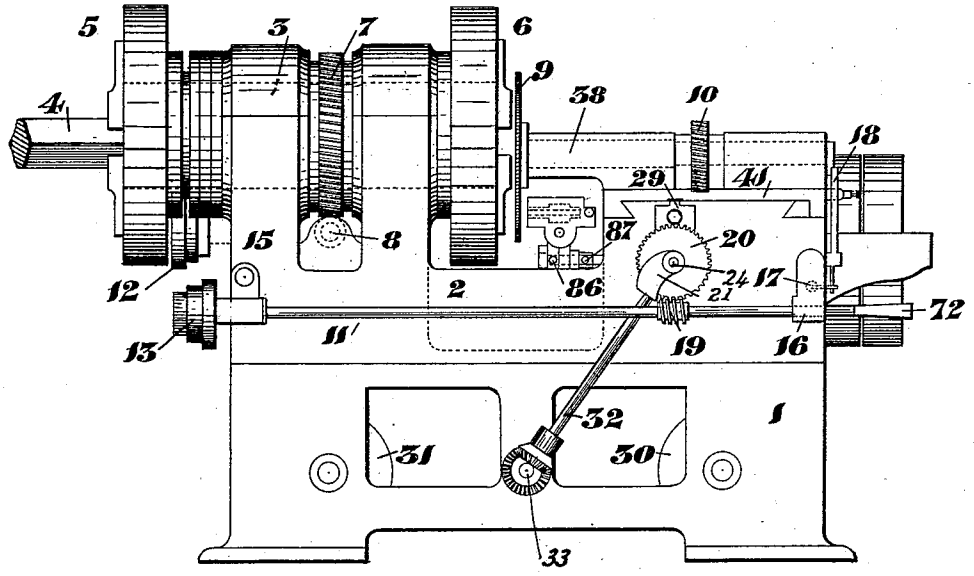
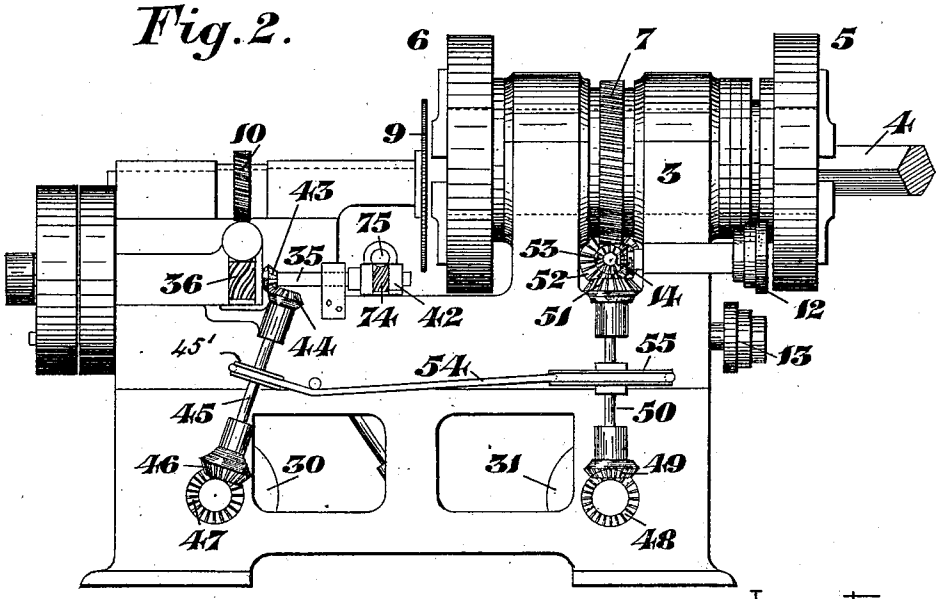


Fig. 2.



Witnesses

Geo. C. Poulton

Wm. H. Bates

Inventors

J. E. Carter and S. A. Wright.

by Herbert W. Jenner. attorney.

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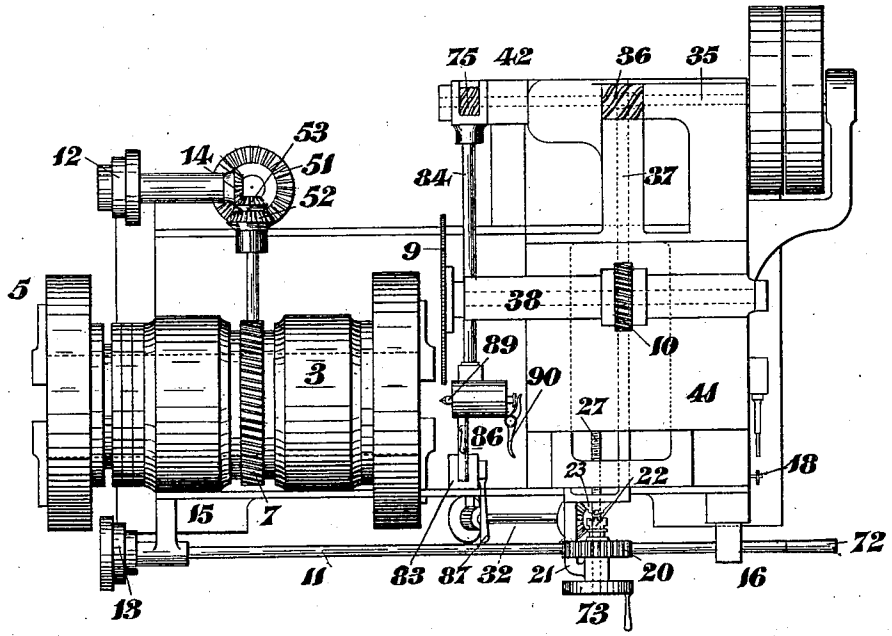
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 3.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 4.

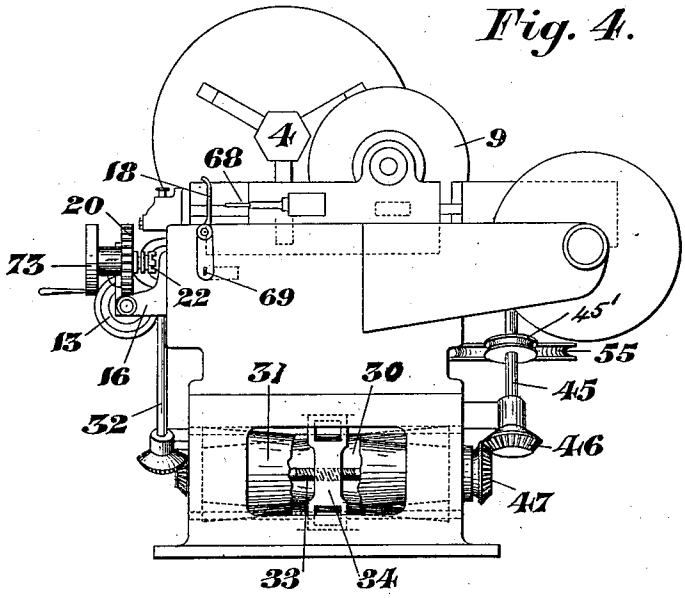


Fig. 5.

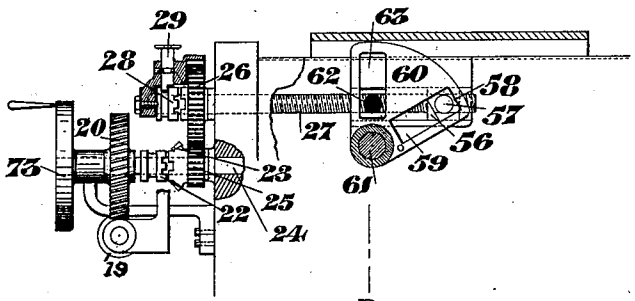
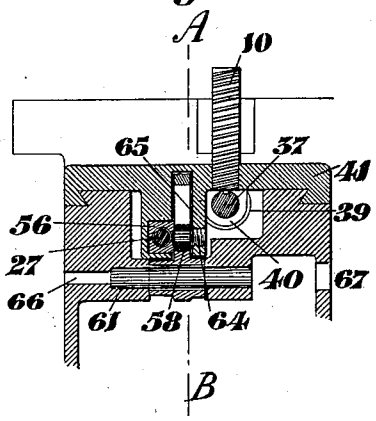


Fig. 6.



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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 7.

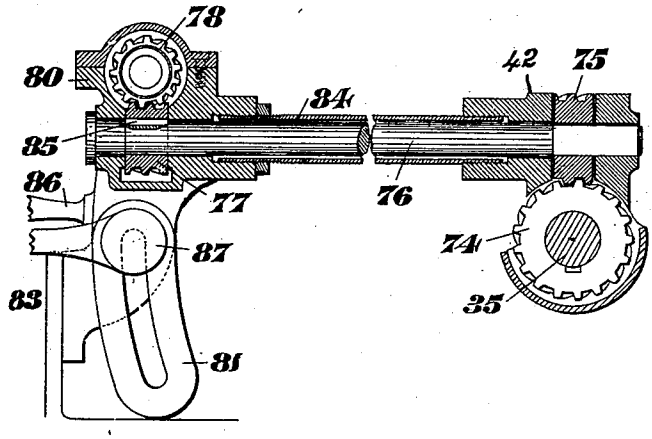


Fig. 8.

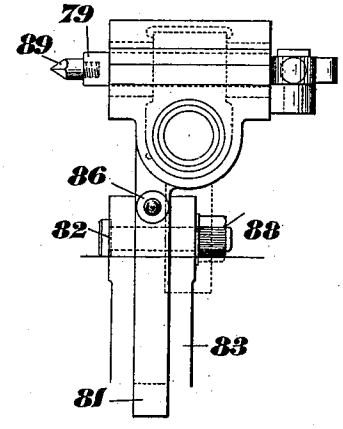


Fig. 9.

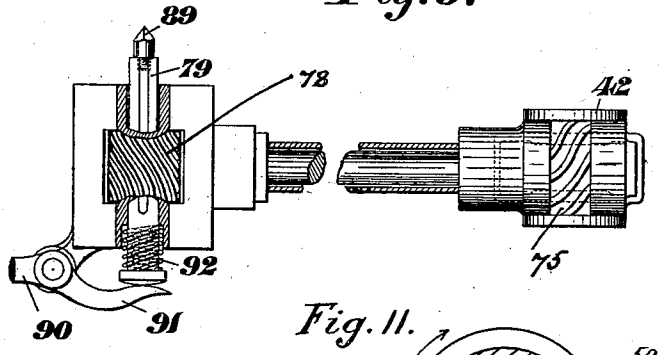


Fig. 10.

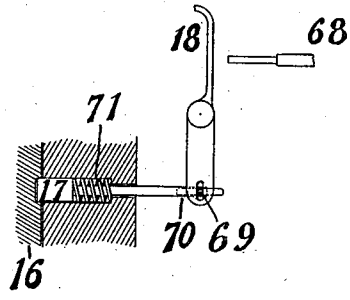
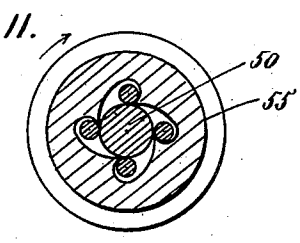


Fig. 11.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JAMES EDWARD CARTER AND SAM AYRTON WRIGHT, OF HALIFAX, ENGLAND.

COLD-IRON-SAWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 722,810, dated March 17, 1903.

Application filed May 10, 1902. Serial No. 106,771. (No model.)

To all whom it may concern:

Be it known that we, JAMES EDWARD CARTER and SAM AYRTON WRIGHT, residing at Halifax, in the county of York, England, have invented certain new and useful Improvements in Cold-Iron-Sawing Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention consists in an improved machine for sawing bars of cold iron, the principal features of improvement embodied therein comprising means for accelerating both the speed at which the bar itself revolves and the feed of the saw toward the center of the bar as the diameter of the portion of the bar left uncut decreases and also means for centering the cut bar before its removal from the machine. In this machine the bar is rotated in one direction and the saw, in contact therewith at right angles, is rotated in the opposite direction, being fed toward the center of the bar as the cut progresses. It is obvious that if the whole bar revolved at a uniform speed as the circumference of the portion of the bar left uncut decreased the rate of rotary movement of any point on the said circumference would also decrease, and thereby the cutting would be more slowly done.

By our invention to maintain the speed of cutting we gradually increase the speed of revolution of the bar by the introduction into its driving mechanism of a pair of taper cones, the speed of the driven cone, and therefore of the bar, being accelerated by automatically shifting the driving-belt along the cones during the cut. It is also obvious that the rate of feed of the saw which would suffice when beginning to cut the periphery of the bar would not be sufficient to enable the saw to operate on the same quantity of metal when the bar was half cut, and so on. We therefore give an accelerated feed to the saw by the use of two blocks sliding in slots in a quadrant, one block being traversed by a screw in such manner as to continually decrease its radial distance from the center of movement of the quadrant and the second block being traversed by the quadrant in such manner as to continually increase its radial distance from such center, thereby obtaining the effect of a lever-arm of increasing length, giving a correspondingly-increased motion to the second block, which is secured to a saddle which supports the saw and its connections. We also combine with the machine an arrangement, as hereinafter described, by which when the bar has been cut and the saw-saddle wound back from the face of the bar the bar can be centered ready for placing in a lathe or other machine to be further operated on, thereby effecting a considerable economy of time.

In order that our invention may be more fully understood, we will now refer to the accompanying drawings, wherein—

Figure 1 is an elevation of the front of a machine constructed according to our invention. Fig. 2 is an elevation of the back thereof. Fig. 3 is a plan. Fig. 4 is an end elevation. Figs. 5 and 6 are details of the apparatus for accelerating the feed of the saw, Fig. 5 being a section on the line A B of Fig. 6 and Fig. 6 a section on the line C D of Fig. 5. Figs. 7, 8, and 9 are details of the mechanism for centering the bar, Fig. 7 being a sectional view from the driving end of the machine, Fig. 8 a view from the front of the machine, and Fig. 9 being a plan, partly in section, with cover removed. Fig. 10 is an enlarged detail of the stop-motion apparatus. Fig. 11 is a sectional view of the free wheel 55.

Number 1 represents the framework of the machine, the body of which forms or incloses a tank 2 for the lubricant.

3 is a hollow spindle or tube carrying the bar 4, said bar being held in position by self-centering jaw-chucks 5 6 at each end. The said hollow spindle 3 has a worm-wheel 7 for the purpose of being rotated by worm 8.

9 is the saw or milling-cutter, which is caused to rotate in a direction opposite to that of the direction of rotation of the bar-spindle by means of worm-wheel 10.

11 is a shaft driven by belt connecting speed-cones 12 and 13, the speed-cone 12 being rotated by bevel-pinion 14, Figs. 2 and 3, the said shaft 11 being hinged at 15 and at its other end supported in bracket 16, held in position by stop-pin 17, so that when such stop-pin 17 is drawn back the said shaft 11 is

released by the automatic action of the stop-lever 18, as hereinafter described.

On the shaft 11 is a worm 19, which when the shaft 11 is in the position shown engages worm-wheel 20, supported in bracket 21, projecting from the framework of the machine. On the back of worm-wheel 20 is a clutch 22 (see Fig. 5) for engaging with bevel-pinion 23, said bevel-pinion 23 running free on shaft 24, journaled in the framework of the machine. On the said shaft 24 and behind the bevel-pinion 23 is keyed a spur-pinion 25, gearing with a spur-wheel 26, which wheel 26 runs freely on the shaft at the end of the screw 27, which controls the feed of the saddle. A clutch 28 is keyed on said shaft, which clutch can engage with a corresponding clutch formed on the front of the spur-wheel 26, the said clutch 28 being actuated by the turning of the eccentric-pin 29. A similar eccentric-pin is provided for actuating the clutch 22, but is for the sake of clearness omitted from the drawings.

30 and 31 are speed-cones for obtaining the accelerated speed of the bar-spindle 3.

32 is an inclined shaft driven from bevel-pinion 23, which shaft 32 by bevel-gearing rotates a screw 33, Fig. 4, passing across the machine, which screw 33 gives movement to a belt-shifter 34, which carries the belt laterally along the cones 30 and 31.

The main shaft 35, Fig. 3, by spiral gear at 36 drives a cross-shaft 37, which again by worm-wheel 10 gives a rotary movement to the saw-spindle 38 and the saw 9. The worm 39 for driving the worm-wheel 10 is keyed on the cross-shaft 37 in a long keyway, and said worm 39 is supported in a bracket 40, depending from the saddle 41, as shown in Fig. 6, so that as the saddle 41 carries the worm-wheel 10 toward the front of the machine it also carries along with it the worm 39, which thus continues to drive the saw during the whole of its feed.

The main shaft 35 carries a bevel-pinion 43, Fig. 2, which engages with bevel-pinion 44 on shaft 45. At the foot of said shaft 45 is bevel-pinion 46, engaging bevel-pinion 47, which drives cone 30. Cone 30 by belt drives cone 31, on the shaft of which is keyed bevel-pinion 48, driving bevel-pinion 49 on shaft 50 and by bevel-pinions 51 and 52 driving worm 8 and worm-wheel 7 to rotate the bar-spindle 3. The smaller pinion 53 (on the end of the shaft of bevel-pinion 52) drives bevel-pinion 14 to rotate the speed-cone 12 in order to transmit by belt on cones 12 and 13 the power to shaft 11 and parts in connection therewith.

When the cutting is begun, the belt between the cones 30 and 31 is at the small end of driving-cone 30 and at the larger end of driven cone 31, so that the rotation of the bar-spindle 3, given through bevel-pinions 48, 49, 51, and 52 from the said cone 31, is at the slowest. As the cut proceeds and the rotation of the bar-spindle 3 requires to be accelerated the belt-shifter 34, Fig. 4, is taken across the machine by the screw 33, the said screw 33 being rotated by bevel-gearing, Fig. 1, from inclined shaft 32, such inclined shaft 32 having at its upper end a bevel-pinion in gear with bevel-pinion 23, Fig. 5. By this means at the end of the cut the belt will be on the large end of the driving-cone 30 and the small end of the driven cone 31, whereby the speed of rotation of the bar-spindle 3 will be rendered much greater than at the beginning of the cut. If this acceleration be not required, the belt-shifter 34 can be rendered inoperative by simply withdrawing the clutch 22 from engagement with the bevel-pinion 23, as shown clearly in Fig. 5. The belt-shifter 34 will also be rendered inoperative whenever the hinged shaft 11 is let down, as hereinafter mentioned.

In case it is required to start the machine with the bar-spindle rotating at a certain definite speed this can be accomplished by driving the shaft 50 directly from the shaft 45 by belt 54, as shown in Fig. 2, the belt on the cones 30 and 31 meanwhile running freely; but as soon as the belt-shifter 34 has moved the belt along the cones far enough to increase the speed of the bar-spindle beyond that speed at which it is being driven by the belt from the shaft 45 then the driving of the bar-spindle is accomplished by the cones 30 and 31 and the wheel 55 on shaft 50 runs free. The said wheel 55 may be constructed somewhat after the fashion of a bicycle free wheel, so that as soon as the shaft 50 begins to overrun the speed of the wheel 55 the said wheel 55 loses its grip on the shaft 50 and runs freely. The cone 31 is connected to its shaft in the same manner as the free wheel 55. At the commencement of the cut the shaft 45 (driven by beveled pinions 43 and 44 from the main driving-shaft 35) drives the shaft 50 by means of the belt-wheel 45′, belt 54, and free wheel 55, and the free cone 31 runs loose on its shaft. When the belt-shifter increases the speed of the free cone 31, so that it revolves faster than the said shaft 50 can be revolved by the free wheel 55, the free wheel 55 is automatically uncoupled from the shaft 50, and the subsequent driving of the shaft 50 is effected by the cone-pulleys 30 and 31 and the beveled toothed wheels 46 47 48 49, as hereinbefore described, the free cone 31 engaging automatically with its shaft just before the free wheel 55 is released. This arrangement obviates any difficulty in starting which might otherwise be caused by the slipping of the belt on the cones 30 and 31.

The acceleration of the feed of the saw is obtained as follows: The eccentric-pin 29, Fig. 5, being turned so as to bring the clutch 28 into engagement with the clutch on the spur-wheel 26, the rotation of the wheel 26 is communicated to the screw 27, and thereby the nut 56 travels on the screw 27 toward the front of the machine. The nut 56, being connected by the runner 57 to the block 58, sliding in the

slot 59 in the quadrant 60, the block 58 moves forward in a straight line and causes the quadrant 60 to turn on its center 61, and thereby advance the block 62, sliding in the slot 63 in the said quadrant, also in a straight line. As, however, the block 58 is gradually decreasing its radial distance from the center pin 61 of the quadrant while the block 62 is gradually increasing its radial distance from such center pin, the rate of advance of the block 58 being constant, a continually-accelerating movement will be given to the block 62 by the quadrant. The block 62 is connected by screw 64 to a downwardly-projecting part 65 of the saddle 41, and the accelerating movement of the block 62 therefore causes a corresponding movement of the saddle 41, which feeds the saw toward the center of the bar 4. A hole 66 is left in the machine-frame at one side for convenience in knocking out the pin 61, on which the quadrant turns, and a larger hole 67 at the other side for conveniently replacing the said pin. When the saddle has advanced so far that the saw has reached the center of the bar being cut, the adjustable stop-rod 68, Figs. 4 and 10, comes in contact with stop-lever 18, which draws back the pin 69, moving in groove 70 in the machine-frame, thereby drawing back the pin 17 against the resistance of the confined spiral spring 71 and allowing the bracket 16 and hinged worm-shaft 11 to fall down by their own weight. When the saddle 41 is wound back, as hereinafter described, and the hinged shaft 11 lifted up to its operative position by means of the handle 72, the withdrawal of the stop-rod 68 on the saddle 41 allows the stop-lever 18 and pin 69 to be returned to their normal positions by the expansion of the spring 71, thereby returning the nose of the pin 17 into the socket in the back of the bracket 16 and retaining said bracket 16 and shaft 11 in their working positions. While the hinged shaft 11 is down the belt-shifter 34 is of course stopped and also the feed of the saw, so that almost the full power of the machine is available to work the centering apparatus. The feed of the saw can also be stopped independently of the shaft 11 by disengaging the clutch 28.

The winding back of the saddle 41 and belt-shifter 34 can be accomplished by hand by means of the hand-wheel 73. (Shown in Figs. 3, 4, and 5, but omitted for the sake of clearness in Fig. 1.) The winding back of the belt-shifter without winding back the saddle can be accomplished by disengaging the clutch 28 and engaging the clutch 22, while to wind back the saddle without winding back the belt-shifter the clutch 28 is engaged and the clutch 22 disengaged.

On the main driving-shaft 35 is hinged a bracket 42, which incloses a pair of spiral gears 74 and 75, (shown clearly in Fig. 7,) one gear on the main shaft, the other on a shaft 76 at right angles to the main shaft. At the other end of the shaft 76 is keyed a spiral gear 77, which meshes with a spiral gear 78, which rotates the centering-spindle 79. Depending from the casing 80, which incloses the spiral gears 77 and 78, is a curved slotted arm 81, capable of moving up and down on the pin 82 in bracket 83 on the machine-frame. The said casing 80 is attached by screw-thread to tube 84, surrounding the shaft 76, and as the keyway on the said shaft permits of a little movement of the key 85 the distance of the centering-spindle 79 from the main shaft 35 can be accurately adjusted by slightly rotating the tube 84, so as to draw the casing 80 nearer to the bracket 42 or force the said casing farther away from the said bracket. A handle 86 is provided on the curved arm 81 for lifting up the centering-spindle 79 to bring same opposite the center of the bar and also for lowering the centering mechanism after the bar has been centered. A handle 87 is also provided in the form of a screw-key or spanner for tightening up the nut 88 against the curved arm, so as to lock the centering apparatus either in its higher or lower positions.

After the bar has been cut and the saddle carrying the saw-spindle wound back the curved arm 81 is lifted up by the handle 86 until the centering-drill 89 is opposite the center of the bar. The hand-lever 90, Fig. 9, is then operated, causing the finger 91 to press in the spindle 79 against the resistance of the spiral spring 92, which has previously held back the centering-drill 89. The pressure on the hand-lever 90 is maintained while the spiral gears are revolving the centering-drill 89 against the center of the bar until a sufficiently-deep hole or "center" has been made. The pressure on the hand-lever 90 is then removed, allowing the spring 92 to draw back the tool. The handle 87 is turned to slacken back the nut 88 and the centering mechanism lowered out of the way of the bar, when the handle 87 is again used to tighten up the nut 88 to prevent undue vibration of the parts while inoperative.

We claim as our invention—

1. In a cold-iron-sawing machine, the combination, with a hollow spindle provided with means for holding the bar to be sawed; of driving mechanism for the said spindle provided with shafts 45 and 50, two speed-cones, a belt, and two pairs of beveled toothed wheels operatively connecting the said shafts 45 and 50, a belt-shifter operated from the said driving mechanism so that the speed of the said spindle is accelerated as it revolves, and two pulleys and a belt which connect the said shafts 45 and 50 direct, one of the said pulleys being automatically disengageable from its shaft when a prearranged speed is attained, and one of the said cones being automatically engageable in a similar manner with its shaft, substantially as set forth.

2. In a cold-iron-sawing machine, the combination, with a frame, a slidable saw-saddle, and a revoluble saw mounted in the said sad-

dle; of a saddle-feed screw journaled in the said frame, means for revolving the said feed-screw, a quadrant pivoted to the said frame and provided with two substantially radial slots, a nut arranged on the said screw and operatively connected with one of the said slots, and a block carried by the said saddle and operatively connected with the other said slot, whereby the feed of the said saddle is accelerated as the feed-screw is revolved, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES EDWARD CARTER.
SAM AYRTON WRIGHT.

Witnesses:
ERNEST PRIESTLEY NEWTON,
LEONARD H. CROSSLEY.