July 10, 1923. 1,461,712

W. ELLIS

NAIL PULLING MACHINE

Filed May 20, 1922 4 Sheets-Sheet 1

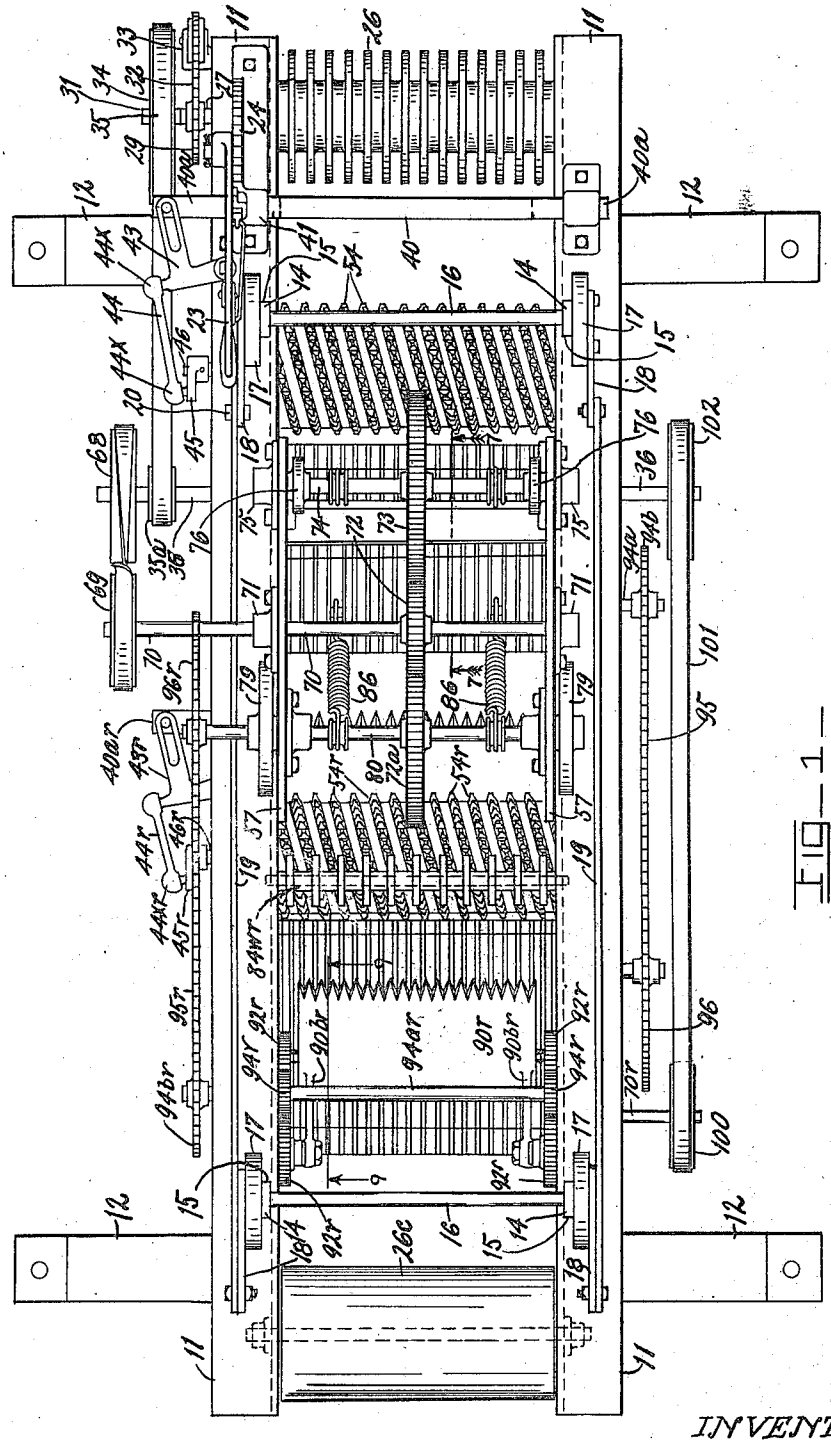


FIG. 1.

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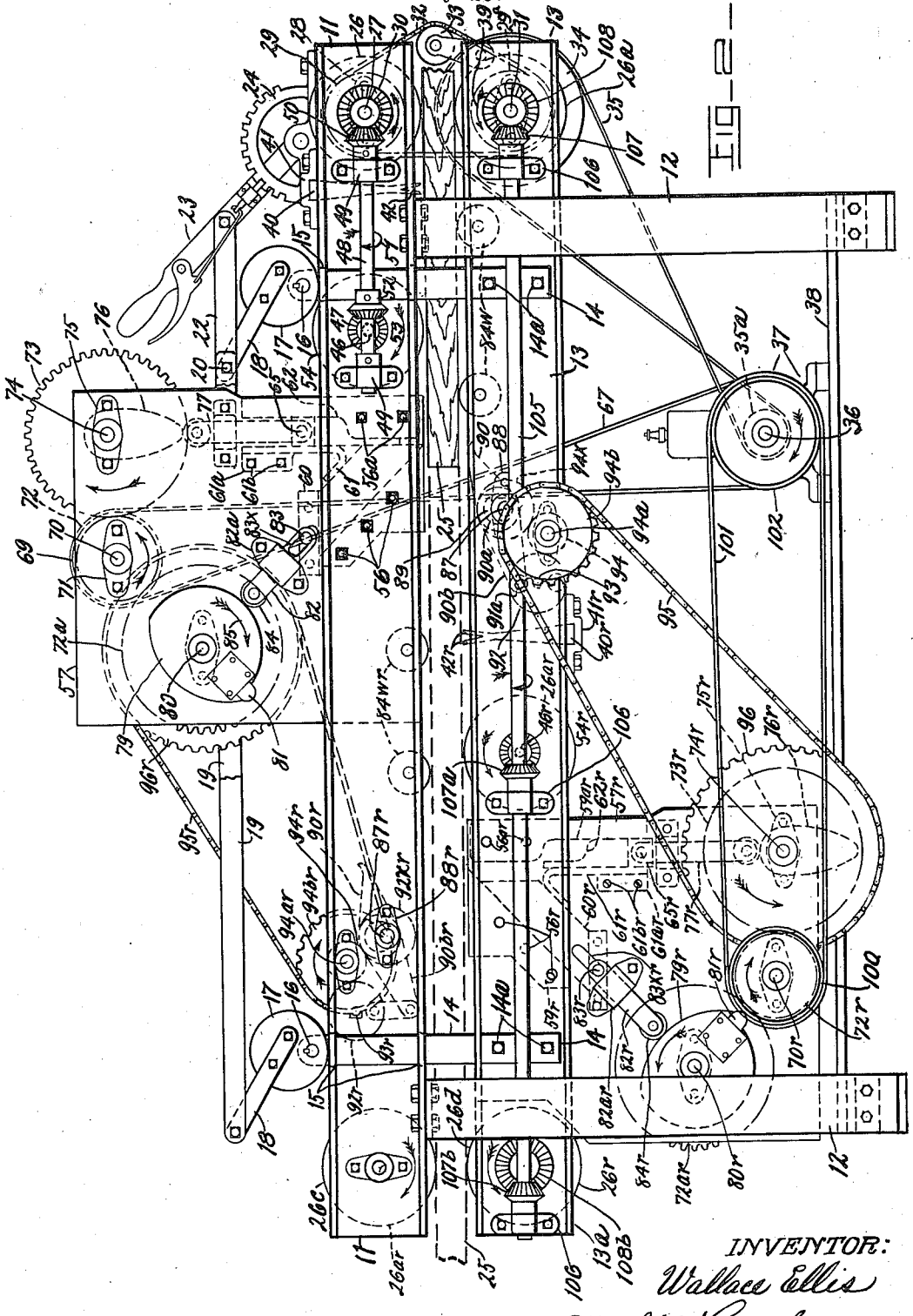
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Fig. 2.



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NAIL PULLING MACHINE

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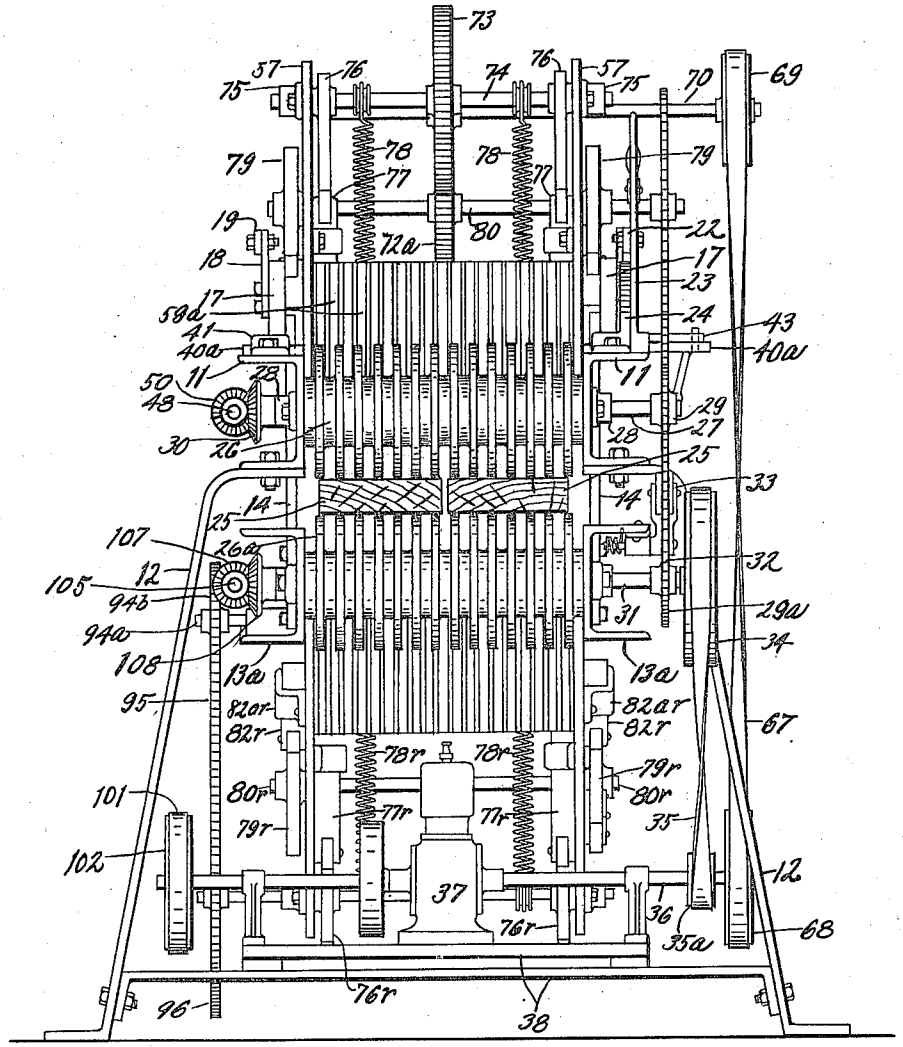


FIG. 3.

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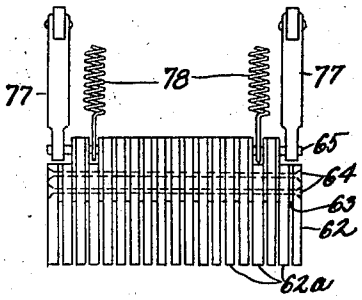


Fig. 4.

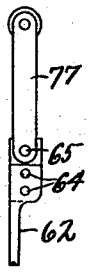


Fig. 5.

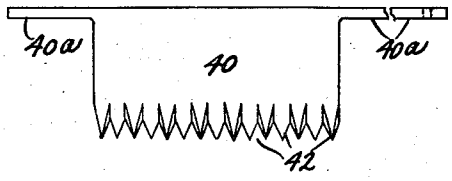


Fig. 6.

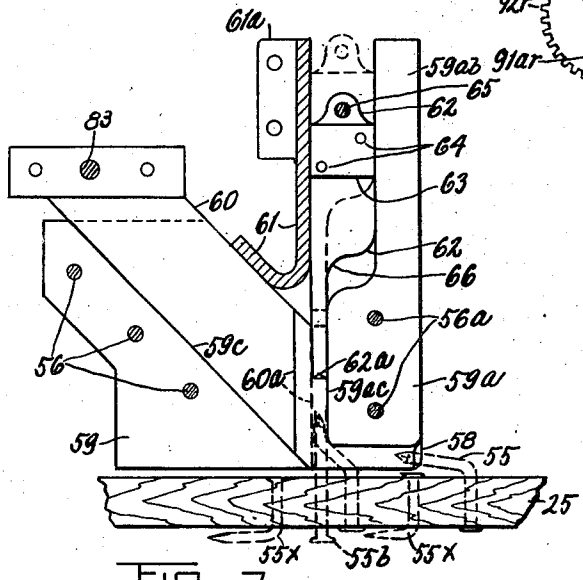


Fig. 7.

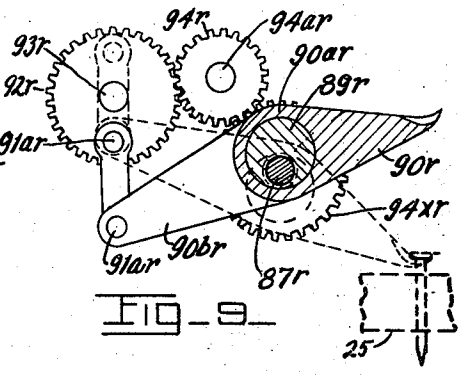


Fig. 9.

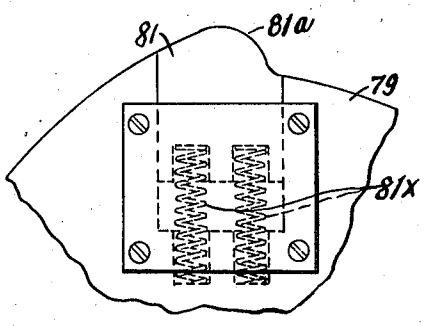


Fig. 8.

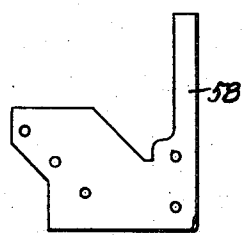


Fig. 10.

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Patented July 10, 1923. 1,461,712

UNITED STATES PATENT OFFICE.

WALLACE ELLIS, OF BELOIT, WISCONSIN, ASSIGNOR OF ONE-HALF TO WILLIAM RAY, OF BELOIT, WISCONSIN.

NAIL-PULLING MACHINE.

Application filed May 20, 1922. Serial No. 562,305.

To all whom it may concern:

Be it known that I, WALLACE ELLIS, a citizen of the United States, residing at Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Nail-Pulling Machines, of which the following is a specification.

My invention relates to devices for extracting nails from boards or planks and the object is to provide a device of said kind adaptable mainly for extracting nails from planks which have been used in concrete form work and must necessarily be cleared of nails before being used again for the same or other purposes.

In the accompanying drawings;

Fig. 1 is a top view of the complete machine.

Fig. 2 is a side elevation of Fig. 1.

Fig. 3 is a front elevation of the machine looking as from the right toward the left in Fig. 2.

Fig. 4 is a detail face view of the nail driver of my machine and Fig. 5 is an edge view of Fig. 4.

Fig. 6 is an elevation of the so-called rake used in my machine.

Fig. 7 is an enlarged detail elevation on line 7—7 in Fig. 1.

Fig. 8 is an enlarged fractional face view of the yielding portion of cam 79 in Fig. 2.

Fig. 9 is an enlarged sectional view on line 9—9 in Fig. 1.

Fig. 10 is a detail elevation of one of the main separator plates used in conjunction with the nail-straightening and removing mechanism of my machine.

Referring to the drawings by reference numerals, my device preferably consists of an elongated upper main frame of two parallel channels 11, mounted securely on four offset supports 12, and a secondary frame 13 suspended below the first mentioned channels and comprising also parallel channels 13^a spaced similar to the former. Vertical sliding bars 14 secured as at 14^a to the web of each lower frame channel, extend upwardly through slots 15 in the main frame and the upper end of each engages a transverse shaft 16 keyed in a wide faced disk wheel 17 normally resting on the top flange of the main frame channel 11.

Each disk 17 functions as a cam, having a lever arm 18 secured to it and a connecting rod 19 is pivotally connected with the two cams on each side (see Figs. 1 and 2) one of the two forward cam arms 18 (to the right in Figs. 1 and 2) being connected at 20 to the rear end of a pitman 22 the forward end of which is pivotally secured to a hand lever 23 normally engaging a toothed segment 24. Manipulation of said lever will raise or lower the secondary frame, disks 17 rolling on the flanges of the main frame, raising or lowering the shafts 16 and thereby the secondary frame, the object being to set the two frames a certain distance apart according to the thickness of planks to be cleared of nails by the mechanism mounted in said frames and which will now be described.

The right hand end of Figs. 1 and 2 is the front of the machine illustrated also in Fig. 3, into which boards or planks 25 are fed between two transversely arranged corrugated rollers 26, 26^a, of which 26, the upper roller, is mounted loosely on a shaft 27 rotating in bearings 28 in the main frame channels 11, said shaft 27 having a chain sprocket 29 keyed to its right hand end (Fig. 3) and a bevel gear 30 at its other end. The lower roller 26^a is keyed to its shaft 31 which has a sprocket 29^a corresponding to sprocket 29 of the upper roller shaft and a sprocket chain 32 engages the two sprockets, one of its runs being kept taut by a chain stretcher 33. Adjacent sprocket 29^a I provide on shaft 31 a pulley 34 engaged by a belt 35 extending from a pulley 35^a on the shaft 36 of an engine 37, shown secured to a platform 38 in the lower portion of the machine, imparting motion to the corrugated lower roller 26^a in the direction indicated by arrow 39 (Fig. 2) and thereby feeding the planks 25 inwardly toward the left in Figs. 1 and 2.

In the preferred form of my machine, as illustrated, one wide plank or two narrow ones 25 may be fed through at one time and the first operation is to remove the nails having their heads down, by mechanism mounted mainly in the rigid frame. The second operation is to remove nails having their heads in the upper side of the planks, by another mechanical unit similar to the first, mounted mainly in the secondary frame and necessarily in inverted position relative to the first mechanism. I will therefore describe only the mechanism of the first nail removing unit and only such parts of the second unit as are not common to both.

The rollers 26, 26ª, which I will call the feed rollers have deep and narrow corrugations, as shown, permitting planks to be inserted between them, the protruding nails being guided into the grooved portion of the corrugations and the planks immediately are moved rearwardly to start the first operation (removing nails with their heads down). Immediately back of roller 26, in the main frame, I mount a transversely reciprocable, vertically disposed blade 40 of heavy plate steel (see Fig. 6) having at its upper edge oppositely extended flattened bars 40ª adapted to slide in bearings 41, secured on the top flanges of the main frame 11, and its lower edge comprising a row of downwardly and alternatively forward and rearwardly projecting pointed teeth 42. The entire blade is reciprocated transversely by a horizontally arranged bell crank 43 receiving motion through a connecting rod 44, having ball joints 44× (see Fig. 1), the rear end of which is rotated by a crank 45 at the outer end of a shaft 46 extending through the main frame and its other end having a bevel gear 47. A shaft 48 mounted in bearings 49 on the side of the channel 11, has one bevel pinion 50 meshing with gear 30 on shaft 27 by which said pinion 50 and shaft 48 are rotated in direction of arrow 51, and another bevel pinion 52 meshing with bevel gear 47 rotates shaft 46 in direction of arrow 53 (Fig. 2). 54 is a spirally corrugated drum keyed on shaft 46, the spiral ridges thereof comprising a continuous row of tapered pegs resembling each a frustrum of a pyramid.

The teeth 42 of blade 40 are normally just even with the surface of plank 25 being fed into the machine and the crosswise reciprocating movement causes said teeth to engage the pointed ends of nails 55 bent to the surface of the plank and turns said ends rearwardly or to approximately 30 degree angle with relation to the long edge of the plank as the latter moves toward the spirally corrugated roller 54. The spirally arranged semi-pyramidal pegs of the said roller engage the angularly arranged nail ends as the plank travels rearwardly and turns all of said nail ends toward the rear of the machine and in the direction the plank 25 travels.

The next operation is to straighten the rearwardly pointing nail ends to a vertical position and to right angles with the surface of the plank, then driving the nails downward just before they are extracted from the plank, by the following mechanism which, for convenience, I call the rapper.

Said rapper is mounted on a number of transversely arranged bolts 56 and 56ª between two upright frame plates 57 secured on the inner sides of the main frame channels 11. The bolts 56, 56ª may be extended through the channels and be provided with nuts at the outer sides of the channel webs. On said bolts are placed a series of alternate thick and thin plates the entire distance between the upright frame plates 57. The thin plates 58 are spacers, preferably one-eighth inch thick and of the shape shown in Figs. 7 and 10, and the thick plates 59, 59ª, are preferably three-eighths inch thick for best results, 59ª being elongated vertically and having reduced upper portions 59ªᵇ. Said upright members are engaged by the bolts 56ª in the forward part of the rapper and the rear spacer plates 59, also three-eighths inch thick, having each the forwardly and downwardly sloping surfaces 59ᶜ, are secured between the thin plates 58 on the bolts 56. Guided vertically between the plates 58 and on the sloping surface or edge 59ᶜ of each plate 59 is a driving plunger or plate 60 with a vertical front face 60ª (see Fig. 7). These plungers are three-eighths inch thick and in alignment longitudinally of the machine with the vertical members 59—59ª of the rapper, the latter members having each a rearwardly exposed vertical face 59ªᶜ. The upper angular face of plunger 60 is guided by a guide member 61 with ears 61ª at its ends having perforations for bolts 61ᵇ to hold the guide in the upright frame plates 57. A series of vertical plungers 62 with spacers 63 at their upper ends, and all perforated for connecting bolts 64 and the plungers only extended upwardly and perforated for a larger bolt 65 operatively connected with means, to be described, for simultaneously operating all of the vertical plungers 62. These plungers 62 are the same thickness as the rear plungers 60, the lower ends of the former being reduced as at 66 in Fig. 7 and their extreme lower ends cut square and slightly counterbored upwardly as at 62ª. The angular plungers 60 are reciprocated, by other means to be described, coming down on their forward stroke so that their front ends 60ª stop close to the vertical face 59ªᶜ of the upright members 59ª at a time when the vertical plungers 62 are at their upper position,

shown dotted in Fig. 7. In said Fig. 7, assuming plank 25 is moving rearwardly the point of a nail 55 is guided between two of the separator plates 58 then brought against the sloping face 59^c of the separator plate 59 which starts to bend the end of the nail upward and as the plank gradually moves on the plungers 60, by its hammering forward strokes straightens the nail with its vertical face 60^a until the nail end reaches a height where the alternating vertical plunger strikes said end downwardly with its lower end 62^a. The latter action forces the nail downward so that its head will be below the lower surface of the board (see 55^b in Fig. 7) at which time another device mounted in the lower frame of my device instantly removes the nail.

The vertical plungers of the above device are operated by a crossed belt 67 engaging a pulley 68 on engine shaft 36 and extended upwardly to a pulley 69 keyed on a transversely arranged shaft 70 in bearings 71 in the upper frame plates 57. Keyed on said shaft, between the plates 57, is a spur gear 72, meshing with another spur gear 73 keyed on a transverse shaft 74 rotating in bearings 75 in the plates 57. The latter shaft carries two spaced cams 76 adapted to contact with the upper ends of correspondingly spaced vertically guided sliding bars 77 the lower ends of which are engaged by the shaft 65 of the vertical plunger series. The cams (76) push the plungers 62 down once for each revolution of shaft 74, and the whole plunger member is immediately pulled up, after the cam action, by means of coil springs 78 engaging the same shafts 65 and 74 with their opposite ends. (See Figs. 3, 4, and 5.)

The angularly arranged plungers 60 are reciprocated by another set of two cams 79 mounted on a transverse shaft 80 outside of the plates 57, and between the plates is a spur gear 72^a secured to the shaft and meshing with the gear 72 on shaft 70 previously described. Said cams 79 each have one side concentric with the shaft and the other side flattened (see Fig. 2) the meeting point of the two surfaces, at one side only, having a resilient radially slidable bumper 81 with a rounded outer end and is normally spring pressed outwardly by coil springs 81^x. A sliding bar 82 sliding in guides 82^a and arranged linearly with and extending back from the straightener plates 60, is connected to the latter by engaging a transversely arranged shaft 83 projecting through slots 83^x in the plates 57, and its rear end provided with roller 84 normally engaging the cam, the latter rotating in direction of arrow 85 in Fig. 2. The plungers, sliding bar, etc., are normally held pressed toward the cam 79 by coil springs 86 attached to shaft 83 and to shaft 80 with their opposite ends. In Fig. 2 the plungers are down the slide 82 also down because it is held thus by the outer curve of the cam 79 but when the cam rolls around the slides 82 and consequently the plunger 80 are brought upward by the springs 86 against the flattened surface of the cam until the high point of bumper 81 comes in contact with slide 82. As the latter point is reached the slide is furthest forward permitting the straightener plates 60 to drop forward to the furthest point with their faces 60^a. If however an extra large nail comes between said face and face 59^{ac} of the upright member 59^a in the straightener, the radially yielding part 81 of the cam prevents any breakage of parts. Said yielding element 81 is merely a radially slidable bar in the cam, with coil springs 81^x back of it which yield radially when undue pressure is exerted on its outer curved face 81^a (see Figs. 2 and 8).

84^w are corrugated supporting rollers spaced as desired and mounted transversely in the secondary frame 13 to support the under side of planks being fed into the machine and 84^{wr} are similar rollers mounted in the main frame 11 for engaging and guiding the upper side of the plank 25 being passed through the machine.

I have described above how nails to be extracted from the lower sides of planks are started downwardly so that their heads are away from the lower side of the plank as 55^b in Fig. 7. At this instant the nail or nails are immediately extracted by a claw member, as follows;

In the lower or secondary frame I key on a transverse rock shaft 87 extending through the channel members of said frame and having bearing 88. Said shaft 87 has keyed to it a number of eccentric disks 89 engaged by corresponding disk rings 90^a of a forwardly and upwardly inclined toothed member 90 extending across the frame between its channels. Said shaft also has a spur gear 94^x meshing with pinion 94 and is driven by the latter. This member 90 has two rearwardly inclined arms 90^b the rear ends of which are pivotally connected each with a pin 91^a of a spur gear 92 rotating on a stub shaft 93 secured in the frame channel 13 and meshing with a driving gear 94 secured on one end of a transverse shaft 94^a with a sprocket 94^b rotated by a chain belt 95 driven by a sprocket 96 on a shaft 74^r in lower rear portion of the secondary frame 13. A spur gear 73^r on the same shaft 74^r is driven by another spur gear 72^r on a transverse shaft 70^r in lower part of the same frame (see Fig. 2), the latter shaft 70^r having secured at its outer end a pulley 100 engaged by a belt 101 driven by a pulley 102 on the engine shaft 36.

The rotation of rock shaft 87 and its eccentrics causes the claw member, which consists

of a row of claws across the frame, to make forwardly and upwardly lunging motions with the claws coming close enough to the lower surface of the plank to catch and engage any and all nails protruding downwardly therefrom and extract them by a powerful downward movement of the claw member caused by the continued downward rotation of the eccentrics 89 on shaft 87.

The process and parts so far described includes only the removal of nails having their heads down, but to get other nails, as 55ˣ in Fig. 7, and having their heads in or near the upper surface of the plank the same mechanism is duplicated in inverted position to the rear of those already described, the planks merely proceeding rearwardly and emerging from the rear end of the machine cleared of nails. I have designated all parts of the latter nail removing device having counterparts in the first nail removing means with like numerals and the exponent "r" in each case.

A shaft 105, rotating in bearings 106 on the side of the secondary frame channel 13 has a bevel pinion 107 engaging a bevel gear 108 on the shaft 31 of the initial feed roller 26. Said shaft has an intermediate bevel pinion 107^a and a similar pinion 107^b at its rear end for driving the bevel gears 108 which in turn rotates the rear feed rollers 26^c and 26^d by means (not shown) similar to those which rotate the initial feed rollers 26—26^a.

The construction and operation of my invention have now been disclosed but variations or modifications in various parts thereof will probably be necessary to the perfection of it, without however departing from the spirit and scope of the invention.

What I claim is:

1. In a device of the class described, a rigid elongated frame and a secondary vertically adjustable frame below the rigid frame, means within said frames for moving a number of planks longitudinally between them and means for removing protruding nails from the planks during the movement of the same.

2. The structure specified in claim 1, and means for holding the secondary frame in spaced parallel relation to the rigid frame according to the thickness of planks from which nails are to be removed.

3. The structure specified in claim 1, said plank moving means comprising pairs of corrugated, transversely arranged feed rollers mounted in spaced relation vertically, for each pair one in each frame, and all rotated with uniform speed and in a direction to move the planks rearwardly.

4. The structure specified in claim 1 in which the nail removing means successively remove the nails from one side of the planks and then from the other side thereof.

5. The structure specified in claim 4, the nail removing means for each side of the planks comprising successively transversely reciprocable means for turning the pointed nail ends forwardly and rearwardly in approximately longitudinal direction of the travel of the plank, means comprising a transversely arranged spirally corrugated roller for turning said nail ends all in one general direction rearwardly, means rearward of the drum for straightening said nail ends to vertical position, means impelling said vertically straightened nail ends towards the surface of the plank and simultaneously bringing the heads of the nails away from the opposite surface of the plank and means engaging said headed end of each nail for extracting them from the plank.

6. The structure specified in claim 5, said transversely arranged nail straightening means comprising a vertically disposed blade with alternately forwardly and rearwardly pointed teeth in its lower edge and adjacent the surface of the plank to engage pointed nail ends to turn them in a generally forward or rearward direction while the plank is passing said reciprocating toothed blade.

7. The structure specified in claim 5, said drum arranged rearwardly of the reciprocating blade and having spirally arranged ridges comprising rows of closely set projections each resembling a frustum of a pyramid and said spiral ridges adapted to engage the nail ends and turn them all in a rearwardly directed position with their points.

8. The structure specified in claim 5, said nail straightening means rearward of the drum comprising a series of stationary spaced plates each with a sloping face terminating adjacent the surface of the plank and engaged by one of the pointed nail ends and tending to raise said nail end while the plank is moving rearwardly a reciprocating guided plunger sliding on said sloping surface its forward face vertical and adapted to contact with the nail to straighter the nail vertically.

9. The structure specified in claim 8, and a series of vertically disposed spaced plungers reciprocating vertically and adapted to contact with the ends of the vertically straightened nails to drive the latter partly out of the plank.

10. The structure specified in claim 5, said means for extracting the nails by their headed ends comprising a transversely arranged shaft in the frame, eccentrics keyed on said shaft, a transversely arranged blade having its forwardly directed edge provided with a row of claws and having also sleeves engaging said eccentrics, said claws normally adjacent the surface of the plank, rearwardly extended lugs on said blade each operative-

ly connected with a rotating wheel to give the blade a rocking motion and said eccentrics giving the blade a lunging motion with its claw edge toward the surface of the plank thence away from said surface to extract all nails with their heads projecting therefrom.

11. The structure specified in claim 9, and vertically disposed spacers between the plates having the sloping surfaces, for guiding the angular and vertically reciprocating plungers.

In testimony whereof I affix my signature.

WALLACE ELLIS.