Oct. 25, 1927. 1,646,955

D. W. EDWARDS ET AL.

INCISING MACHINE

Filed June 30, 1922 4 Sheets-Sheet 1

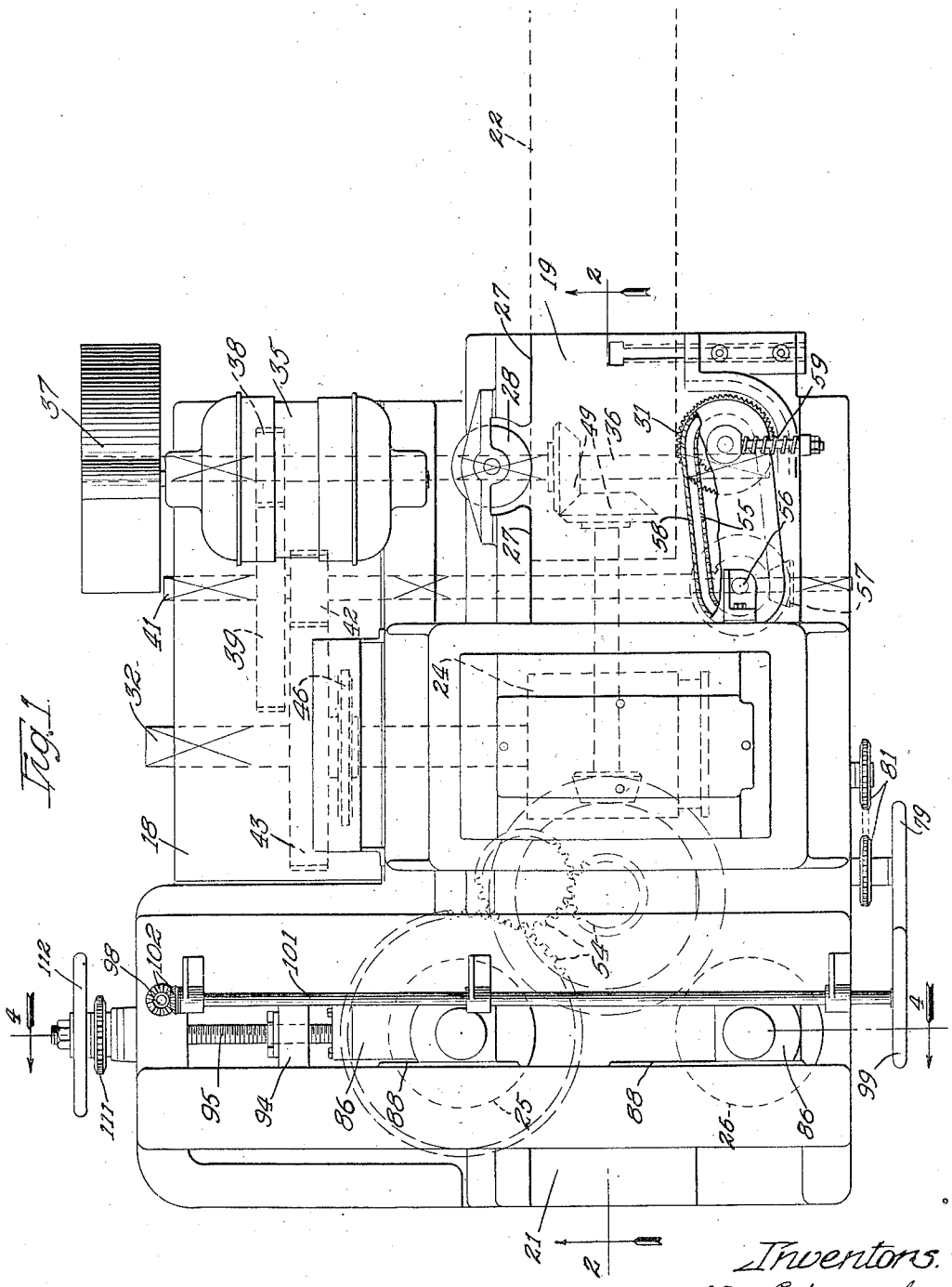


Fig. 1.

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Filed June 30, 1922 4 Sheets-Sheet 2

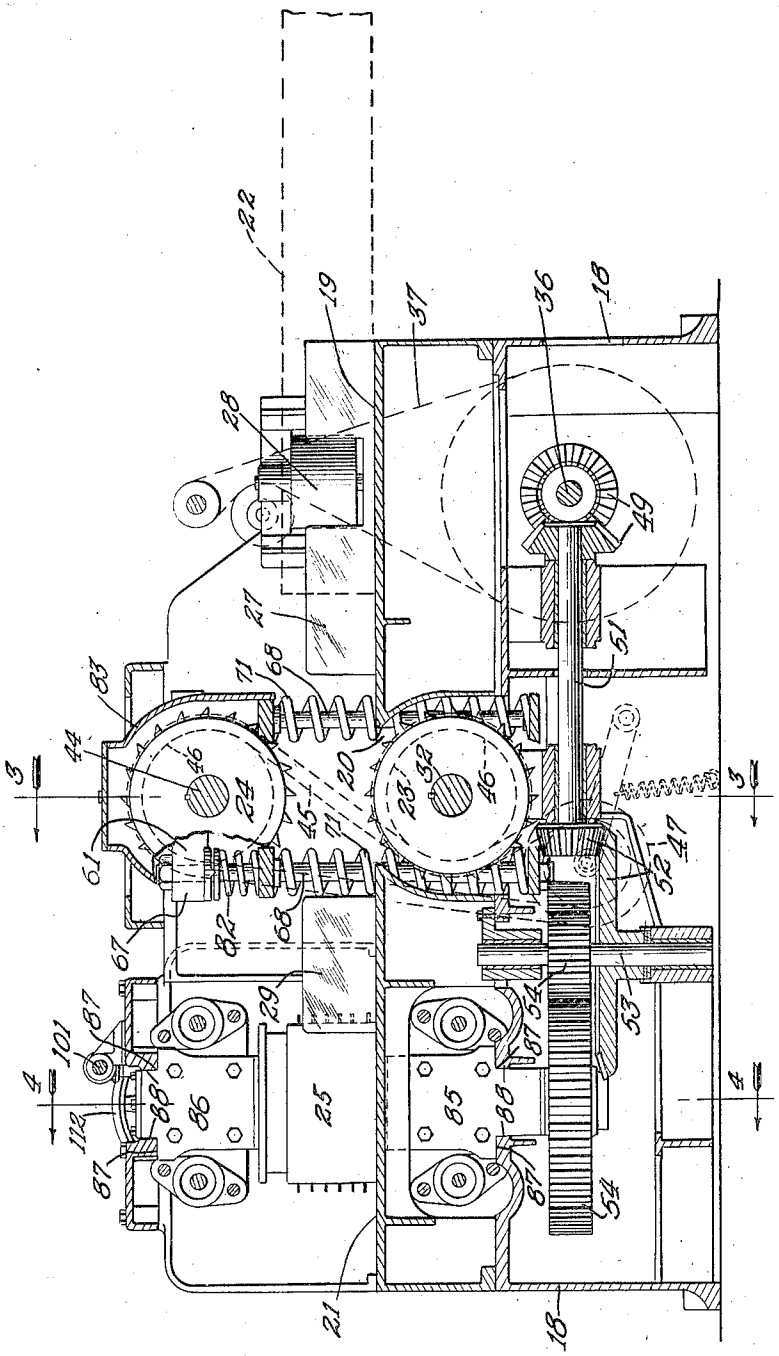


Fig2.

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INCISING MACHINE

Filed June 30, 1922 4 Sheets-Sheet 3

Fig. 5.

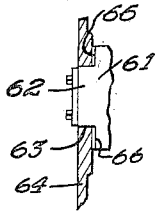


Fig. 3.

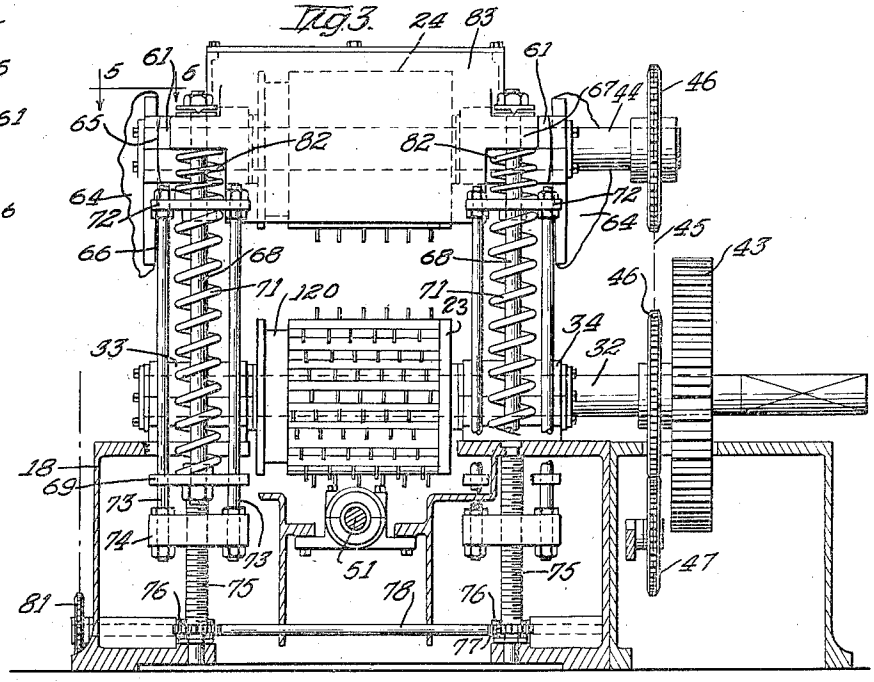


Fig. 4.

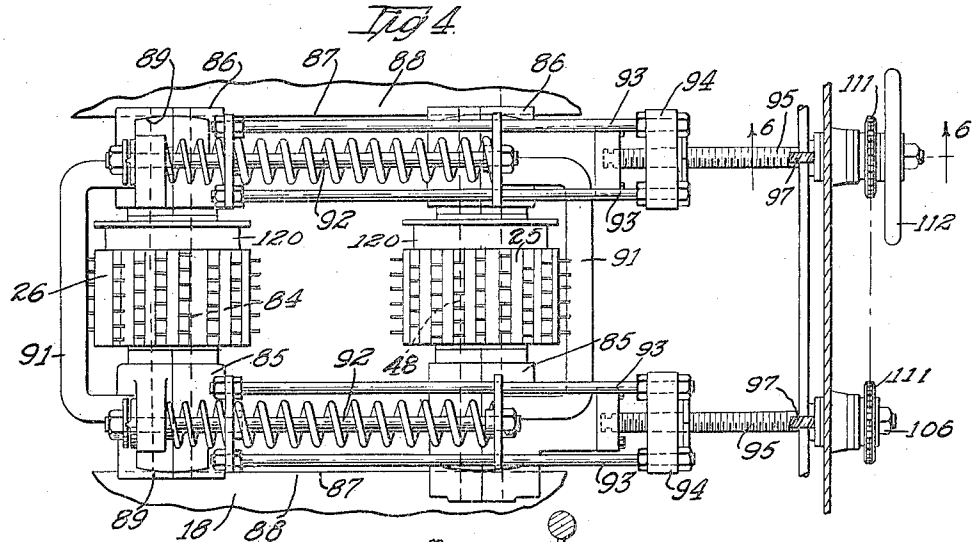
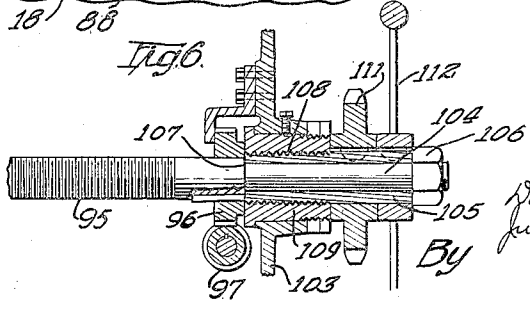


Fig. 6.



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Oct. 25, 1927. 1,646,955

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INCISING MACHINE

Filed June 30, 1922 4 Sheets-Sheet 4

Fig. 7.

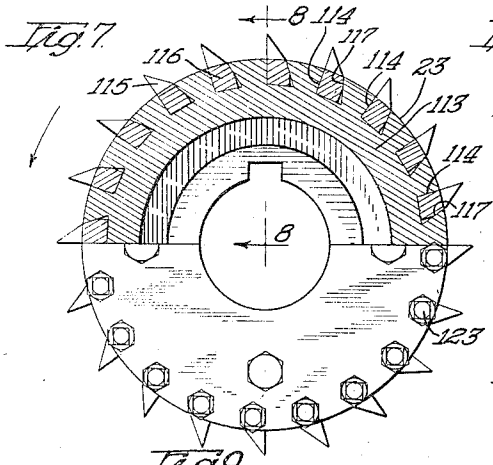


Fig. 8.

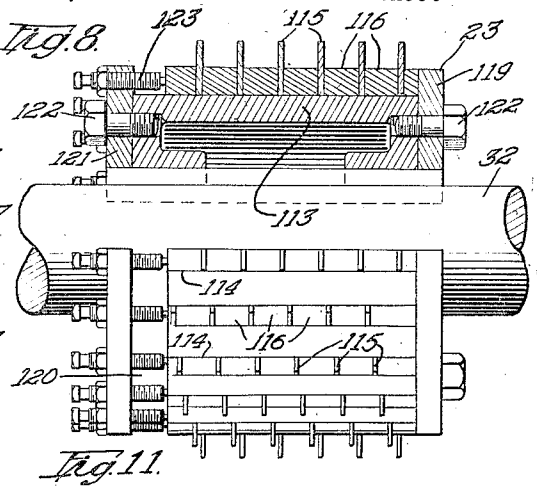


Fig. 9.

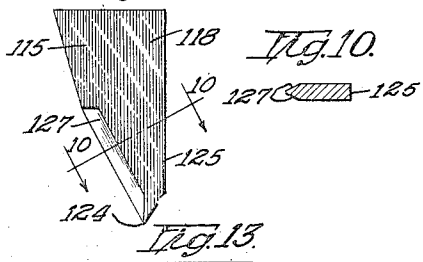


Fig. 10.

Fig. 11.

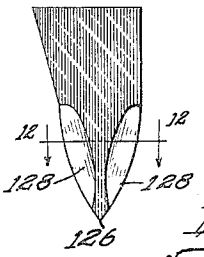


Fig. 12.



Fig. 13.

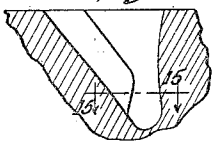


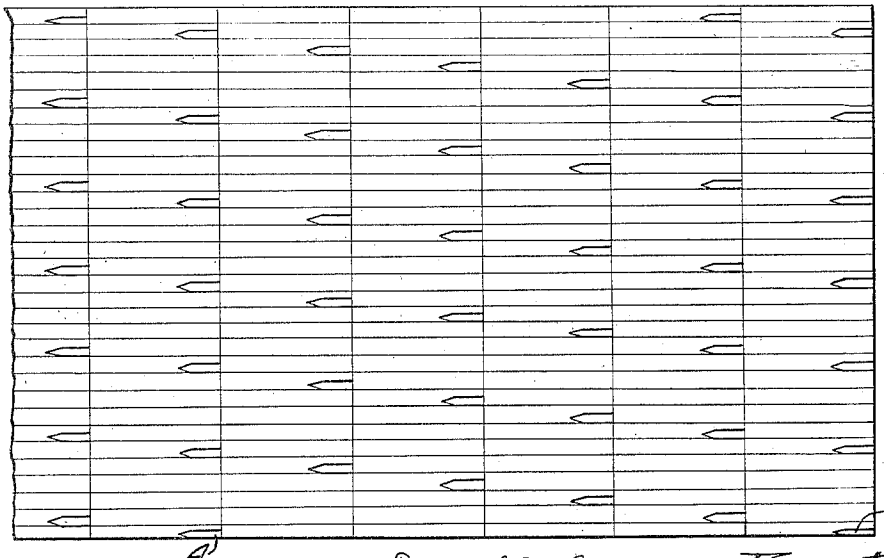
Fig. 14.



Fig. 15.



Fig. 16.



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Patented Oct. 25, 1927. 1,646,955

UNITED STATES PATENT OFFICE.

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INCISING MACHINE.

Application filed June 30, 1922. Serial No. 572,010.

This invention pertains to the art of preserving wood, and has more particular reference to mechanical means for incising or perforating the surface of wood to prepare it for treatment by preservative fluid. The value of preserving by creosoting and like processes is well recognized, and is especially desirable as a means for preventing checking and deterioration in railway ties, timbers, and beams used for structural purposes. It is found, however, that some species of wood are so refractory in their resistance to preservative treatment, due to the peculiar nature of their cellular structure, that it is practically impossible by merely external application, to secure proper penetration of the preservative, at least, without serious injury to the physical strength of the timber caused by over-heating during treatment. This condition has been overcome by incising or perforating the surface of the timber so that the fibres are opened at spaced intervals permitting the preservative to pass lengthwise and crosswise of the grain over a limited area. By properly arranging or spacing the incisions, these areas meet or overlap and in this way penetration of the preservative fluid will be complete for a given depth. This process while generally applicable, is especially desirable in the treatment of certain species of wood which on account of its comparative hardness and toughness and the refractory character of its heart wood, makes it very well suited for use for railway ties and for timbers and beams used in the building of bridges, bulk heads, pontoons, culverts, marine railways, and for mining timbers, etc.

The present invention relates more particularly to the incising or perforating of timbers commercially, and has for its primary object the provision of an improved and novel machine for this purpose. In other words, we have aimed to provide a commercially successful incising machine by means of which the incising operation may be performed at a comparatively low cost, with uniform results regardless of variations in sizes in different classes of timbers or ties, and in such manner as to secure complete and uniform penetration of the preservative without impairing the physical strength of the timber.

A further object of this invention is to enable reduction or complete elimination of checking in green ties and timber, if the perforating is done with reasonable promptness after cutting and is followed by impregnation, to enable reduction of temperatures required to secure satisfactory impregnation, and to enable reduction of the time required to treat the timber in the retorts.

In furtherance of the foregoing, we have provided an incising machine of novel construction, especially suited for the conditions and requirements above set forth. The structural features and advantages of this machine will be better understood by those skilled in this art as the invention becomes better understood by reference to the following description when considered in connection with the accompanying drawings, in which—

Figure 1 is a top view of an incising machine embodying our invention;

Fig. 2 is a vertical longitudinal sectional view through the machine taken substantially on the line 2—2 of Fig. 1;

Figs. 3 and 4 are fragmentary vertical sectional views taken substantially on the lines 3—3 and 4—4, respectively, of Fig. 2;

Figs. 5 and 6 are detail sections taken respectively on the line 5—5 of Fig. 3 and line 6—6 of Fig. 4;

Fig. 7 is an end view, partly in section, of one of the incising rolls or drums;

Fig. 8 is a side view of said roll, partly in section, as taken on the line 8—8 of Fig. 7;

Fig. 9 is a side view of one of the incising teeth removed from the roll;

Fig. 10 is a sectional view through said tooth taken on the line 10—10 of Fig. 9;

Fig. 11 is a side view of another form of incising tooth embodying our invention;

Fig. 12 is a sectional view through said tooth taken on the line 12—12 of Fig. 11;

Fig. 13 is a longitudinal section through an incision made by the tooth 9;

Fig. 14 is a top view of said incision;

Fig. 15 is a section through said incision taken on the line 15—15 of Fig. 13; and

Fig. 16 is a diagrammatic view illustrating an arrangement of incisions made by this machine.

Referring more particularly to Figs. 1 and 2, it will be observed that we have provided a suitable base 18 supporting bed sections

19 and 21 upon and along which a tie or timber 22 is adapted to be moved. During its travel over this bed the timber passes between a pair of vertically spaced incising rolls 23 and 24 and a pair of laterally spaced upright incising rolls 25 and 26, these numerals being generally applied. The lower roll 23 is supported in a stationary position in an opening 20 intermediate the bed sections 19 and 21. These rolls are peripherallly equipped with incising teeth which incise the four sides of the timber as will be more fully described hereinafter. In its passage through the machine, the timber will be guided on the bed section 19 by a stationary guide wall 27 and a guide roller 28 and on the bed section 21 by a stationary guide wall 29. The timber will be urged laterally against the guide wall 27 by means of a fluted roll 31 which is driven from the main driving mechanism, as will be presently described. The timber may be fed into the machine by hand or any suitable power driven mechanism.

We will consider first the mounting and the driving of the incising rolls, and take up later the construction of the rolls or drums per se. As shown in Fig. 3, the shaft 32 to which the incising roll 23 is fixed, is journaled in suitable bearings 33 and 34 mounted on the base 18. This shaft 32 may be driven by power in any suitable manner, and in the present instance we have shown for this purpose an electric motor 35 mounted on the base 18 and driving a shaft 36 through means of a belt 37, which shaft is connected by spur gears 38 and 39 to a shaft 41, which in turn is connected by spur gears 42 and 43 to said shaft 32. The upper roll shaft 44 is driven from the lower roll shaft 32 by a sprocket chain 45 trained over sprocket wheels 46 on said roll shafts and over an idler sprocket wheel 47 which serves as a chain tightener. The lower roll 23 will thus be revolved in a counter-clockwise direction and the upper roll in a clockwise direction, viewing Fig. 2.

Only one of the upright incising rolls, namely, what we term the inside roll 25, is driven by power. To this end any suitable means may be provided, such as a driving train between the shaft 36 and the roll shaft 48 comprising bevel gears 49, a horizontal shaft 51, bevel gears 52, a vertical shaft 53 and spur gears 54.

The timber feed roll 31 above referred to, may also be suitably driven as by a sprocket chain 55, driven from a vertical shaft 56, in turn driven by bevel gears 57 from the above mentioned shaft 41. It will be noted that the feed roll 31 is carried by a casing 58 which incloses the chain 55 and is adapted to oscillate about said shaft 56, a compression spring 59 being employed for urging the feed roll against the timber.

Referring now to the mounting of the upper incising roll 24, this provides a yieldable or floating support, which permits said roll to give or yield bodily to accommodate timbers of different thickness, and also to tilt vertically in accordance with the shape of such timbers. To this end, we have journaled the shaft 44 in bearing blocks 61, each of which has an outer end 62 vertically slidable between ways 63 in the side frame 64 and arcuate end surfaces 65 adapted to bear against and rock on the ways 66. Each bearing block has opposed lugs 67 through which passes a spring rod 68. To the lower end of each pair of spring rods 68 at each end of the roll mounting, is fixedly bolted a cross-head 69, and upon each rod is positioned a coil compression spring 71. An upper cross-head 72 loose on each pair of rods 68, seats on these springs 71 and is connected by rods 73 to a lowermost cross-head 74 which is threadingly engaged on a vertical screw 75. Each screw 75, suitably journaled in the base, is equipped with a worm gear 76 in mesh with a worm 77 fixed to a shaft 78, which extends beyond one side of the base and is adapted to be turned by a hand wheel 79 through the agency of a sprocket chain connection 81. By turning the hand wheel 79 the screw cross-heads 74 may be simultaneously lowered or raised as the case may be, for vertically adjusting the bearing blocks 61, and consequently varying the elevation of the upper roll, it being noted that a rebound coil spring 82 is interposed between each bearing block projection 67 and the upper cross-head 72. The bearing blocks 61 are rigidly joined by a yoke 83 which likewise serves the purpose of a protective hood, open only on the underside of the roll. From the foregoing it will be manifest that the position of the upper roll 24 with respect to the lower roll 23 may be varied primarily by adjustment in accordance with the depth of the timber to be incised; that in any adjusted position of such roll it has capacity for yielding upwardly at one or both ends against the pressure of the springs 71 to accommodate variations in shape and dimension of the timbers; that in any position of the upper roll, that is, whether horizontally disposed or tilted, its bearing blocks are supported with equal rigidity and the same end thrust bearing is obtained due to the arcuate shape of the ends of the bearing blocks; and that such tilting and vertical shifting of the upper roll does not affect its driving connection by reason of the fact that the chain 45 is so arranged as to allow vertical shifting of the roll center.

The vertical rolls 25 and 26 are mounted similarly to the horizontal rolls, and moreover, both rolls are capable of adjustment in a horizontal plane for the purpose of backing the rolls away from a timber so that the incising teeth will not function as in the

case when only the horizontal rolls are employed for incising a pole tie. As shown in Figs. 2 and 4, the roll shafts 48 and 84 are journaled at opposite ends in bearing blocks 85 and 86 mounted on horizontal ways 87 and between vertical ways 88 for movement crosswise of the machine. The end surfaces 89 of the bearing blocks adapted to bear against the horizontal bearing surfaces 87 are curved or arcuate to permit tilting of the rolls and still maintain the end thrust bearing. The bearing blocks for each roll are rigidly connected by a yoke 91, so that each roll constitutes an integral unit. Each bearing block of the roll 26 has connected therewith a pair of spring rods 92 carrying fixed and loose cross-heads and compression springs similar to those described above with reference to the roll 24. The rods 93 connected to the loose cross-head on the spring rods 92 are fixed to cross-heads 94 threadingly engaged on screws 95. Each of these screws has splined thereon, a spiral gear 96, held against axial displacement as shown in Fig. 6, and adapted to be turned by a complemental gear 97 fixed to a vertical shaft 98 in turn adapted to be rotated by means of a hand wheel 99 at the front of the machine through the agency of a suitable shaft 101 and bevel gears 102 shown in Fig. 1. It will be apparent that by turning the hand wheel 99, both screws 95 will be revolved, thereby feeding the roll 26 horizontally toward or from the roll 25. The roll 25 is likewise horizontally adjustable but by axial translation of the screws 95, which are connected to the bearing blocks 85 and 86 of the roll 25 in the manner shown in dotted lines, Fig. 4. Each screw is connected at its opposite end with the side wall 103 of the frame or bed section in the manner shown in Fig. 6. That is, the outer end 104 of the screw is revoluble in a sleeve 105 confined by the nut 106 and shoulder 107 for axial translation with the screw 95. This sleeve is threaded at 108 at its inner end in a nut 109 fixed in said side wall 103 and has keyed to its outer end a sprocket wheel 111. One of the sleeves 105 has keyed thereto a hand wheel 112. Both sprocket wheels 111 are connected by a sprocket chain. By turning the hand wheel 112, both sleeves 105 will be revolved, thereby feeding the screws 95 outwardly or inwardly for correspondingly adjusting the position of the roll 25, it being noted that in Fig. 6 the screw 95 is at its innermost limit and that axial translation of the screw does not rotate the screw or disturb the gears 96 and 97. Inasmuch as the adjustment of the inside roll 25 is mainly for the purpose of backing away from the operative position, the movement need be only sufficient to withdraw the incising teeth from the plane of the guide face 29; consequently, this may be done without unmeshing the gears 54. It will thus be seen that the vertical rolls are adjustable into and out of operative position and that the roll 26 is adjustable for different widths of timbers; that such adjustments may be quickly and easily made without disturbing the operative relation of the rolls, or the operativeness of their spring compensating devices which permit the outside roll to tilt to accommodate irregular ties and insure penetration of the incising teeth to uniform depth.

Our invention also contemplates the provision of novel incising rolls and teeth, particularly advantageous for use in a machine of the character described. Since each of the rolls 23 to 26 inclusive is of similar construction, a description of one will suffice. Referring more particularly to Figs. 7 to 16 inclusive showing the roll 23, it will be observed that in its preferred embodiment, this roll comprises a cylindrical drum or body 113 keyed to the shaft 32 and having longitudinal slots 114 milled or otherwise formed at circumferentially spaced points about its periphery. These slots reach substantially from end to end of said body and have opposed walls in angular relation, the front and bottom wall forming in this instance a right angle and the rear and bottom wall an acute angle. In each of these slots is adapted to be positioned a series of incising teeth 115 and spacing blocks 116 arranged in alternation. Each spacing block, originally approximately square in cross section, has a corner 118 beveled to an angle complemental to that of the angular wall of a slot. The incising teeth are formed preferably from flat stock and the shanks 118 are shaped complemental to the cross sectional shape of a slot, so that upon entering said shanks and the spacing blocks in a slot in alternation the shanks of the teeth will be confined between the spacing blocks in the plane of rotation of the roll. While it is necessary to insert the spacing blocks from the ends of the slots, the incising teeth may be inserted between two separated blocks by canting the tooth to permit entrance of its wide end through the narrow outer end of the slot and upon straightening the tooth and moving the blocks together the tooth will be confined against outward and endwise displacement. The spacing blocks may, however, be conveniently removed or replaced by withdrawal endwise to the annular channel 120 which intersects the slots 114 at one end of the roll. End plates 119 and 121 are secured to the ends of the body 113 by bolts 122, the plate 121 carrying clamping screws 123 in registration with the slots 114 for clamping the blocks and incising teeth therein. This construction permits quick removal and replacement of any teeth or blocks without dis-

mantling the roll. It also enables variation in spacing and arrangement of the teeth so that the perforations will be most effective for different woods, the lateral spacing being changed by the substitution of spacing blocks of different lengths, and the distance between the rows by the substitution of a roll having a greater or less number of slots.

The incising teeth are shaped to sever the grain crosswise the width of each tooth and substantially the full depth of the blade end, with the result that incisions will be made of such character as to insure maximum penetration of the preservative with minimum destruction of the wood structure. The blade end of each tooth is of the same width as its shank end, substantially to its cutting edge 124. The forward edge 125 of the tooth may be straight as shown in Fig. 9, or curved as shown in Fig. 11. In this latter form the cutting edge 126 also extends crosswise of the tooth substantially the full width thereof and severs the wood fibers crosswise, to the full depth of penetration. In the form shown in Fig. 9, the heel or trailing edge of the tooth is beveled at each side 127, and in the form shown in Fig. 11, both edges of the tooth are beveled at both sides as indicated by 128. This in addition to the tapered contour of the teeth, causes a wedging penetration, which spreads the fibers, although the cutting edges 124 and 126 actually sever the fibers the width of the tooth. The tooth shown in Fig. 9 will penetrate substantially as shown in Figs. 13, 14 and 15, from which it will be manifest that the wood cells are opened crosswise of the grain to the full depth of the incision. Referring more particularly to the action of the cutter shown in Fig. 9 and to the cut or incision effected thereby shown in Fig. 13, it will be observed that these cutter teeth are carried on the periphery of a drum such as shown in Fig. 7, which revolves continuously in a counter-clockwise direction, and that this being the lower drum, the piece of timber is fed over it in the same direction and at the same speed as the periphery of said drum, the under-face of said timber being substantially tangential to said periphery. In Fig. 13 the direction of travel of the timber is to the left, with the figure inverted so that the incision will correspond to what is produced by a cutter tooth on the drum 23. In the example cited, the cutting edge 124 enters the timber, severing the wood fibers crosswise the full width of the tooth and is forced by rolling action of the drum into the wood to the depth indicated in Fig. 13. Said edge 124 severs the wood fibers crosswise throughout the depth of this incision or until the front face 125 of the tooth is perpendicular to said tangential under-face of the timber. At this point the shape of the incision is substantially as shown in Fig. 13. Upon continued movement of the drum and the timber, the tooth rolls out of or withdraws from the incision much the same as the action of an involute spur gear, without affecting the incision to any appreciable extent. It will be noted that the fibers are severed crosswise to a substantial depth by a V-shaped incision, thus opening a relatively large area of the cellular structure to the impregnating fluid without appreciably impairing the strength of the wood. Inasmuch as the preservative fluid penetrates lengthwise of the grain considerably farther than crosswise, we arrange the teeth in spiral order, as shown in Fig. 16, which insures complete penetration of the fluid over the surface of the wood to a uniform depth. In the present roll the rows of teeth are two inches apart, and in the arrangement shown in Fig. 16 the distance between any two longitudinally aligned teeth A and B is ten inches, and the blocks 116 are of such length as to position the teeth 1¼ inches apart. For more refractory woods, the longitudinally aligned teeth will be brought closer together, that is, to every third, fourth or fifth row, as the case may be, proportional to the spread of the fluid, due to the cellular structure of the wood. Likewise, the crosswise spacing of the teeth would be lessened. It will be manifest that by adjustably mounting the teeth in rows as described above, the spiral arrangement may be at a greater or less pitch and the teeth brought into greater or less proximity to insure proper incising of the wood according to its physical structure. Incising teeth of the character described are not only economical to produce, but they have considerable potential strength, are secured very rigidly to the roll and may be easily removed or replaced in case of breakage, and they are especially well adapted for making up different patterns of incisions.

In operation, the driving rolls 23, 24 and 25 will be continuously revolved at a proper speed, which in the present showing is approximately 25 R. P. M., making the lineal travel of the timbers through the machine about 100 feet per minute, it being obvious that the outside roll 26 will be correspondingly revolved by engagement of its teeth with the respective timbers. In the case of sawn ties, all of the rolls are brought into action, incising the four sides, and for pole ties the two vertical rolls will be backed off so that only the horizontal rolls 23 and 24 function to incise the opposed sides. As explained above, the rolls by reason of their compensating spring mountings, will automatically accommodate themselves to variations in shape and dimensions of a timber, thus insuring uniform penetration of the incising teeth. During the incising operation, little or practically no wood fiber is removed

by the teeth, this being due to the peculiar cutting and wedging action thereof.

It is believed that the foregoing conveys a clear understanding of the objects prefaced above, and while we have illustrated but a single working embodiment, it should be understood that considerable change might be made in the construction and arrangement without departing from the spirit and scope of the invention as expressed in the appended claims:

We claim:

1. An incising machine of the character described having means for incising timber including teeth each having a transverse cutting edge for severing the wood fibers crosswise to the full depth of the incision by a rolling action.

2. An incising machine as set forth in claim 1, in which said teeth are carried on the periphery of a rotary incising roll and each tooth is substantially triangular in the plane of rotation with its base along said periphery and its cutting edge at the opposite angle.

3. An incising machine as set forth in claim 1, in which said teeth are carried on the periphery of a rotary incising roll and each tooth is substantially triangular in the plane of rotation with its base along said periphery and its cutting edge at the opposite angle, and in which the front face of the tooth is substantially radial with respect to the roll.

4. An incising machine as set forth in claim 1, in which said teeth are carried on the periphery of a rotary incising roll and each tooth is substantially trinagular in the plane of rotation with its base along said periphery and its cutting edge at the opposite angle, and in which the heel or trailing edge of the tooth is beveled on each side.

5. In an incising machine of the character described, the combination of rotary incising rolls, and incising teeth, each formed of a body of flat material providing a shank portion and a blade portion, the shank portion being adapted to be secured in the peripheral portion of a roll with the flat plane of the tooth body parallel with the plane of rotation of the roll, and the front and rear faces of the blade portion converging outwardly from its shank portion and terminating in a cutting edge parallel with the axis of rotation of the roll.

6. In an incising machine as set forth in claim 5, each roll having a plurality of circumferentially spaced slots in its peripheral portion extending lengthwise thereof, and means for securing the incising teeth in said slots including spacing blocks arranged in each slot in alternation with the shank portions of the teeth and means for clamping said blocks and teeth in the slots and for permitting removal of any of the teeth independently of the others.

7. In an incising machine as set forth in claim 5, each roll having a plurality of circumferentially spaced slots in its peripheral portion extending lengthwise thereof, and means for securing the incising teeth in said slots including spacing blocks arranged in each slot in alternation with the shank portions of the teeth and means for clamping said blocks and teeth in the slots and for permitting removal of any of the teeth independently of the others, each slot having an inclined retaining wall, and said spacing blocks and the shank portions of the teeth being shaped to fit and be held in each slot by the retaining wall thereof.

8. In an incising machine of the character described, an incising roll having circumferentially and axially spaced incising teeth, each formed of flat stock and tapered toward its outer end which terminates in a transverse cutting edge, and the trailing edge of each tooth being reduced at its sides.

9. In an incising machine of the character described, a pair of opposed incising rolls, one roll being journaled in fixed bearings and the other in bearings rigidly tied together and mounted to independently yield to accommodate irregularities and variations in shape of the timbers.

10. In an incising machine of the character described, a pair of opposed incising rolls adapted for incising opposite sides of a timber, one of said rolls being journaled at each end in a bearing block, a yoke connecting said bearing blocks, ways on which said bearing blocks are slidable for movement of the roll toward and from its companion roll, said bearing blocks having arcuate surfaces operable on said ways and permitting tilting of its roll with respect to said companion roll.

11. In an incising machine of the character described, a pair of spaced incising rolls journaled at their ends in bearing blocks, a spring-carrying rod attached to the bearing blocks of one of the rolls at opposite sides thereof for yieldingly supporting said roll, a screw rod connected with the pair of spring-carrying rods at each end of said roll, and means for simultaneously rotating the screw rods for adjusting said yieldable roll with respect to its companion roll.

12. In an incising machine, means for incising a timber including incising teeth, each having a transverse cutting edge adapted for severing the grain crosswise to the full depth of penetration.

13. In an incising machine of the character described, means for perforating a timber comprising teeth, each having a transverse cutting edge adapted for severing the grain crosswise to the full depth of pene-

tration and having a tapered edge which tapers the incision lengthwise of the grain at one side of the deepest point of penetration.

14. In an incising machine of the character described, the combination of a rotary roll, and incising teeth carried on the periphery thereof, adapted for perforating a timber by rotation of the roll, each tooth having a transverse cutting edge for severing the grain crosswise to the full depth of the incision.

15. In an incising machine of the character described, a pair of incising rolls each equipped with incising teeth and journaled at its ends in bearing blocks, and means supporting one of the rolls so that it may yield bodily or at either end to accommodate irregularities in the timber being incised, including arcuate end thrust surfaces on the bearing blocks.

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