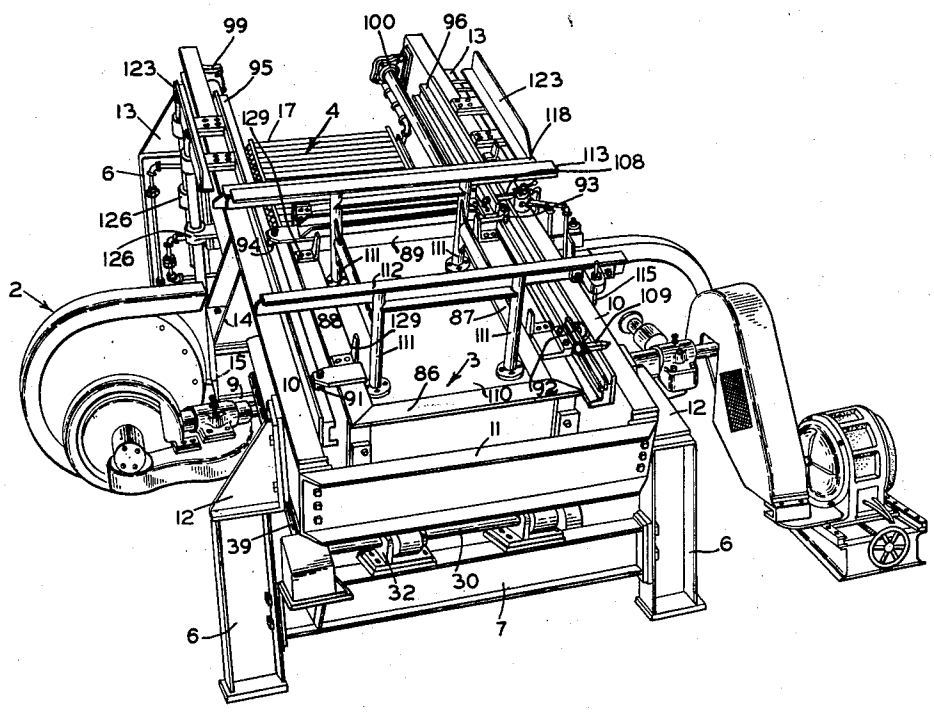
March 2, 1954 L. H. LOCKWOOD ET AL 2,670.771

AUTOMATIC SPLITTING MACHINE

Filed Aug. 30, 1949 6 Sheets-Sheet 1

Fig. 1



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Filed Aug. 30, 1949 6 Sheets-Sheet 2

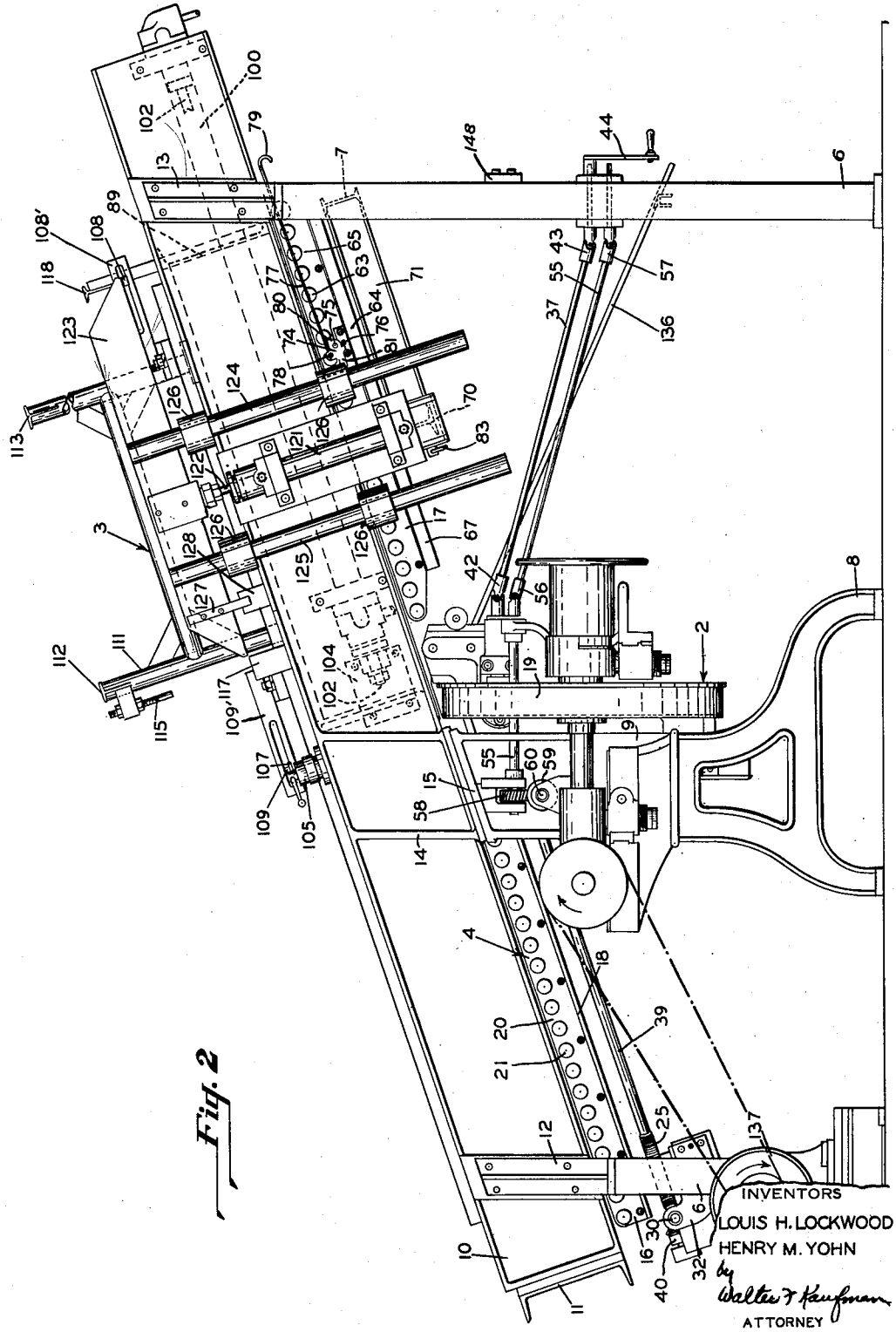

Fig. 2

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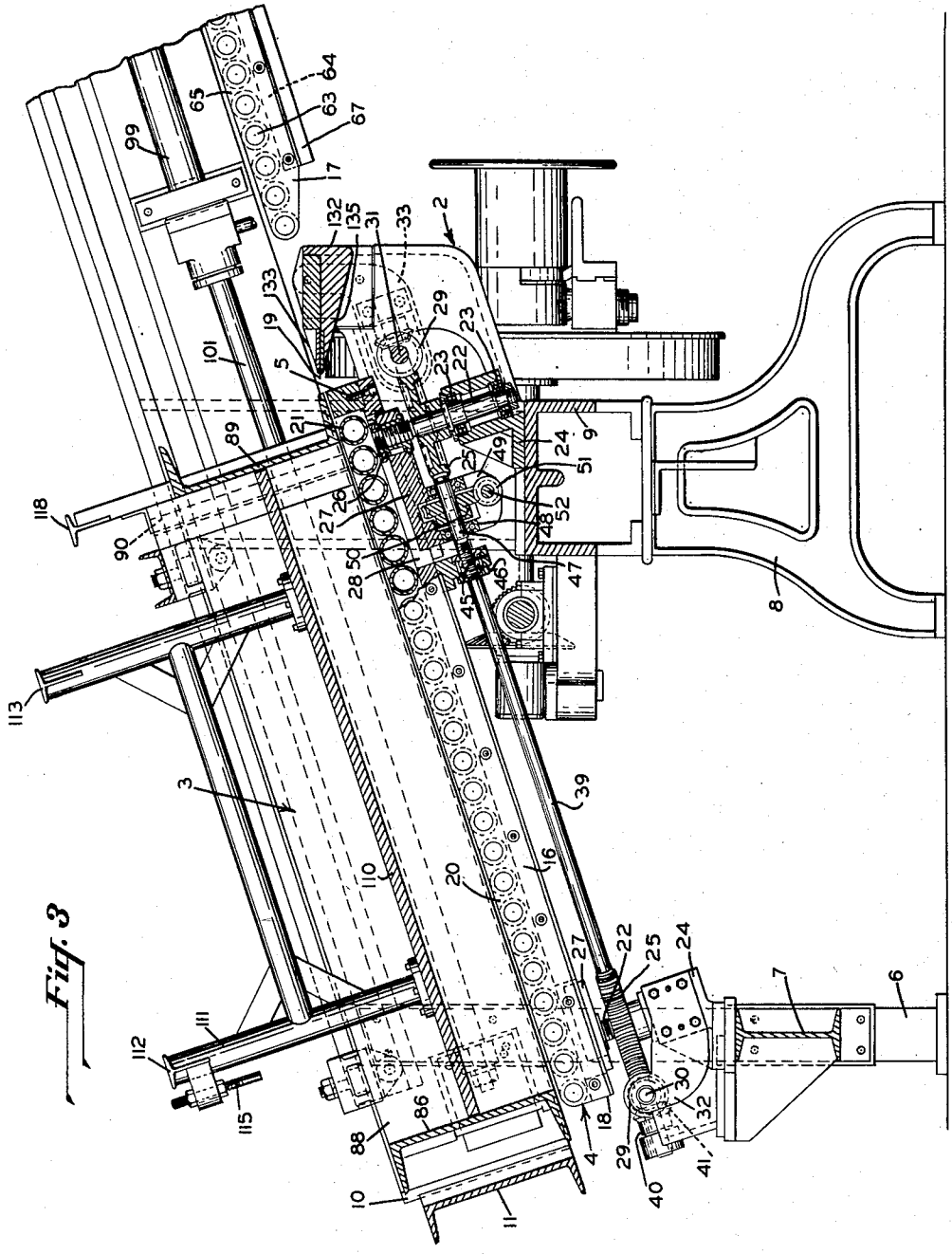

Fig. 3

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AUTOMATIC SPLITTING MACHINE

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Fig. 4

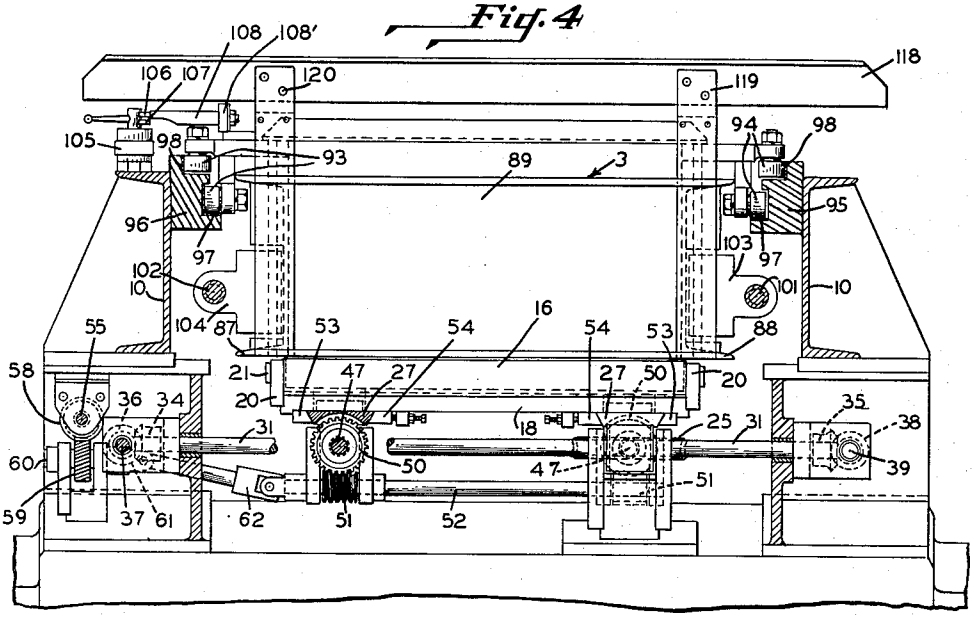
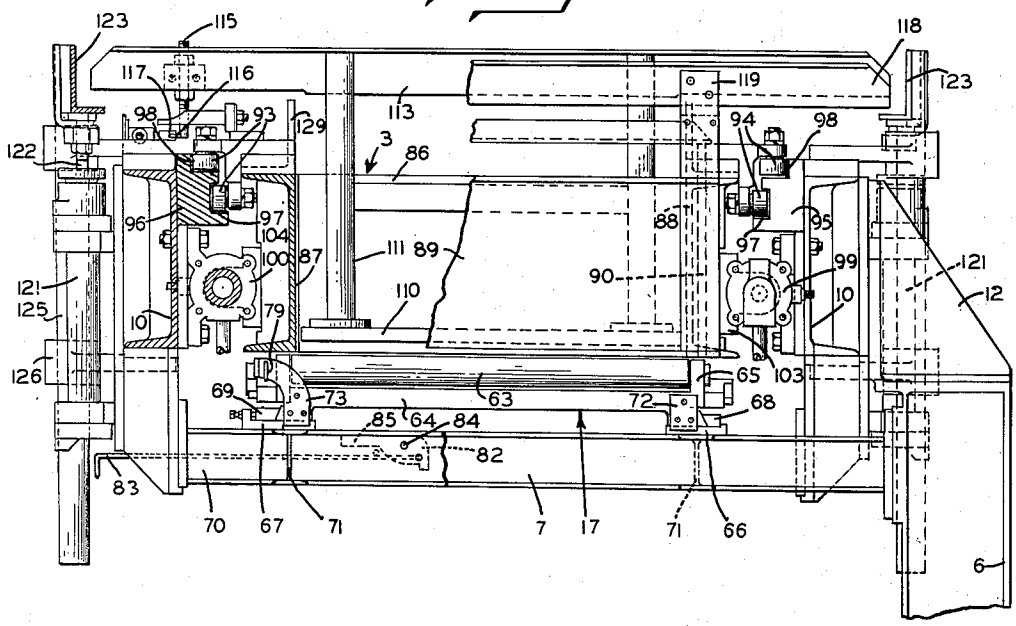


Fig. 5



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AUTOMATIC SPLITTING MACHINE

Filed Aug. 30, 1949 6 Sheets-Sheet 5

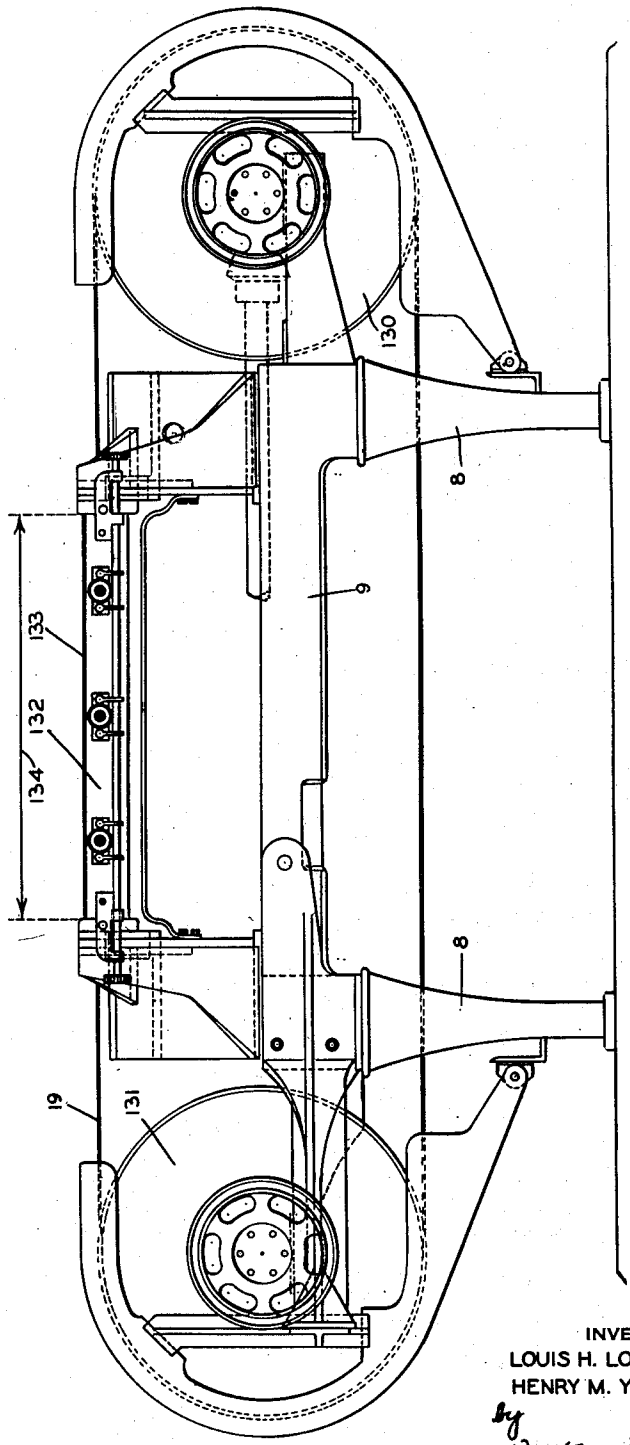

Fig. 6

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AUTOMATIC SPLITTING MACHINE

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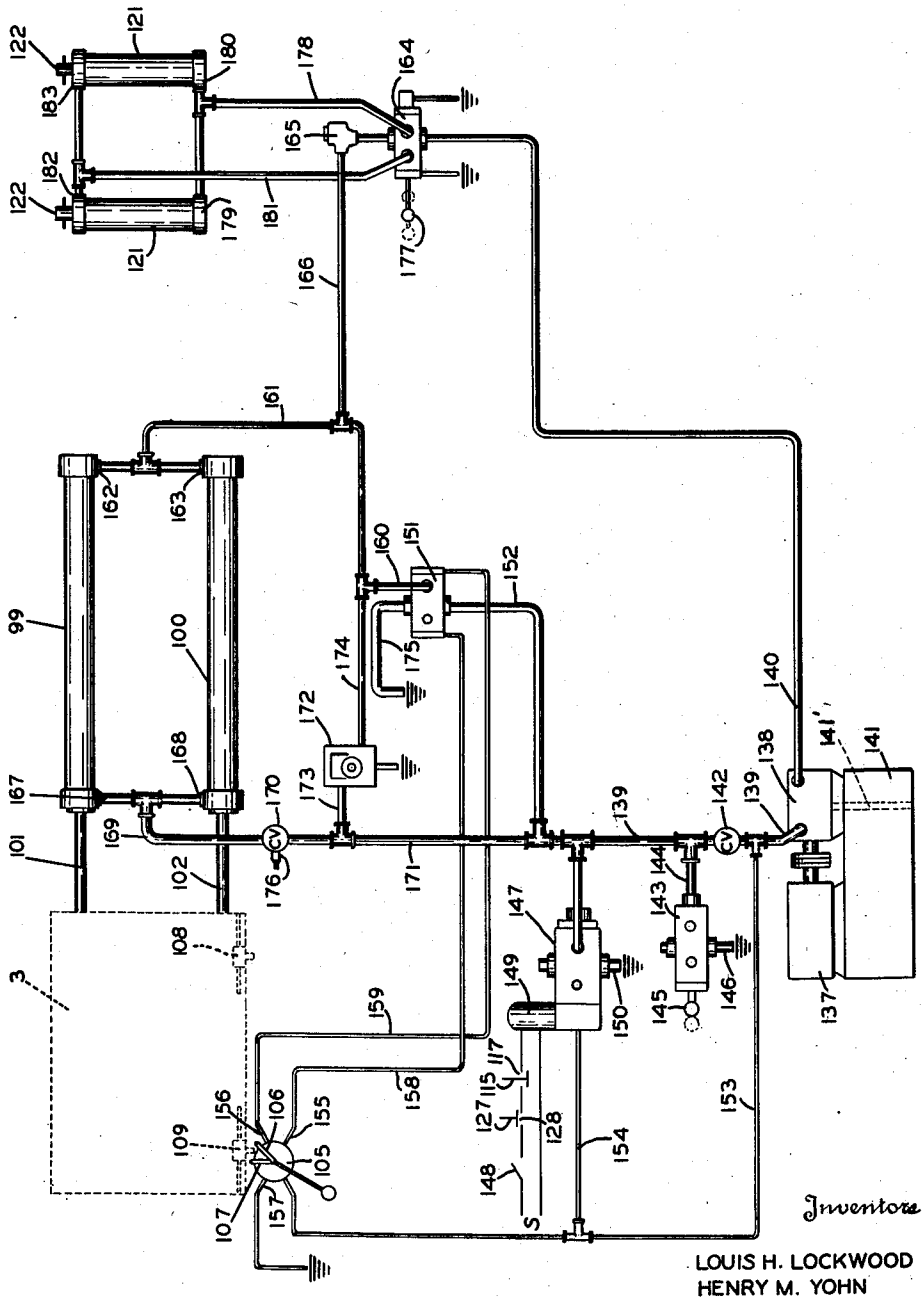
Fig. 7



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Patented Mar. 2, 1954 2,670,771

UNITED STATES PATENT OFFICE

2,670,771

AUTOMATIC SPLITTING MACHINE

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Application August 30, 1949, Serial No. 113,137

13 Claims. (Cl. 144—178)

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This invention relates to splitting machines. More particularly, it relates to splitting machines which automatically split sheets of predetermined thickness from a mat or block of cork composition or the like.

In the splitting of large mats of cork composition, the prior machines commonly employed use two horizontal rolls between which the block of composition is fed against the cutting edge of a moving endless band knife. In order to feed the material against the edge of the knife, the rolls have to exert considerable pressure on the block because of the small contact area that is developed. To improve the grip of the drive roll, it is common to score or corrugate the surface thereof. The other roll is the so-called gauge roll. The vertical distance between the gauge roll and the cutting edge of the knife determines the thickness of the sheet which is split from such a block by these prior machines. Sufficient horizontal clearance must be left between that cutting edge and the rolls at the nip to avoid jamming either the balance of the mat or the sheet being cut therefrom while the splitting operation is in progress.

There are a number of objections to the use of these prior machines. In operating each of them, at least two men have to be employed, one to feed the mat or block through the rolls and the other to catch the reduced mat and the sheet split off of it. The reduced mat must be manually returned to the feeding end of the machine to repeat the cycle. As the thickness of the mat decreases, the distance at the nip between the rolls has to be changed in order to maintain relatively even pressure on the block during the feeding operation. Otherwise, sheets of varying instead of uniform thickness may be obtained. The problem is intensified as the character of the material being split becomes of more compressible nature, a factor which also has to be taken into account in determining the correct pressure to be applied through the driving roll. Moreover, the size of the blocks of material which can be handled is limited not only by the character of these prior machines but also by the weight which the average worker in this field can conveniently handle.

In the new machine of this invention, the various foregoing difficulties are overcome. In the new machine which is automatic, an even pressure is applied over the block and higher rates of speed are obtained in the splitting operation. Moreover, the same block is even more quickly returned for the commencement of a new cutting

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stroke. No manual adjustment is required as the thickness of the block is sucessively decreased. Further, in the new machine the split sheets may be maintained to closer tolerance limits with respect to the predetermined thickness than those obtained with the prior machines. Still further, in the new machine the feeding of the block is always in the proper angular relation to the cutting edge of the knife and not subject to any human error. In addition, sheets of lesser thickness can be cut uniformly in the automatic machine of this invention than is the case with the use of prior machines, and any limitation on the size of the block of material to be split is only limited in this invention by the size of the new machine.

Other objects and advantages of this invention will be apparent from the following description and from the drawings, which are illustrative only, in which:

Figure 1 is a perspective view of a machine constructed in accordance with this invention;

Figure 2 is a view in side elevation of the machine of Figure 1 to an enlarged scale;

Figure 3 is a view in side elevation, partially in section, of the rear portion of the machine to a scale larger than Figure 2;

Figure 4 is a view in front elevation of the machine, partially in section, showing essentially a carriage mechanism which conveys the mat to be split;

Figure 5 is a view in front elevation of the upper front part of the machine shown in Figures 1 and 2 with a portion of the carriage mechanism broken away to show details of the machine;

Figure 6 is a view in elevation of the rear of the splitting knife mechanism of the machine; and

Figure 7 is a schematic diagram of a hydraulic system for operating the carriage mechanism and pressure plate and end gate lifting mechanism of the machine.

General construction

A preferred embodiment of the invention is shown in the drawings. The machine includes a band knife severing mechanism 2, a reciprocating carriage 3 which moves the material to be severed into cooperative relationship with the band knife severing mechanism and returns the material to its original position for severance of another sheet upon each complete cycle of reciprocation of the carriage, an antifriction supporting table 4 over which the material is moved by the car-

riage, and a gauge bar arrangement 5, the table 4 and gauge bar 5 being adjustable with respect to the band knife in order to vary the thickness of the sheet which is severed. The general arrangement is shown in Figure 1, and the gauge bar is best seen in Figure 3.

The machine is mounted upon a framework which comprises vertical columns 6 disposed at the four corners of the machine as shown in Figures 1 and 2. The columns 6 are connected together by horizontal cross girders 7, one at the rear of the machine as shown in Figure 1 and one at the front of the machine as shown in Figure 2.

The band knife severing mechanism 2 is mounted upon a pair of pedestals 8 disposed on opposite sides of the machine as best shown in Figure 6. The pedestals 8 are connected together by a cross member 9.

The reciprocating carriage mechanism 3 is mounted for reciprocatory movement within a framework made up of inclined longitudinal girders 10 connected at the rear of the machine by a cross girder 11 as shown in Figure 1. The longitudinal girders 10 are supported by rear brackets 12 mounted on the vertical columns 6 and corresponding front brackets 13 mounted on the front pair of vertical columns 6. The midportions of the longitudinal girders 10 are supported by brackets 14 mounted on vertical posts 15 supported by the cross member 9. This provides a solid, massive frame structure.

Inclined antifriction supporting table and gauge bar

The inclined antifriction supporting table 4 over which the mat of material to be severed travels is made up of two sections as shown in Figure 3, the rear section being indicated at 16 and the front section, disposed beyond the band knife severing mechanism 2, being indicated at 17. The rear section 16 supports that portion of the mat which is about to be severed and carries the gauge bar 5 which supports the mat adjacent the line of severance, its position with respect to the cutting edge of the band knife determining the thickness of the sheet which is severed. The gauge bar 5 is shown at zero setting in Figure 3. The front section 17 supports the mat as it leaves the zone of the band knife severing mechanism. It is normally fixed with respect to the band knife and needs no adjustment. The supporting table is inclined and is disposed below the reciprocating carriage 3 within the framework 10—11 and, as its name implies, constitutes an antifriction table over which the carriage 3 reciprocates carrying the mat to be severed back and forth with respect to the cutting knife.

The rear table section 16 which carries the gauge bar 5 is mounted independently of the carriage framework 10—11 and is adjustable in a direction perpendicular (at right angles) to the plane of movement of the carriage 3 thus to vary the position of the table and the gauge bar with respect to the cutting edge of the band knife and thus to vary the thickness of the sheet which is severed from the mat. The rear table 16 is also adjustable along the direction of travel of the carriage to vary the longitudinal clearance between the gauge bar and band knife.

The rear table section 16 is shown in Figures 3 and 4. It is formed of a base plate 18 which extends across the machine and is of a length to extend from a position adjacent the cross member 11 to a position adjacent band knife 19 of the band knife severing mechanism 2. Journal plates 20 are secured to the base plate 18 on opposite sides thereof and a plurality of rollers 21 are mounted for free rotation in the journal plates 20, the rollers 21 extending across the width of the table. They are closely spaced so as to provide a substantially continuous rolling support for the mat to be severed. The rollers 21 support the mat in a position parallel to the upper surface of the gauge bar 5 which, as shown in Figure 3, is attached to the base plate 18 at the forward end thereof, closely adjacent to the cutting edge of the band knife 19.

Mechanism is provided by which adjustment may be simply but accurately effected to vary the position of the rear table section 16 and its associated gauge block assembly 5 with respect to the band knife 19 in both directions parallel to the direction of travel of the carriage 3 and perpendicular thereto.

Adjustment in a direction perpendicular to the direction of travel of the carriage is accomplished by supporting base plate 18 at its four corners on adjustable mounting posts 22, two of which are shown in Figure 3. The forward mounting post 22 shown in Figure 3 is typical of all of the posts, and reference will be made to it in the description which follows. Mounting post 22 is journalled in bearings 23 fitted into a bracket 24 secured to the cross support 9. A worm wheel 25 is keyed to the mounting post 22 and the upper end of the mounting post is threaded into a bushing 26 received within a mounting plate 27 which slidably supports the base plate 18, an opening 28 being provided in the base plate to permit limited sliding movement of the whole of the rear table section 16 in a direction parallel to the direction of movement of the carriage 3, regardless of the position of perpendicular adjustment of the table section 16, as will be more fully hereinafter described. This permits the operator to adjust the elevation of the rear table section and gauge bar for the desired thickness of sheet to be severed and to adjust the longitudinal position of the gauge bar with respect to the cutting edge of the band knife. In splitting a cork composition mat, for example, the gauge bar may be positioned closer to the cutting edge of the band knife in a longitudinal direction when thin sheets are being split than when thicker sheets are being cut. When elevation of the rear table section 16 is effected to split a thicker sheet, it will be found desirable to retract the rear table section 16 rearwardly away from the cutting edge of the band knife to provide a greater space between the gauge bar and knife edge. The two should be kept as close together as possible to provide the best possible support for the mat as it is severed.

Upon rotation of the mounting posts 22 in their respective threaded bushings 26, the rear table section 16 will be raised or lowered in a direction perpendicular to the direction of movement of the carriage. To effect such motion uniformly, the worm wheels 25 for each of the four mounting posts 22 are connected in such manner that they are rotated in unison. Each worm wheel 25 is provided with a worm 29, there being two worms for the lower end and two for the upper end of the rear table section 16 of the table 4, one for each of the mounting posts. The lower end worms 29 are keyed to a cross shaft 30 and the upper end worms 29 are keyed to a cross shaft 31, these shafts being journalled in

brackets 32 and 33 respectively. In order to impart a simultaneous and uniform rotation to the cross shafts 30 and 31, shaft 31 is provided adjacent each of its ends with beveled gears 34 and 35 which are shown in Figure 4. Gear 34 meshes with a bevel gear 36 attached to an operating shaft 37, and gear 35 meshes with a bevel gear 38 attached to a jack shaft 39 extending lengthwise of the machine, shown in Figure 3, connecting cross shafts 30 and 31 by a bevel gear 40 attached to its lower end. This gear 40 meshes with a bevel gear 41 attached to shaft 30. The operating shaft 37 extends to the front of the machine as shown in Figure 2, being connected through universal joints 42 and 43. A crank 44 is provided for rotation of the shaft 37. Upon rotation of shaft 37 coincidental rotation is effected in each of the mounting posts 22. As the mounting posts rotate in their threaded bushings, the rear table section 16 and gauge bar 5 are raised or lowered in a direction perpendicular to the direction of travel of the carriage 3.

In order to provide for adjustment of the rear table section 16 and the gauge bar 5 along a direction parallel to the direction of movement of the carriage 3 to adjust the clearance between the gauge bar 5 and the band knife 19, as discussed above, the following mechanism is provided, shown in Figures 3 and 4. Referring first to Figure 3, a pair of mounting brackets 45 (one being shown in Figure 3) are secured to the base plate 18 adjacent to each side thereof and depend therebelow. Each of these brackets carries a threaded bushing 46 which is fixed to the bracket 45. Each bushing 46 receives the threaded end of a shaft 47 which is mounted in bearings 48 provided in a bracket 49 secured to mounting plates 27 for the adjustable mounting posts previously described. In order to impart motion to shafts 47 each has keyed to it a worm wheel 50 which meshes with a cooperating worm 51 keyed to a cross shaft 52 extending across the machine. Upon rotation of the cross shaft 52 the worms 51 rotate the worm wheels 50 and impart rotary motion to the shafts 47 causing the bushings 46 to travel along the threaded portions of their operating shafts 47 and thus moving the rear table section 16 in a direction along the axis of the shafts 47 and parallel to the path of movement of the carriage 3. In order to provide for smooth and accurate movement of the section 16, each mounting plate 27 is received within gibs 53 and 54, the latter gib being adjustable in a conventional manner. The gibs 53 and 54 are attached to the base plate 18 and guide its movement along the mounting plates 27. Similar gibs are provided for the lower pair of mounting plates 27, four of which mounting plates are provided for the table section 16, as previously described.

Convenient rotation of cross shaft 52 from the front of the machine, as shown in Figure 2, is provided by an operating shaft 55 which is connected through universal joints 56 and 57 to a spiral gear 58 which is keyed to operating shaft 55. This spiral gear operates in mesh with a similar gear 59 keyed to an extension 60 of cross shaft 52. The shaft section 60 is connected to the cross shaft 52 through universal joints 61 and 62. The crank 44 which is used to rotate operating shaft 37 of the table-elevating mechanism may be used to rotate operating shaft 55.

Thus it will be seen that upon rotation of the crank 44 connected to operating shaft 55 simultaneous rotation will be imparted to the worms 51, rotating the worm wheels 50 attached to shafts 47; and upon such rotation of shafts 47, the table section 16 will slide in the gibs 53 and 54 moving along the direction of travel of the carriage 3 to bring the gauge bar 5 into proper longitudinally adjusted position with respect to the cutting edge of the band knife 19.

The front section 17 of the supporting table is similar in construction to the rear section 16. It consists principally of a series of rollers 63 which are mounted on a base plate 64 in journal plates 65 which are disposed in spaced relationship on opposite sides of the base plate. The front section 17 is normally disposed in the position shown in Figure 2, but in order to permit the upper section to be moved away from the cutting knife assembly to permit the operator to make adjustment on the knife guiding jaws, the upper section is made movable from the position shown in Figure 3 to an advanced position away from the band knife severing mechanism. The base plate 64 of the upper section 17 is constructed so as to slide in ways 66 and 67, guided by gibs 68 and 69 of which gib 69 is adjustable. This is clearly illustrated in Figures 2 and 5, the gibs and ways being shown particularly in the latter figure. The ways 66 and 67 are supported by cross girder 7 at the front of the machine, and another cross girder 70 is disposed to the rear thereof and connected to the cross girder 7 by connecting girders 71. The ways 66 and 67 are inclined as seen in Figure 2 and are disposed parallel to the path of travel of the carriage 3. The front table section 17 is held in its normal position as shown in Figure 3 by a pair of stops 72 and 73 which, as shown in Figure 5, are attached to the base plate 64 and depend therebelow, engaging the ends of the ways 66 and 67 and arresting movement of the front table section 17 toward the band knife assembly.

Forward movement of the carriage 3 may be employed to slide the front table section 17 to its inoperative position. Referring again to Figures 2 and 5, there is shown on the front table section 17 a dog 74 attached to the journal plate 65 and pivoted at 75. A stop 76 is attached to the journal plate 65 and limits movement of the dog 74 about its pivot 75. An actuating rod 77 is pivoted to the dog 74 at point 78, and the rod extends to the front of the machine where it terminates in a handle 79, shown in Figure 2, for convenient grasp by the machine operator. The dog 74 is shown in inoperative position in Figure 2. In moving the front table section 17 by the carriage 3, the operator pulls handle 79 outwardly, thus rotating the dog 74 about its pivot 75 until stop 76 is engaged by a projecting ear 80 of the dog. This brings finger 81 of the dog 74 into the path of movement of carriage 3 as it moves from its lower position shown in Figure 3 to its upper position shown in Figure 2. Thus when the dog 74 is so actuated, the carriage 3 will move the upper table section 17 along its ways. In order to hold the upper table section in its inoperative position and permit the return of the carriage 3 to the position shown in Figure 3 so that the operator may work in the cleared area about the band knife, a pivoted latch 82 which is similar to the dog 74 is provided on the front frame member 70 as shown in Figure 5. An actuating rod terminating in a handle 83 extends to the side of the machine. The latch is shown in inoperative position in Figure 5. When the handle 83 is pulled out by

the machine operator, the latch 82 is rotated about pivot 84 which brings a finger 85 of the latch 82 into a position above the lower surface of the base plate 64 of the table section 17 and thus the latch arrests any movement of the upper table section from its inoperative position until the latch is released, but the latch will not prevent movement of the carriage 3, which may be returned to its lower position as shown in Figure 3, and the operator will have access to the band knife severing mechanism.

As shown in Figure 3 the gauge bar 5 is preferably rectangular in section and extends across the full width of the table to fully support the material as it is fed to the knife 19. The bar is relatively narrow, and thus there is very little frictional drag as the mat moves over it. It is of sufficient width, however, to fully support the mat. The gauge bar will lie with its upper edge parallel with the upper, generally horizontal run of the band knife but in a plane therebelow, the distance between the upper surface of the gauge bar and the cutting edge of the band knife in its horizontal run determining the thickness of the sheet which is severed.

The reciprocating carriage

The carriage 3 receives the mat to be sliced and feeds it to the band knife. The mat is pressed firmly against the table and particularly the gauge bar to insure a true cut and a severed sheet of uniform thickness.

The carriage is in the form of a rectangular box open at the bottom and provided at the top with a removable closure which presses the mat disposed within the carriage against the table and gauge bar. The front wall of the carriage is in the nature of a gate which may be elevated, and the mat to be sliced may be inserted through the opening provided when the gate is lifted. The carriage is reciprocated over the table, and a sheet is severed on each stroke of the carriage.

Referring to Figures 1 to 5 which illustrate the carriage 3, it is fabricated from channels and includes a rear channel 86 and two side channels 87 and 88. A front channel gate 89 is provided which is arranged to slide in guides 90 on the side channels 87 and 88 as indicated in Figure 3. This permits the gate 89 to be elevated for feeding of the machine and discharge of the thin scrap portion of the mat which remains at the completion of slicing of each mat.

Referring now to Figures 1 and 4, the carriage 3 is mounted on four pairs of rollers 91, 92, 93, and 94, one pair being provided on each corner of the carriage and each pair being carried by supporting brackets attached to the carriage. Tracks 95 and 96 are welded to the longitudinally inclined frame members 10. The tracks are provided with one rail 97 and a second rail 98 upon which ride the rollers 91—94 as will be seen in Figure 4. The tracks 95 and 96 extend over the table 4 and are parallel with it. By having two rails on the tracks as shown, the carriage will follow a true course without lateral sway.

The carriage is reciprocated by a pair of hydraulic rams 99 and 100 (Figure 1) connected to the side frames 10. The rams include pistons and piston rods 101 and 102 (Figure 4) which are connected to the carriage 3 by brackets 103 and 104 secured on opposite sides of the carriage. Upon the forward stroke of the pistons, the carriage is moved along the tracks 95 and 96 to the position shown in Figure 2; and upon the rearward stroke of the pistons, the carriage is returned along the tracks to the position shown in Figure 3.

The action of the rams 99 and 100 is controlled by actuation of a control valve 105 mounted on side frame 10 as shown in Figure 4. The valve has an upper actuating finger 106 and a lower actuating finger 107. The carriage has trippers 108 and 109 mounted adjustably in brackets 108' and 109', the forward tripper 108 being engageable with finger 106 and the rear tripper 109 being engageable with finger 107. The tripper 108 rotates the control valve 105 to cause the hydraulic rams 99 and 100 to force the pistons 101 and 102 forwardly to move the carriage through its cutting stroke; and, upon completion of that stroke, the tripper 109 reverses the valve causing the hydraulic rams 99 and 100 to force the pistons 101 and 102 rearwardly, effecting the return stroke of the carriage. The adjustable trippers 108 and 109 provide for adjustment of the positions at which the direction of travel of the carriage is reversed. This will depend upon the length of the mat being split into sheets. The operation of the hydraulic system will be more fully hereinafter described.

A pressure plate 110 is slidable within the carriage frame 86—89 and applies sufficient weight to the mat to be split to hold it firmly in engagement with the table 4 and gauge bar 5 during splitting. The plate 110 carries four posts 111 adjacent to its corners, these posts being connected together and braced as shown in Figure 1. The posts have mounted on them a pair of cross bars 112 and 113 by which the plate may be elevated to facilitate charging and discharging of the carriage. The pressure plate 110 carries a switch control arm or trip 115 which is mounted on cross bar 112. The switch control arm, which is adjustable as shown in Figure 2, is positioned so as to engage roller 116 of a normally closed microswitch 117 as the carriage moves to its forward position after having severed the final slice from the mat. The microswitch 117 is thus opened and prevents further movement of the carriage in either direction, as will be described in connection with the description of the hydraulic system which operates the carriage. The pressure plate 110 is shown in an elevated position in Figure 3 and in a lowered position in Figure 5 with the switch control arm 115 in engagement with the roller 116 of microswitch 117.

The pressure exerted by plate 110 on a block of material in carriage 3 is even over the entire surface of the block. Moreover, the squared end of such a block which is rectangular in character abuts against the inside of rear channel 86 so that at all times the block approaches the splitting knife 19 squarely and under a uniform feeding pressure.

Gate 89 is provided with a cross bar 118 by which it may be raised and lowered. Elevation is preferably effected simultaneously with raising of the pressure plate 110 to permit removal of the thin portion of the mat which remains at the completion of slicing of each mat and insertion of a new mat for splitting. The cross bar 118 is mounted on uprights 119 and 120 attached to gate 89 (Figure 4).

Elevation of the pressure plate 110 and the end gate 89 is effected through a pair of hydraulic rams 121 mounted on the side frames 10, one on each side of the machine near the front end, one being seen in Figure 2, and the one on the opposite side of the machine being similar in construction. Therefore, only one will be de-

scribed. The piston rod 122 of the ram 121 has mounted upon it a lifting angle 123 which extends along the table of the machine a distance sufficient to receive the lateral ends of the cross bars 112 and 113 of the pressure plate 110 and the cross bar 118 of the end gate 89 when the carriage 3 is at the end of its forward stroke. Guide bars 124 and 125 are welded to the lifting angles 123 and slide in pairs of bearings 126 attached to the side frame member 10.

The rams 121 are actuated upon completion of the severance of each block; and, upon upward movement of the piston rods 122, angles 123 on opposite sides of the machine engage the cross bars 112 and 113 of the pressure plate 110 and the cross bar 118 of the end gate 89 and lift them, thus opening the end gate and elevating the pressure plate. The mat scrap is removed and a new mat is inserted. The pistons are reversed and the lifting angles are lowered, bringing the pressure plate 110 into engagement with the top of the mat to be severed and closing the end gate. As will be seen by reference to Figure 5 the lifting angles 123 will normally lie below the cross bars on the pressure plate and end gate when the pistons of the rams 121 are in lowered position, even though the pressure plate be in its lowermost position and the end gate fully closed, permitting ample clearance for the carriage in its travel back and forth over the table during sheet splitting.

A safety trip 127 is carried by lifting angle 123 as shown in Figure 2 and actuates a normally open switch 128 which must be closed before movement of the carriage can be effected. The lifting mechanism must be in its lowered position, clear of the carriage, before the switch will be so closed. This switch is also connected into the electrical control of the hydraulic system and its functioning will be further described.

Safety stops 129 are mounted on the carriage side members 87 and 88 in the path of downward movement of the cross bars 112 and 113 (see Figure 1) and serve to limit such downward movement to prevent the pressure plate 110 from extending below the bottom of the carriage where it might come into contact with the cutting knife. Figure 5 shows the relative positions of stop 129 and cross bar 113 with plate 110 adjacent its lowermost position.

The band knife severing mechanism

This assembly may be of the generally conventional type as shown in Figure 6 including a pair of pulleys 130—131 over which band knife 19 is trained. The knife 19 is guided in its upper horizontal run by an adjustable guide 132, the upper surface 133 of which (Figure 3) is inclined at the same angle as the table 4 and particularly the upper surface of the gauge bar 5. Thus the surface 133 lies in a plane substantially parallel to the plane of the upper surface of gauge bar 5 and substantially in the plane of the splitting edge of knife 19 and of the bearing surface of front table section or bed 17. The knife is guided at least throughout the extent of the width of the mat to be severed as indicated by the dotted lines 134 in Figure 6. This insures that the knife will run along a straight path as it severs each sheet from the mat. The work-engaging cutter guide is more fully illustrated and described in the copending application of Henry M. Yohn, one of the present inventors, Serial No. 123,663, filed October 26, 1949. With a cork composition mat in the form of a rectangular block 6" thick by 28" x 50", the guided portion of the knife will be at least 28" and preferably 30" from edge to edge, as indicated at 134. The lower surface 135 of the guide is inclined as shown in Figure 3 and provides clearance for the sliced sheet to pass below onto an inclined platform 136, shown in Figure 2. The sheets slide down this platform and may be deposited into a tote box or onto a conveyor for inspection and packing or further fabrication. The platform is removable to permit access to the band knife assembly when the front table section 17 is moved forward.

Figure 2 shows a motor 137 which drives the band knife through conventional driving connections.

The hydraulic system

A schematic hydraulic system layout for the carriage reciprocating mechanism and the hold-down plate and end gate lifting mechanism is shown in Figure 7. The system includes a constant speed motor 137 connected to a double-acting hydraulic pump 138 including two feed lines 139 and 140, the line 139 being fed at a higher pressure than line 140. A supply tank 141 has been diagrammatically illustrated and is connected to a suction line 141' to the pump. In the diagram the return lines to the tank 141 have been indicated by the conventional symbol; in actual construction the return of exhausted hydraulic fluid will be to the tank 141.

In the piping diagram of Figure 7 the hydraulic rams 99 and 100 of the carriage reciprocating mechanism and the hydraulic rams 121 of the lifting mechanism have been shown conventionally. The reversing valve 105 and its operating fingers and the actuating trippers 108 and 109 have been shown similarly.

The main feed line 139 from the pump 138 includes a check valve 142. The supply of fluid from main feed line 139 is controlled by a manually operated valve 143 which is connected to the main feed line 139 by a branch line 144. An operating control handle 145 is provided which, in the solid line position, closes the valve 143 to the return to tank 141 through line 146. When the control handle 145 is in the dotted line position, the line 146 to the tank is opened and hydraulic fluid from the pump 138 fed through line 139 is by-passed and returned directly to the tank 141. With the control handle 145 in solid line position, hydraulic fluid will flow through the line 139 to an automatic stop valve 147 which is connected electrically with the control mechanism for the operation of the machine, including the switch 117 actuated by its tripper 115 on the hold-down plate 110, switch 128 actuated by its tripper 127 on the elevating mechanism for the hold-down plate and end gate, and a manual push button starting switch 148 at the front of the machine as shown in Figure 2. Automatic stop valve 147 includes a solenoid 149 which is normally de-energized and in such position renders the valve 147 operative to return hydraulic fluid directly to the tank 141 through line 150. Upon energization of the solenoid 149 from a source of current S, which will occur only if the manual push button switch 148 is closed by the operator, normally open switch 128 is closed by proper lowering of the elevating mechanism for the hold-down plate and end gate, and normally closed switch 117 is held in closed position by proper elevation of the hold-down plate; valve 147 will be closed and hydraulic fluid then will flow through line 139 (being blocked to return

lines 146 and 150 by valves 143 and 147) to a three-way valve 151 through line 152. This valve 151 is controlled by the reversing control valve 105. The valve 105 receives its hydraulic pressure from the pump 138 through a control line 153.

A branch line 154 is connected to line 153 and is effective for applying hydraulic pressure against the actuating spring of control valve 147. Thus the solenoid 149 works against the control line pressure, and when energized, pressure in line 154 moves valve 147 from its normal position where it connects return line 150 to tank 141 to supply line 139 for the by-passing of hydraulic fluid to a position where fluid flows from line 139 to control valve 151.

Reversing control valve 105 includes ports 155 and 156 and a return port 157. Port 155 is connected by line 158 to one side of three-way valve 151 and port 156 is connected by line 159 to the opposite side of the valve 151. When the reversing valve is in the position shown in Figure 7, the cutting stroke has been completed and the pistons 101 and 102 of the hydraulic rams 99 and 100 which have moved the carriage 3 to its forward position are about to be moved to the left in Figure 7 to return the carriage 3 to its rear position for the next cutting stroke. In this position of the reversing control valve 105, hydraulic fluid from the source 141 is fed by the pump 138 through the line 153 and through the valve 105 to the line 156. This positions valve 151 so that hydraulic fluid from the lines 139 and 152 passes through lines 160—161 into the ports 162 and 163 of the hydraulic rams 99 and 100.

In order to accelerate the return stroke of the carriage, we provide an arrangement for feeding a large volume of hydraulic fluid to the pistons 101—102. This arrangement is shown in Figure 7 and includes the feed line 140 which is controlled by manual control valve 164 which, when in the neutral position which is shown in solid lines, permits the flow of hydraulic fluid through check valve 165 and into line 166 which is interconnected with the line 161. Thus additional volume of hydraulic fluid is supplied in this manner to accelerate the return of the carriage. In addition, as the pistons are moved to the left in rams 99 and 100, the hydraulic fluid exhausted through ports 167 and 168 is conveyed back by line 169 through a check valve 170 and line 171 interconnected with line 152. Thus still further quantities of hydraulic fluid are fed into the ports 162 and 163, still further accelerating the return stroke of the carriage 3.

When the carriage 3 moves to the left, the trip 108 will engage the finger 107, reversing the position of the control valve 105 and starting the cutting stroke of the machine in which the carriage is moved to the right as shown in Figure 7. This is effected in the following manner: Hydraulic fluid flowing through line 153 now passes through port 156 and line 159, reversing the position of valve 151 so that hydraulic fluid from the pump 138 is blocked both to the return to the tank 141 and feed line 160 but flows through line 171 and check valve 170 into line 169 and through ports 167 and 168 into the hydraulic rams 99 and 100, urging the pistons 101 and 102 to the right.

In order to regulate the speed of the cutting stroke there is provided a bleeder valve 172 which is effective for by-passing a portion of the hydraulic fluid flowing through line 171, the bleeder valve 172 being interconnected with line 171 by a line 173. The fluid bled through the bleeder valve 172 flows through a line 174 into line 160 and from there through valve 151 into line 175 back to the tank 141.

It will be noted from the foregoing description that during the return stroke of the rams 99 and 100 there is hydraulic fluid under pressure acting against the pistons 101 and 102, being fed through ports 167 and 168. There exists, however, a differential in pressure application to the pistons due to the presence of the piston rods on the lower side of the pistons which decrease the effective areas of the pistons on their lower sides.

In order to prevent the carriage 3 from drifting downwardly along its inclined ways, the check valve 170 is provided with an adjustable spring arrangement 176 which is effective for applying a back pressure against which the hydraulic fluid passing through the line 169 must act. The mechanism 176 is adjusted in order to maintain the carriage against backward sliding movement when at rest.

There is a differential pressure existing between the lines 139 and 140, for greater pressure is required on the cutting stroke of the carriage than on the return stroke, and in order to prevent feed-back from the pump through the line 139 and its connecting lines into the line 140 and its connecting line, the check valve 165 is provided.

To provide a constant minimum pressure in the control line 153, the check valve 142 is employed which insures that sufficient pressure is built up in the line 153 before pressure is developed in the line 139 beyond the check valve 142.

Considering now the mechanism for lifting the end gate 89 and the pressure plate mechanism including the plate 110, it will be observed by reference to Figure 7 that this operation is controlled by the manual valve 164. It is shown in neutral position in solid lines in Figure 7 where it controls the supply of fluid to the rams 99 and 100, in an elevating position for the rams 121 in dotted lines, and in lowering position for the rams 121 in chain lines. When the control handle 177 of the valve 164 is moved to the dotted line position, hydraulic fluid will flow from line 140, into valve 164, and through a line 178 into the ports 179—180 which will cause the pistons 122 of the hydraulic rams 121 to rise, thus elevating the mechanism which lifts the gate and moves the pressure plate 110 to a position where a new block can be inserted. When the elevating mechanism moves upwardly, tripper 127 will be moved away from switch 128 and it will open the circuit for solenoid valve 149 and the carriage cannot be moved so long as the switch remains open. Upon completion of the elevation and insertion of a new block, the control handle 177 may be moved to the chain line position shown in Figure 7; and, thereupon, the hydraulic fluid from the line 140 will pass through the valve 164, through a line 181, and into the ports 182 and 183 causing the pistons 122 of the rams 121 to move downwardly to their lowered position. Thereupon, the trip 127 will close switch 128 and the carriage may be put into operation.

From the foregoing it will be clear that in the operation of the machine the operator first elevates the end gate and the pressure plate mechanism, inserts the block or mat, lowers the pressure plate and end gate mechanism into position and then moves the control handle 177 to neu-

tral position. The operator then pushes switch 148 to close the circuit from source S to solenoid valve 149 which will be energized since switches 128 and 117 will be closed because the pressure plate will be in elevated position by engagement with the mat in the carriage and the elevating mechanism will be in its lowered position. Thereupon, the operator closes control valve 143 and brings the carriage to its rear position, ready to start the cutting cycle which is effected automatically upon engagement of the trip 108 with the finger 107 of control valve 105. The carriage is then reciprocated in an up-and-down manner along its inclined path until the switch 117 is actuated by the trip 115; whereupon, the solenoid 149 for the valve 147 is de-energized and the supply of hydraulic fluid to the reciprocating pistons 101 and 102 is discontinued, being bypassed through valve 147 to tank 141 through return line 150. Thereupon, the operator moves the control valve operating handle 177 to the elevating position; the end gate and pressure plate mechanism are elevated; and the entire operation is repeated. It is unnecessary, however, to actuate control valve 143 unless it is desired to shut down the machine and restart it later. Switch 148, however, is preferably of the type which automatically opens upon any break in the supply of current from source S and must be reset after each break in the current supply.

Although we have illustrated a preferred practice and embodiment of the machine of this invention, it will be understood that changes in the details and arrangements may be made without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. In a splitting machine, in combination, a reciprocating carriage adapted to move a block of material therewith, a bed along which said carriage travels while said block movably engages said bed, means for pressing said block against said bed during travel of said carriage, a moving knife positioned across said bed in the path of travel of said block and adapted to split a sheet of material from said block, means for driving said reciprocating carriage, and means controlled by said pressing means for stopping said carriage when said block has been reduced to a predetermined thickness, said means comprising a control device mounted upon said machine in the path of travel of an actuator for said control device carried by said pressing means.

2. In a splitting machine, in combination, a reciprocating carriage adapted to move a block of material therewith, a bed along which said carriage travels while said block movably engages said bed, means for pressing said block against said bed during travel of said carriage, means for adjusting the length and position of the feeding and return strokes of said carriage relative to said bed, means for automatically reversing the direction of travel of said carriage upon reaching the predetermined end of each stroke, a moving knife positioned across said bed in the path of travel of said block and adapted to split a sheet of material from said block, means for driving said reciprocating carriage, and means controlled by said pressing means for stopping said carriage when said block has been reduced to a predetermined thickness, said means comprising a control device mounted upon said machine in the path of travel of an actuator for said control device carried by said pressing means.

3. In a splitting machine, in combination, a reciprocating carriage having sides which substantially define an enclosure for a block of material, a bed positioned immediately beneath and parallel to the plane of movement of said carriage, said carriage adapted to cause said block to move over said bed in movable engagement therewith, a plate fitting into said enclosure and adapted to be moved by said carriage while pressing said block against said bed, an endless moving band knife positioned across said bed and projecting into the path of travel of said block, said knife being adapted to split sheets of predetermined thickness from said block on each feeding stroke of said carriage, means for lifting said plate to facilitate the removal of the remainder of said block when it has been reduced by such splitting to a predetermined thinness, a common hydraulic system for reciprocating said carriage and for actuating said means for lifting said plate, a normally open switch in said system, and a trip on said means for lifting said plate adapted to hold said switch closed except when said means for lifting said plate are actuated, whereby the reciprocation of said carriage is prevented during actuation of said plate-lifting means.

4. In a splitting machine, in combination, a carriage adapted to reciprocate in an inclined plane and to contain a block of cork composition or the like, said carriage being open on the underside thereof, a sectional supporting surface positioned adjacent said underside of said carriage and adapted to supportably engage said block during the movement thereof caused by said carriage, a moving endless band knife positioned between the sections of said supporting surface and across the path of travel of said block, said band knife having a cutting edge projecting a predetermined distance into said path of travel and adapted to cut a sheet of predetermined thickness from said block during each feeding stroke of said carriage, hydraulic rams for driving said carriage, a reversing hydraulic valve connected to said rams, trips adjacent the respective ends of said carriage for successively engaging said valve to reverse the direction of movement of said carriage, a pressure plate to maintain engagement between the underside of said block and said supporting surface, a trip attached to said pressure plate, and a switch actuated by said trip, said switch being adapted to interrupt the flow of hydraulic fluid to said hydraulic rams and stop said carriage at the end of its feeding stroke when said block is reduced to a desired thinness by the splitting of sheets therefrom.

5. In a splitting machine, the combination of a travelling band knife having a substantially straight run, an antifriction supporting table comprising a plurality of rollers which provide a bearing surface for supporting a block to be split and along which said block may be moved in a fixed plane of movement into severing relationship with said band knife, a gauge bar having an upper supporting surface in the plane of movement of said block over said supporting table, means for simultaneously moving said table and gauge bar with respect to said band knife in a direction perpendicular to said plane of movement of said block, said means comprising a table frame, mounting plates slidable in ways in said table frame, said ways being disposed to guide said table to move in a path substantially parallel to the plane of movement of said block, threaded openings being provided in said mounting plates, threaded mounting posts received within said threaded openings, means for simultaneously ro-

tating said mounting posts to uniformly move said table and gauge bar in a direction perpendicular to said plane of movement of said block, and means for sliding said table frame in said ways toward and away from said band knife.

6. In a splitting machine, the combination of a splitting knife, a table section for supporting a block to be split and along which said block may be moved in a fixed plane of movement into severing relationship with said splitting knife, a second table section for supporting said block in its travel in said plane of movement from severing relationship with said splitting knife, a carriage for receiving said block and for carrying the same over said table sections, means for mounting said second table section for movement along the plane of movement of said block, means engageable with said carriage and said second table section for moving said second table section with said carriage to separate said first and second table sections, and latching means for holding said second table section in separated position with respect to said first table section to provide access to said splitting knife disposed between said table sections.

7. In a splitting machine, the combination of a splitting knife, an inclined supporting table along which a block to be split may be moved in a fixed plane of movement into severing relationship with said splitting knife, a reciprocating carriage movable over said supporting table in an inclined path substantially parallel to said plane of movement of said block for carrying said block back and forth upon said table for the severance of sheets from the block by said splitting knife, and a hydraulic system for reciprocating said carriage, said system including a piston connected to said carriage and movable within a cylinder, lines connecting said cylinder with a source of fluid under pressure for moving said piston in said cylinder in opposite directions to reciprocate said carriage, a valve controlling the supply of fluid to said lines, means for holding said carriage against drifting down said incline comprising a loaded check valve in the line through which fluid is discharged from said cylinder upon movement of said piston in a direction to permit movement of said carriage down said incline, and means for delivering to said piston fluid under a pressure which will overcome the loading of said check valve and move said carriage down said incline.

8. In a splitting machine, the combination of a splitting knife, a supporting table upon which a block to be split may be moved into cutting relationship with said splitting knife, a reciprocating carriage movable over said supporting table and comprising a frame open at the top and bottom and having a sliding end gate, a pressure plate received within the top opening of said carriage for holding said block disposed through the open bottom of said carriage in contact with said supporting table, a trackway upon which said carriage moves in its reciprocation, means projecting from the pressure plate and end gate on opposite sides of the supporting table, lifting means disposed along the trackway including lifting members movable upwardly through a path which intersects the projecting means on the pressure plate and end gate, and means for moving said lifting members from a position below said projecting means into engagement with said projecting means to an elevated position to permit the insertion of a block to be severed within said carriage through the end gate and below the pressure plate.

9. In a splitting machine, in combination, a reciprocating carriage movable in a fixed plane and having sides which substantially define an enclosure open at the bottom thereof, said enclosure being adapted to contain and move a block of material inserted therein, a frame having ways in which said carriage is mounted for reciprocation, a first bed positioned beneath the bottom opening of said enclosure, a bearing surface on said first bed lying substantially parallel to the plane of movement of said carriage for supporting said block in movable engagement therewith, an endless moving band knife positioned across said first bed, with the splitting edge thereof extending a predetermined distance above the bearing surface of said first bed into the path of travel of said block, a gauge bar on said first bed positioned immediately in advance of said splitting knife, said gauge bar coacting with the splitting edge of said knife to determine the thickness of the sheets to be split from said block, supporting jaws for said splitting knife positioned across said first bed, the upper of said jaws having an outermost upper surface lying in a plane substantially parallel to the plane of the upper surface of said gauge bar and substantially in the plane of said splitting edge, means for adjusting said first bed and gauge bar in a direction normal to the plane of said bearing surface to alter the thickness of the sheet to be severed, a second bed disposed to the rear of the splitting edge of said knife and positioned beneath said carriage, and a bearing surface on said second bed disposed substantially in the plane of the splitting edge of said knife and substantially parallel to the plane of movement of said carriage, said bearing surfaces offering a substantially continuous support to said block for a distance at least equal to the length of the block on each side of said splitting knife.

10. In a splitting machine, in combination, a reciprocating carriage having sides which substantially define an enclosure for a block of material, a frame in which said carriage is mounted on ways for reciprocation, a bed positioned immediately beneath and parallel to the path of movement of said carriage, said bed adapted to have said block rest thereon in movable engagement therewith during reciprocation of said carriage, one of the sides of said carriage transverse to the direction of travel of said carriage comprising a gate, lift-engaging means on said gate projecting beyond the ends of said gate over said frame, lifting members positioned along the path of travel of said carriage on opposite sides of said frame and engageable with said lift-engaging means to lift said gate to permit insertion of a block into said enclosure upon movement of said block along said bed, and means for actuating said lifting members when said lift-engaging means are in position to be engaged by said lifting members upon movement of said carriage on said ways to a predetermined position.

11. In a splitting machine, in combination, a reciprocating carriage having sides which substantially define an enclosure for a block of material, a frame in which said carriage is mounted on ways for reciprocation, a bed positioned immediately beneath and parallel to the path of movement of said carriage, said bed adapted to have said block rest thereon in movable engagement therewith, a plate fitting into said enclosure and adapted to be moved by said carriage while resting on said block to press the same against

said bed, one of the sides of said carriage transverse to the direction of travel of said carriage comprising a gate, lift-engaging means on said gate projecting beyond the ends of said gate over said frame, lift-engaging means on said plate projecting beyond the carriage and over said frame, lifting members positioned along the path of travel of said carriage on opposite sides of said frame and engageable with said lift-engaging means to lift said gate and said pressure plate to permit insertion of a block into said enclosure upon movement of said block along said bed, and means for actuating said lifting members when said lift-engaging means are in position to be engaged thereby upon movement of said carriage on said ways to a predetermined position.

12. In a splitting machine, the combination of claim 9 in which said bearing surfaces are in the form of antifriction rollers.

13. In a splitting machine, in combination, a reciprocating carriage movable in a fixed plane and having sides which substantially define an enclosure open at the bottom thereof, said enclosure being adapted to contain and move a block of material inserted therein, a first bed positioned beneath said carriage, a bearing surface on said first bed lying in an inclined plane substantially parallel to the plane of movement of said carriage for supporting said block in movable engagement therewith, an endless moving band knife positioned across the width of said first bed and across the path of travel of said block, the splitting edge of said knife extending above said bearing surface into said path of travel, a second bed disposed to the rear of the splitting edge of said knife and positioned beneath said carriage in an inclined plane parallel to but offset from that of the first bed, a bearing surface on said second bed disposed substantially in the plane of the splitting edge of said knife and substantially parallel to the plane of movement of said carriage, jaws for supporting said band knife in its run across said first bed, the upper of said jaws having a block-supporting upper surface lying substantially in the plane of the bearing surface of said second bed and cooperating with said bearing surface of said second bed to support said block as it is moved past said knife and a sheet is severed from said block, and a plate received within said carriage for movement by said carriage while resting on said block to press it against the bearing surfaces of said beds during travel of said carriage.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
126,667	Zierden	May 14, 1872
174,056	Bartlett	Feb. 29, 1876
183,172	Jenkins	Oct. 10, 1876
271,290	Witzmann	Jan. 30, 1883
447,462	Crane	Mar. 3, 1891
477,201	Damus	June 21, 1892
561,393	Hass	June 2, 1896
657,817	Ensign	Sept. 11, 1900
786,560	Grimsley	Apr. 4, 1905
907,242	Joecken	Dec. 22, 1908
919,556	Dittbenner	Apr. 27, 1909
937,240	Haldeman	Oct. 19, 1909
1,110,789	Hurley	Sept. 15, 1914
1,350,879	Nylund	Aug. 24, 1920
1,615,489	Straub	Jan. 25, 1927
1,828,643	Cannon	Oct. 20, 1931
2,008,317	Voight	July 16, 1935
2,094,640	Koster	Oct. 5, 1937
2,201,815	Hendricks	May 21, 1940
2,253,617	Griffith	Aug. 26, 1941
2,274,603	Herman	Feb. 24, 1942
2,438,527	Werner	Mar. 30, 1948