Dec. 14, 1937. F. A. NICHOLSON ET AL. 2,102,186

WOOD PLANING MACHINE

Filed July 20, 1936 3 Sheets-Sheet 1

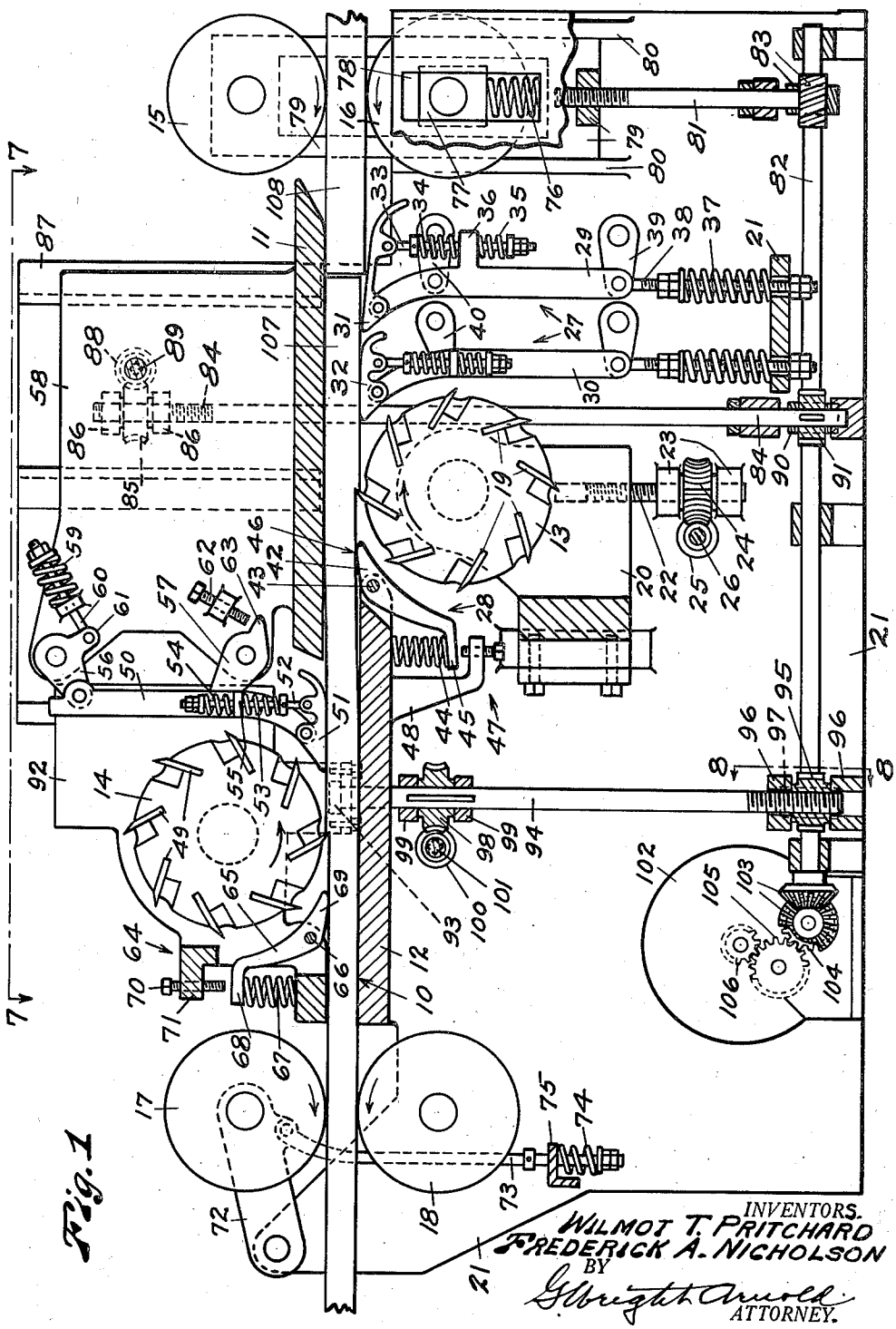


Fig. 1

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WOOD PLANING MACHINE

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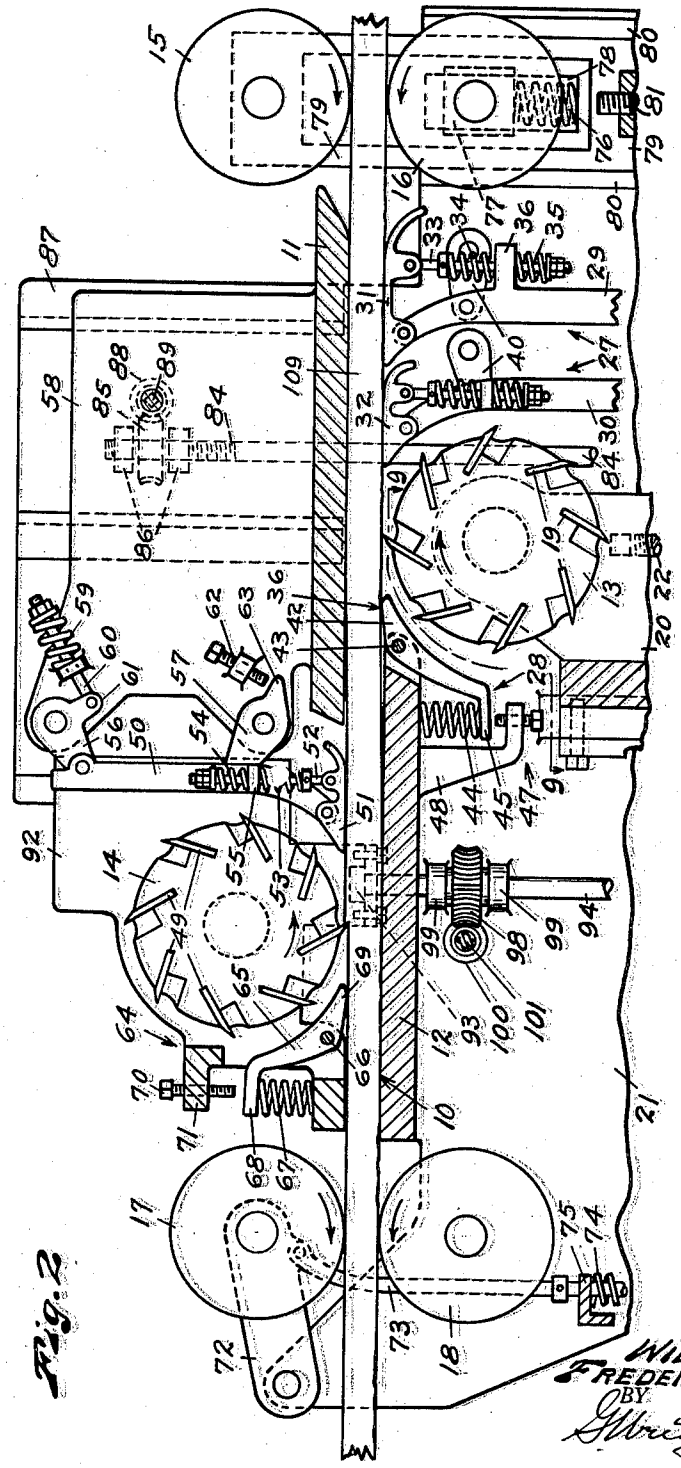


Fig. 2

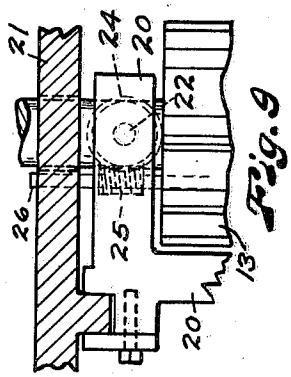


Fig. 9

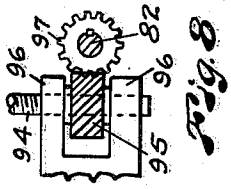


Fig. 8

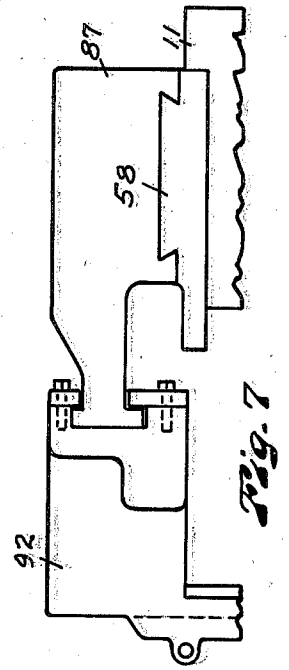


Fig. 7

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WOOD PLANING MACHINE

Filed July 20, 1936 3 Sheets-Sheet 3

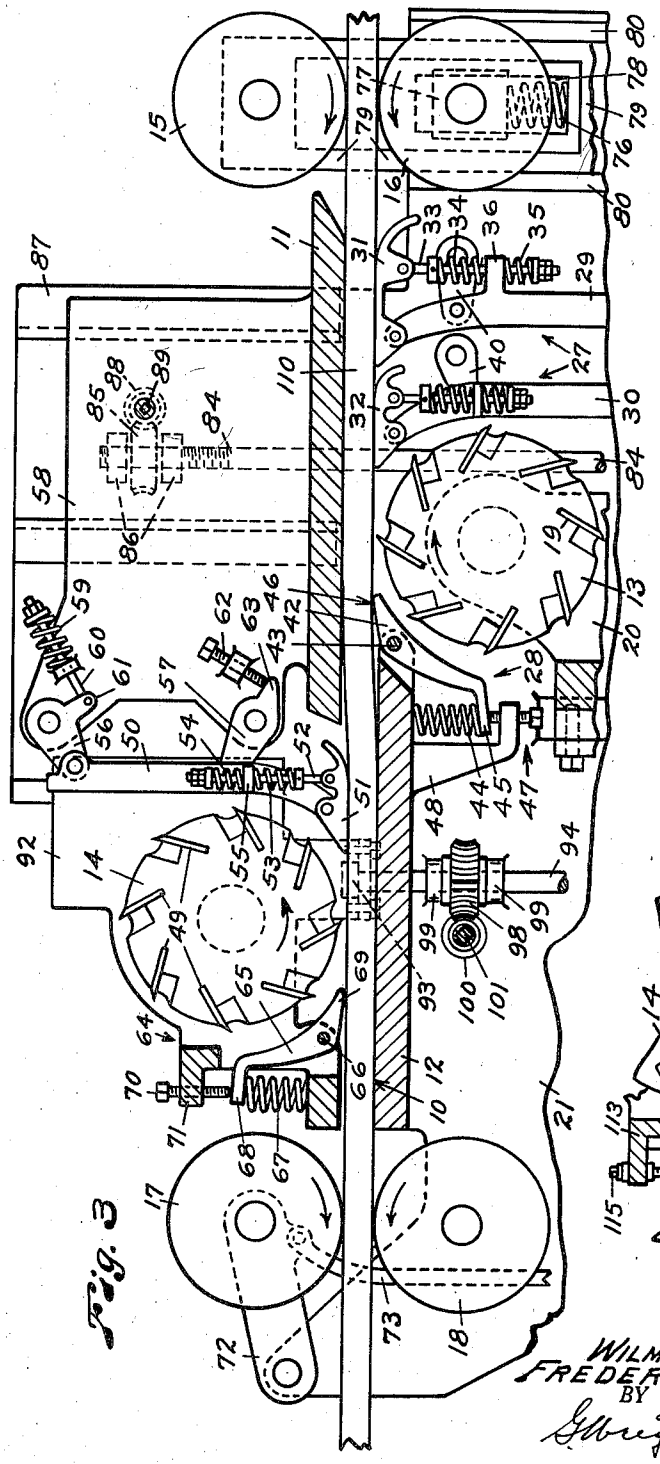


Fig. 3

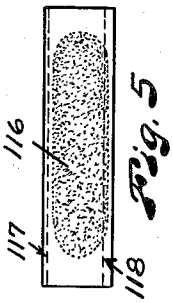


Fig. 5

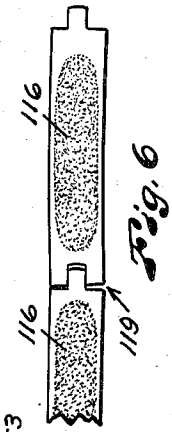


Fig. 6

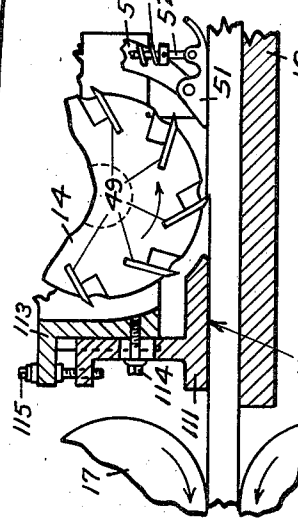


Fig. 4

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UNITED STATES PATENT OFFICE

2,102,186

WOOD PLANING MACHINE

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Application July 20, 1936, Serial No. 91,568

12 Claims. (Cl. 144—116)

Our invention relates to a method of planing wood and a wood planing machine for carrying out said method. More particularly, our invention relates to a novel method and a novel planing device to provide smooth flat surfaces on a board and to plane the board to an exact predetermined thickness.

It must be remembered that the wood stock delivered to the finishing or planing machine is the stock which is almost the final product from the trees. In other words, the cost of logging, transportation, sawing and the like have all been accumulated against this stock. In the event that any of the stock is wasted by an inefficient method or by an imperfect planing machine, such stock as well as the cost previously expended or accountable against a particular piece of stock becomes lost. It is, therefore, of primary importance that all waste which has been heretofore caused by the methods used and the planing devices on the market shall be eliminated, and that a method and a device be provided having extreme efficiency.

One great source of waste under present methods of planing lumber and machines used is that of end snipping—a board having a snipped end is one of non-uniform thickness having an end portion of a thickness below the required thickness of the board.

Our invention provides for flexing the lumber or placing the same under a longitudinal strain which holds the lumber firmly against fluttering and vibration, substantially prevents end snipping, provides a better grade of planing or finishing, and permits the machine to run at a greatly increased rate of production.

Wastage of lumber in the commercial operation of machines of the prior art exceeds 8 or 10 per cent of the total output. A large portion of this wastage is brought about by reason of snipped ends. The wastage of lumber by machines embodying our invention has been reduced at least fifty per cent and on our machines there is no substantial wastage of lumber by reason of snipped ends.

Another difficulty found in the prior art machines is the lack of uniformity of thickness of the resulting products. Planing machines of the prior art as presently used provide a product, which product commonly varies in thickness from a predetermined thickness by an amount as great as one sixty-fourth of an inch and often as great as one thirty-second of an inch. It is an object of our invention to substantially overcome this variation in thickness and provide a product of substantially uniform thickness.

The double surfacing planing machines of the prior art, operating on the higher grades of kiln dried lumber, were generally operated with a maximum rate of production of approximately two hundred and fifty lineal feet a minute and only a few under ideal conditions operated on a similar class of lumber at a speed of four hundred and fifty lineal feet a minute, with resultant increased losses. Machines embodying our invention are now operating on a similar class of lumber with a normal rate of production of five hundred and fifty lineal feet a minute. By imparting a flexing in the lumber, we have provided for utilizing the longitudinal stiffness of the lumber and machines embodying our invention not only normally may be operated at greatly increased speeds as compared to prior art machines, but our machines produce, with a high degree of efficiency, a superior grade of lumber. This high degree of efficiency and superior grade of lumber is maintained in our machines despite our increased speeds.

Another difficulty found in the prior art machines is that lumber tends to bind in passing through the machine as the cutting knives become dull. Bed plates have been spaced apart a predetermined distance sufficient to provide a passageway of a size to permit a piece of lumber of a predetermined thickness to pass therethrough with only enough clearance for a snug sliding fit. As the knives dulled or wore away, the thickness of the board increased, causing the board to bind and causing what is usually called in the trade a "tight feed". This was not changed in prior art machines by increasing the clearance of the sliding fit as this would permit the boards to flutter or vibrate resulting in uneven cutting action. In our device, we position the beds apart at such a distance to provide a passageway of size substantially greater than the thickness of the board and flex the board from one bed to the other. Thus even if the thickness of the board increases upon dulling of the knives, the board is still of a thickness less than the size of the passageway and thus, at all times, we provide "free" or "loose feeding".

Free feeding in planing machines is fundamentally important for the following reasons: First, lumber usually run on such machines is kiln dried and is frequently brash or dried to such an extent, for practical reasons in drying, that if we do not have free feeding and unnecessary feeding strains are required, numerous breakages

occur with consequent destruction of material and delay in operation. Second, if there is any obstruction to the feeding of the material, added pressure is required of the feeding means so as to supply firmer grip upon the lumber to force it against and through regardless of the obstruction, and this added pressure crushes the grain on the surface of the lumber and immediately causes undue compression of the grain of the wood which, subsequent to planing operation upon release of pressure, expands and results in what is called "raised grain".

It is also necessary that lumber must be caused to travel uniformly to prevent burning or gouging by the knives occurring during stoppages, and furthermore, if the lumber is not totally stopped and only slowed down, still there is a bad effect, due to lack of uniformity of knife action upon the lumber. For these reasons it is necessary to provide "free feeding."

The standard grading rules of the lumber industry permit of skipped spots on the back of certain patterns of lumber, providing such stock measures full thickness. In the manufacture of such lumber great efforts have been made to take advantage of this grading rule to salvage thin stock that did not contain sufficient thickness to permit of surfacing two sides. Some attempts were made in this direction by running such stock face down taking a fixed cut on the face side, so that the skipped surface would be on the back. This method proved a failure for the reason that at such skipped portions, the upper or thicknessing cutter head was not functioning, and was in itself evidence that the stock was not of uniform thickness. It is a purpose in the invention disclosed to produce a uniform thickness of stock with one side only surfaced, that being the face side, and even though the back be skipped at spots or the full length of board, such stock would be up to full thickness and thus all value conserved.

It is important to note that when thin stock is being planed, our invention surfaces to thickness on less than a full reserved cut, and that an appreciable amount of lumber is salvaged by thus operating between the limited predetermined cut and the minimum cut.

In sawing lumber, an attempt is made to provide a thickness having sufficient surplus over the desired finished thickness to permit the lumber to be properly surfaced on both sides. In the prior art commercial planing machines, one cutter head takes a predetermined cut either from the face or back of the lumber, and the other cutter head attempts to size or determine the thickness of the stock. Contrasted with such operation, in our device the lumber is urged away from one cutter head against a bed plate and thicknessed to an initial predetermined thickness and then placed under longitudinal strain or flexed and urged in the opposite direction away from a second cutter head and against a second bed plate and a final predetermined thickness is obtained. By such operation, if stock enters the planing device at a thickness less than the final predetermined thickness, it will be held alternately against the opposing bed plates as it passes through the machine, and it will not be planed on either surface. Thus, if lumber is too thin to make a predetermined sized stock, it is not made thinner by our machine, directly contrary to the prior art practices, and the full value of such thin stock is retained so that it may be used to produce the maximum thickness of stock obtainable therefrom. Also in our machine if the rough stock has a small surplus sufficient only for planing one side, such surplus is reserved for finishing the face, and when this surplus is planed off, a perfect face and exact predetermined thickness of stock is provided. When the surplus increases over the predetermined preliminary maximum thickness desired, this surplus is planed from the back of the stock. Thus the cutter head which finishes the face of the stock operates under ideal conditions, taking a predetermined almost constant depth of cut and provides a better face.

Furthermore, by providing a predetermined maximum cut on the surface of the face of the stock, and cutting all excess from the back of the stock, we have minimized the tendency of the face to cup or warp and become concave when the moisture content of the stock is reduced subsequent to planing. Lumber stock which is being planed usually has a relatively dry surface and a content of moisture increasing towards the center of the stock. When a heavy cut is taken from a surface of such stock and that surface later dries out, shrinkage occurs tending to concave that surface. By providing a minimum cut on the face surface, we produce a minimum shrinkage on the face surface and a minimum tendency of that surface of the lumber to concave as the lumber dries out. Also, any thick cuts which may become necessary in removing surplus stock are taken from the back so that if the lumber tends to warp in drying, the back of the lumber will be concaved instead of the face. In that event, such concaving on the back of the lumber will not cause cracks in the surface of the flooring or other surfaces where finished lumber is used.

As one of the primary factors in the grading of lumber is the quality of the face surface, it is desirable that the face surface be run face up so that it may be readily examined by the graders and the grade determined. Furthermore, if all excess is first removed from the back of the lumber, which is one of the objectives attained in our invention, a smooth support is provided against which better surface facing can be obtained and a constant, practically uniform amount of stock is left to be removed by the cutterhead producing the face surface. On some patterns of lumber after the stock leaves the surfacing units of the machine, it goes through matcher heads, which form tongues and grooves or other shapes on the edges of the lumber. If the lumber is not perfectly thicknessed, it is apparent that the flooring, or the lumber having other pattern thereon, will not be uniform and level, and that the patterns, as the tongues and grooves, will not properly match. It is also for this reason that the quality and value of the lumber depends in a large degree upon the accurate thicknessing of the same.

The commercial two side surfacing machines of the prior art included a lower cutter head which removed a predetermined fixed cut and an upper cutter head which removed the excess and thicknessed the stock. In some instances the upper cutter head cut last and thicknessed the stock after a predetermined cut had been removed from the bottom and in some instances the upper cutter head cut first and thicknessed the stock to a thickness which included a fixed amount reserved to be removed by the lower cutter head.

When lumber was run face up in such prior art machines, the face of the stock could be readi-

ly examined to determine whether the thicknessing operation had been performed. However, as sawn lumber is produced thick and thin, many boards do not contain sufficient thickness to permit finishing both faces. Therefore if sufficient excess was present to surface one face, this was removed from the back and the face was not surfaced so the stock was thrown out or degraded.

When lumber was run face down, of course the face could not be readily examined for grading purposes. Next when the face was produced by a fixed cut regardless of the thickness of the stock, any failure of such cutter head to cut, as by skip spots, etc. indicated that the thicknessing operation had not been completely performed and the stock was again thrown out or degraded.

It is therefore important to note that in all such machines, irrespective of whether the lower cutter head cut first or last, that if the lumber was not uniformly surfaced by the thicknessing cutter head, after a predetermined amount was removed or reserved to be removed, such stock was not of a uniform predetermined thickness, regardless of whether the stock was run face up or face down.

In an attempt to obtain an exact predetermined thickness in such prior art machines, lumber was generally run face up and the cutter head, which cut the face, was the thicknessing cutter head, while the lower cutter head, which cut the back, removed a predetermined fixed amount. Therefore if the face of the stock was not surfaced, this indicated that the thicknessing operation had not been performed.

Contrasted with the prior art machines, our invention comprises a method and a machine for carrying out said method wherein lumber stock that is sufficiently thick to be surfaced on one side only is always surfaced on the face and is always surfaced to a predetermined exact thickness. Such predetermined exact thickness makes it possible for the stock, if the same is to be matched (i. e., provided with tongues or grooves or other formed edges), to be held continuously in a true position while the tonguing and grooving heads are functioning, and thus accurate matching is accomplished. even though the lumber may be partly or wholly rough on the back.

Again referring to two side surfacing machines of the prior art, such machines resulted in heavy or light cuts (depending on the thickness of the rough stock) being removed from the face. When too light a cut was taken, the face surfacing knives were cutting in the grit (such grit naturally accumulates in the rough surface of the stock when it is in storage) and the knives were rapidly dulled. On the other hand, when too heavy a cut was taken, such knives were doing more cutting than advisable to permit the highest degree of efficient surfacing. Such cutting resulted in poor finishing of the face and required very frequent sharpening and adjusting of the cutter knives to provide the degree of exactness of thicknessing required. Further, such operation when surfacing thick stock resulted in the cupping or concaving of the face when the lumber later dried out because of the heavy cut taken from the face of the stock.

It is the object of our invention to overcome the above difficulties in the art and provide a novel method and device accomplishing the hereinbefore mentioned desirable features.

The above mentioned general objects of our invention, together with others inherent in the same, are attained by the device illustrated in the following drawings, the same being preferred exemplary forms of embodiment of our invention, throughout which drawings like reference numerals indicate like parts:

Figure 1 is a view in longitudinal vertical section with parts shown in elevation of a planer or planing machine constructed in accordance with this invention, and operatively showing in said planing machine lumber of a sufficient thickness so that a cut is taken off of both the back and face of said lumber;

Figure 2 is a similar view with parts broken away showing in the machine lumber of lesser thickness on which no full cut is taken from the back, but a full finishing cut is taken from the face of the lumber;

Figure 3 is a similar view with parts broken away, showing in the machine a relatively thin piece of lumber which passes through the machine without being planed on either back or face;

Figure 4 is a fragmentary sectional view illustrating a modified form of the invention showing a presser means positioned after the face finishing cutter head;

Figure 5 is an end elevation of a piece of unfinished lumber illustrating diagrammatically the location and distribution of the moisture content in said lumber, indicating in dotted lines the cuts which may be taken off of the face and back of said lumber in finishing;

Figure 6 is a view in end elevation showing a plurality of finished pieces of lumber as flooring and showing the seams which result due to shrinkage and warpage, which seams are closed at the face and open at the back when several of said pieces of lumber are assembled as in forming a floor;

Figure 7 is a reduced fragmentary plan view on line 7—7 of Figure 1 showing parts of the frame and mounting members;

Figure 8 is a view substantially on broken line 8—8 of Figure 1; and

Figure 9 is a fragmentary plan view, with parts in section, substantially on broken line 9—9 of Figure 2.

A longitudinal passageway 10 for receiving therethrough traveling lumber is provided between upper bed plate 11 and lower bed plate 12. In our invention the depth of this passageway is adjusted to be substantially greater than the size of the lumber passing therethrough and the lumber is flexed as it is urged against one bed while passing the same and then urged against the other while passing such bed.

Both upper bed plate 11 and lower bed plate 12 are fixed during the operation of the machine. Also the said beds are adjustably mounted for relative movement toward and away from each other. Also the cutter heads 13 and 14 are likewise adjustably mounted for relative movement toward and away from each other. The adjustment of the cutter heads may be with or independent of the bed plates. This may be accomplished by means and for purposes hereinafter discussed.

We have illustrated driven feed rolls 15 and 16, which may be driven by any suitable means (not shown), for urging the lumber through the machine, and driven feed rolls 17 and 18, which may be likewise driven by any suitable means (not shown), for removing lumber from the machine. We wish it expressly understood that we do not limit ourselves to driven feed rolls, as any of the usual feeding devices on the market may be used in connection with our machine.

It has been common practice to provide driven feed rolls or driven feed beds or a combination of the two, and we have set forth driven feed rolls only as an illustration of feeding means. Furthermore, the driven feed rolls 17 and 18 may be eliminated if the device is in continuous operation, as each succeeding piece of lumber stock will force the piece of stock preceding it through the machine.

A vertically adjustable planing device is disposed in operative spaced relation to the upper feed bed 11. We have illustrated such a planing device by means of a driven cutter head 13 provided with the usual knives 19. As illustrative of an adjustable support for the cutter head 13, it may have each end mounted on vertically adjustable frames 20, which are slidingly supported on the main frame 21. (See Figs. 1 and 9.) An adjusting screw 22 may be threaded into each adjustable frame 20. Each adjusting screw 22 is journaled in lugs 23 on main frame 21 and has a worm wheel 24 secured thereon and positioned between the lugs 23. A worm 25 engages each worm wheel 24 and a transverse shaft 26 is operably connected with worm 25. The frames 20, screws 22, worm wheels 24 and worms 25 are in duplicate on the respective sides of the machine. The cutter head 13 may be vertically adjusted relative to bed 12 by angularly moving adjusting screws 22 for purposes hereinafter discussed. Pressure means are operatively positioned as respects the cutter head 13 and provide means for urging the lumber stock away from the cutter head 13 and against the upper bed 11. Such pressure means are positioned on either side of the cutter head 13 as is indicated by pressure means 27 and 28. Pressure means 27 preceding the cutter head 13 as respects lumber stock entering the machine, is preferably composed of members 29 and 30. Pressure members 29 and 30, preferably having pivotally mounted pressure shoes 31 and 32 respectively on the upper ends thereof, are positioned to engage the lower surface of the stock entering the machine and urge the stock upwardly against bed plate 11. Pressure member 29 is pivotally connected to one end portion of the shoe 31 and the other end portion of the shoe 31 is pivotally secured to link 33. Link 33 is resiliently supported through springs 34 and 35 to pressure member 29 through projecting portion 36.

The lower end portion of pressure member 29 is mounted on the main frame 21 of the machine through spring 37 and link 38. Pressure member 29 is guided for vertical movement by links 39 and 40, which links are pivotally secured to the main frame 21 and pivotally secured on their other end portions to the pressure member 29. The pressure member 29, which has been just described, affords a shoe 31 which will resiliently urge lumber stock upwardly against the bed 11 and has its respective end portions urged upwardly together and separately, thereby permitting the shoe 31 to maintain an angular position, urging the end portion of one piece of lumber stock, and also urging upwardly another piece of succeeding lumber stock of a different thickness. Pressure member 30 is similar in construction to pressure member 29. As the parts function similar to the parts of the pressure member 29, similar parts of pressure member 30 and pressure member 29 are provided with similar numbers.

Pressure means 28, which is positioned on the other side of cutter head 13 from the pressure means 27, is preferably in the form of a shoe 42 pivotally secured to the lower bed 12 on pivot 43. A spring 44 resiliently urges the end portion 45 downwardly and the toe 46 of the shoe 42 upwardly, thereby urging lumber upwardly against the fixed bed 11. Stop means 47 limits the downward movement of the end portion 45 of the shoe 42. Said stop means may be in the form of the arm 48 connected to fixed bed plate 12 and the adjustable screw shown.

By turning adjusting screw 22, the peripheral portion of the cutting knives 19 of the cutter head 13 may be adjusted above the bed plate 12 so that lumber will be cut on a level above the bed plate 12 and such lumber will be urged clear of the forward end portion of the bed plate 12 by the pressure means 27 and 28.

Operatively positioned above fixed bed plate 12 is a planing device. Such planing device may be in the form of a driven cutter head 14 provided with cutter knives 49, the peripheral portion of the cutter knives being positioned in spaced relation to the fixed bed 12 to provide the final predetermined thickness of the lumber. The pressure means urging lumber downwardly against bed plate 12 may be in the form of a pressure member 50, having a shoe 51 pivotally connected to one end of the pressure member 50 and the other end of the shoe pivotally connected to a link 52. Link 52 is resiliently secured to pressure member 50 by means of springs 53 and 54 and lug 55. Pressure member 50 is pivotally connected to links 56 and 57, which links are pivotally mounted on adjustable frame 58, thereby permitting vertical movement of the pressure member 50. Pressure member 50 is urged downwardly by spring 59, which is connected by rod 60 with lever arm 61 of link 56. The downward movement of the pressure member 50 is limited by stop 62 engaging portion 63 of link 57.

In view of the fact that the space between the bed plates 11 and 12 is greater than the thickness of the lumber passing therethrough, and in view of the fact that the lumber is urged upwardly by pressure means 28 and then downwardly by pressure member 50, the lumber is flexed. The cutter head 13 preferably cuts approximately .020 of an inch above the bed plate 12 with 18 inches between the cutter heads 13 and 14 for $\frac{3}{4}$ of an inch fir lumber, and if so adjusted a substantial air space .020 of an inch appears between the board and leading end of the bed plate 12. The adjustment may be such so the cutter head 13 cuts only slightly above the bed plate 12 and thereby only places the lumber under an appreciable longitudinal strain or if the distance that the cutter head 13 cuts above bed plate 12 is increased, the lumber will be flexed an amount depending upon the amount of such adjustment. Throughout this application such flexing or strain of the board will be referred to as longitudinal flexing or longitudinal strain.

In the form of our invention shown in Figs. 1 to 3, a resilient pressure means 64, which may be similar to the pressure means 28 is employed. Such pressure means 64 operates upon lumber directly after the same has passed cutter head 14. Thus, resilient pressure means are provided on each side of the cutter 14 urging the lumber against the bed plate 12. By providing such pressure means all tendency of the lumber to chatter or vibrate is entirely removed. Also such pressure means may operate for a long period of time without adjustment. Furthermore, such a

device provides a constant pressure urging the lumber against the lower bed plate after the lumber has passed the cutter head 14.

The pressure means 64 has a foot portion 65 mounted on a pivot 66. A spring 67, exerting pressure against an extension 68 of said pressure member, urges the toe 69 thereof in contact with the traveling lumber. The stop screw 70 supported by a bracket 71 limits the pivotal movement of the pressure means 64.

For assisting in the removal of the lumber from the machine it is preferable that driven feed roll 17 be mounted for vertical movement by pivoted frame member 72 and link 73 which is pivotally connected with frame member 72 and urged downwardly by spring 74 which abuts against fixed frame lug 75. The feed roll 18 may be nonadjustably mounted. Often a two side planing unit operates in conjunction with other mechanism in the machine, such as matcher cutter heads and the like, which may be separate machines or may be a unit of the planing machine. The lumber leaving the planing unit of the machine very often enters directly into the matching units of the machine. In such an event the feed rolls 17 and 18 might be conveniently disposed of or positioned after the matching cutter heads in the line of travel of the lumber.

Referring to the feed rolls 15 and 16, which tend to urge material through the machine, the lower feed roll 16 is resiliently urged upwardly as by a spring 76, which exerts a pressure against a block 77. The block 77 is slidably mounted in a slot 78 in the main frame 21, and the feed roll 16 is journaled in said block 77. This mechanism is necessarily in duplicate at each end of the feed roll 16. The upward movement of this feed roll 16 may be limited by the engagement of the block 77 with the upper end of the slot 78.

The upper feed roll 15 is rotatively mounted in vertically adjustable frame means 79, which is in duplicate at each end of the feed roll 15. Frame means 79 is slidably disposed in guide means 80 and said frame 79 is vertically adjustable by means of an upright adjusting screw 81, which has a threaded connection with frame means 79 and is driven from a shaft 82 through spiral gears 83.

This adjustment provided for upper feed roll 15 makes possible the adjustment of said feed roll 15 along with the adjustable bed plate 11, cutter head 14, and associated parts to adapt the machine for the production of finished lumber of different desired thicknesses.

The resilient mounting of lower feed roll 16 compensates for variation in the thickness of different pieces of stock used in the production of a finished product of any given size, while the adjustment of the upper feed roll 15 changes the machine so that it will accommodate a different size stock to obtain a different size product.

Assuming that a finished lumber size of 50/64 of an inch is desired, the cutter head 13 is vertically adjusted relative to the bed 12 by means of screws 22 and then the upper bed plate 11 is adjusted and its position fixed so that the distance between the bed plate and the peripheral portion of the cutting knives 19 of cutter head 13 is set at a predetermined distance such as 53/64 of an inch or 3/64 of an inch over the desired final predetermined thickness. This distance is preferably the minimum amount which is sufficient to clear up the saw-cuts and other blemishes on the face of the stock and of course will vary with the condition or roughness of the stock. Assuming that 3/64 of an inch is allowed for surfacing the face then all excess of the stock over 53/64 of an inch will be removed from the back by the operation of cutter head 13 as the stock is held upwardly against bed plate 11 by pressure means 27 and 28. As the stock passes under shoe 51 it will be flexed and is transferred from the upper bed 11 to the lower bed 12. The distance between the peripheral portion of the cutting knives 49 of the cutter head 14 and the bed plate 12 is set at the exact distance of the desired thickness of the final product. Again the peripheral portion of the cutting knives 49 has been set at a predetermined distance away from the bed plate 12 and the lumber stock has been forced against the bed plate 12. By this means the lumber is finished to an exact final predetermined thickness and is finished while the usually smooth previously surfaced back is held against a bed plate. The maximum amount of cutting obtained by the cutter head 14 is predetermined by the difference between the spacing of the peripheral portions of the cutting knives 49 of the cutter head 14 from the bed plate 12 and the cutting knives 19 of the cutter head 13 from the bed plate 11. By thus limiting the cutting action of the cutter knives 49 they are able by virtue of the almost constant or uniform depth of cut to do a better grade of work and produce a better finish on the face of the lumber, than the work done by machines of the prior art. Furthermore, as all of the excess of the lumber stock over a preliminary maximum thickness is removed by the cutter head 13, any great wear caused by too heavy and too light cutting falls on the cutter knives 19 of the cutter head 13. This is not objectionable as the condition of the back is of secondary importance. Should the distance between the peripheral portions of the cutter knives 19 and the bed plate 11 vary because of wear due to the heavy and light cutting being done, such wear will cause only a variation in the preliminary predetermined maximum thickness. Thereafter, as the lumber stock is cut to final thickness by the cutter head 14, such variations will not be sufficient to materially change the amount of cutting being done by the cutter head 14 and the cutter head 14 will continue to cut only a sufficient amount to surface the stock to the exact final predetermined thickness. Thus the cutter head 14, taking an almost constant depth of cut, is working under ideal conditions and will not require such frequent sharpening of the knives and consequent frequent adjustment, as is necessary on the planing devices of the prior art. In other words, as the work of the cutter head 14 is reduced to a minimum and is almost constant, the wear afforded the cutter knives 49, because of this uniformity in depth of cut, is reduced to a minimum, and the fixed adjustment or "set", which determines the final size of the product will be maintained over long periods of time, in comparison to the prior art machines. This results in a superior product and eliminates many of the costly idle periods heretofore required.

The bed plate 11 is adjusted relative to the cutter knives 19 by means of an adjusting screw 84, which is threaded through a worm gear 85. The worm gear 85 is positioned between two fixed lugs 86 on the adjustable frame 58, which frame 58 is slidable vertically in an extension 87 of the main frame 21, see Fig. 7. The worm gear 85 is meshed with a worm 88 on a shaft 89, having

suitable means as a square head which may be readily engaged to turn the same. The adjusting screw 84 extends downwardly and is connected by spiral gears 90 and 91 with the adjusting shaft 82. The lower end of the adjusting screw 84 is preferably keyed to spiral gear 91 and is journaled in bearings which prevent vertical movement of the screw 84. The frame 58 is integral with or rigidly secured to the bed plate 11, and the shaft 89 is journaled in said frame 58. By placing a suitable wrench or tool on the square end of the shaft 89 and turning the same, it is possible to adjust the bed plate 11 toward and away from the cutter head 13. Also by rotating adjusting shaft 82 and turning the adjusting screw 84, it is also possible to adjust the bed plate 11 relative to the cutter head 13. This provides for an independent adjustment of the bed plate 11 by means of rotating of shaft 89 and also for an adjustment of said bed plate 11, together with feed roll 15, cutter head 14 and pressure member 50 upon rotation of adjusting shaft 82 as hereinafter set forth. The pressure member 50 being mounted on the frame 58 will be adjusted simultaneously with the bed plate 11.

The finishing cutter head 14 is mounted in frame member 92 and this frame member 92 is connected as at 93 with an adjusting screw 94. Adjusting screw 94 is threaded through a spiral gear 95 which is supported between frame lugs 96 and meshes with another spiral gear 97 on the adjusting shaft 82, see Figs. 1 and 8. This supports the adjusting screw 94 so that when said screw is turned and the spiral gear 95 is nonrotatably held, the adjusting screw 94 will be moved vertically. Also when the adjusting screw 94 is held nonrotatably and the spiral gear 95 is rotated, said adjusting screw will be moved vertically. The adjusting screw 94 has a worm gear 98 splined thereon and positioned between two fixed frame lugs 99. A hand adjusting means in the nature of a worm 100 meshing with worm gear 98 and mounted on a shaft 101, having a square end portion by which it may be turned, is provided for adjusting shaft 94. By turning the shaft 101 manually, it is possible to adjust the frame 92 and finishing cutter head 14 independently of other parts of the machine. By rotation of adjusting shaft 82 it is possible to adjust frame 92, finishing cutter head 14, resilient pressure means 64, along with upper bed plate 11, upper feed roll 15, and pressure member 50.

Adjusting shaft 82 is preferably power driven and may have a driving connection with a motor 102 by means of bevel gears 103 and spur gears 104, 105 and 106, spur gear 106 being on the shaft of motor 102. Motor 102 illustrates a convenient form of prime mover and is connected to any source of electrical power by suitable means (not shown).

It will be thus seen that feed roll 15, bed plate 11, pressure member 50, cutter head 14, and pressure means 64 may be moved together so that the machine may be adjusted to produce various thickness of stock, such as one inch, two inches, or any other desirable thickness within the range of the machine. After the machine is adjusted by the power means to the approximate thickness of a particular stock, then a more accurate adjustment is provided so that the exact distance between the cutter head 13 and the bed plate 11 may be suitably fixed to provide a preliminary predetermined thickness of stock, and the distance between the cutter head 14 and the bed plate 12 may be suitably fixed to provide a final predetermined exact thickness of finished stock. Also the cutter head 13 is adjusted relative to the bed plate 12 to provide the desired flexing of the lumber.

Vertically adjustable bed plates and cutter heads are old in the art, and any of the suitable devices of the art may be used to connect the adjustable bed plate 11 with the main frame 21. Also any suitable mounting means may be used to connect the adjustable cutter heads 13 and 14 with the main frame 21.

In the operation of the device shown in Figure 1, it will be noted that all stock in excess of the preliminary predetermined maximum thickness is removed by the first cutter head as the lumber is urged away from the cutter head toward an opposed fixed bed plate and the final maximum thickness of the lumber is determined as the lumber is flexed and urged in the opposite direction against a fixed bed plate with a cutter head operating in spaced relation to the last mentioned bed plate. Throughout the description, for the purpose of clearness, we have referred to the bed plate 11 as an upper bed plate, and the bed plate 12 as the lower bed plate. It is obvious that the principle of our machine will operate in the event that the machine is rotated on the longitudinal axis of the passageway of the lumber. It is preferable, for reasons heretofore explained, to operate with bed plate 11 as an upper bed plate and bed plate 12 as a lower bed plate, so that the lumber will be finished face up and readily available for examination. However, if the machine is rotated on the longitudinal axis of the lumber passageway, it will function in a similar manner, except that the face of the lumber will be positioned according to the extent of rotation.

In Figure 1, 107 illustrates a board passing through the machine where a relatively heavy cut is removed from the back of the stock by cutter head 13, while the maximum predetermined cut of the finishing cutter head 14 obtains. Board 108, which is illustrated directly behind board 107, is of a greater thickness than the board 107 and illustrates a rocking action by the pressure member 29 and illustrates the feed roll 16 being moved downwardly to accommodate such thicker board 108. Obviously, a thicker cut must be taken from the back of board 108 by cutter head 13 to remove all excess over the preliminary predetermined maximum thickness, while only the difference between the preliminary predetermined maximum thickness and the final predetermined maximum thickness will be removed by the finishing cutter head 14.

In Figure 2, we have shown a board 109 of a thickness, before passing through the machine, substantially equal to the predetermined preliminary thickness. With a board of such thickness, the lower cutter head 13 will skip-spot and true up the back and leave sufficient stock for the finishing cutter 14 to provide a perfect face on the board. As the pressure means 27 and 28 hold the board away from the cutter head 13 and against the bed plate 11, only an excess over the preliminary maximum predetermined thickness may be removed by the cutter head 13.

As the board 109 passes pressure member 50 it is flexed and urged downwardly against the bed plate 12 and thereafter cutter head 14 removes all excess over the final exact predetermined maximum thickness, thereby providing a perfect face for the stock and stock of uniform thickness.

The illustration in Figure 2 shows a useful work accomplished by our machine, which has been heretofore impossible in the art. A board is provided with a perfect face and a predetermined uniform thickness, although the same has skipped spots on the back. The skipped spots on the back do not detract from the grade of the lumber, and first grade lumber may be obtained from thin stock which was heretofore rendered useless by the machines of the prior art, which took or reserved to take a predetermined cut of a certain thickness from one surface of the stock and attempted to thickness the lumber by planing the other surface of the stock.

In Figure 3, we have shown a board 110 which is less than the final predetermined thickness of the lumber which is being produced. With such a board 110, the pressure means 27 and 28 urge the board 110 upwardly against bed plate 11 and clear of the peripheral portion of the cutter knives 19. Thus, the cutter knives 19 do not cut the board 110. As the board 110 reaches pressure member 50 it is flexed and urged downwardly against bed plate 12 and clear of the peripheral portion of the cutting knives 49. Thus the cutting knives 49 do not cut the board 110.

Again we have illustrated a useful operation which is impossible in machines of the prior art, as such machines take a fixed cut regardless of the thickness of the stock. A board, such as 110, will be useful for thinner stocks, but any unnecessary cut from such board renders it thinner and less useful. If it is not available for a predetermined thickness of stock, such as 50/64, the operation of our machine is to pass such stock directly therethrough without reducing the thickness of the stock. In other words, if stock is too thin we have eliminated the heretofore bad functions of the machines of the prior art and we do not make this thin stock thinner and further deteriorate its value.

In Figure 4, we have illustrated a modified form of our invention, where the resilient pressure member 64 is replaced by the shoe 111. This shoe 111 is mounted with its lower surface 112 positioned in a horizontal plane substantially tangent to the peripheral path of the cutting knives 49. The shoe 111 is adjustably mounted in frame 113 by means of set screw 114 and adjustable screw 115. The space between the shoe 111 and the lower bed 12 may be adjusted so that the upward movement of the lumber, as it is passing the cutter head 14, is limited to prevent the lumber from chattering or being gouged by the cutter head 14. Frame 113 corresponds to frame 92 of Figures 1, 2, 3 and 7.

In Figure 5 we have illustrated in end elevation an unfinished piece of stock. As the stock dries out the moisture content of the stock tends to centralize as indicated generally at 116. As such rough stock is cut it will be noted that the cut indicated by dotted line 117, removing a minimum portion from the finished face of the stock, does not cut so near to the moisture content of the stock, which has been driven toward the center by the drying process, as does the thicker cut from the back. On the other hand, the thicker cut on dotted line 118 will cut into the substantially centrally disposed moisture 116, leaving a moisture content along the cutting line 118. As the piece of lumber illustrated in Figure 5 further dries out, the moisture content is again driven toward the center, causing a shrinkage along line 118. When two boards, such as the flooring indicated in Figure 5, are placed alongside of each other, as are shown in Figure 6, the shrinkage along the back face will cause an opening at seam 119. In our device we have provided means for always removing the excess from the back of the stock, and only a predetermined maximum amount of stock may be removed from the face. This maximum cut which may be taken from the face of the stock may be limited so that it is not sufficient to cut close enough to the centrally disposed moisture to cause a damaging shrinkage along the face. On the other hand, if a deep cut is necessary to remove the excess stock to obtain a proper thickness, we provide a means for always removing this excess from the back, so that if the board does shrink by reason of relocating the moisture content after the board has been planed, it will tend to concave the back of the stock and may possibly cause openings at the seams, such as 119. These openings on the back will not open seams which will show on the top surface of the floor or other places where the stock is used, and will not cause damage, while on the other hand, if the openings at the seams were on the face, a very serious damage would result. In the machines of the prior art no provision has been made for limiting the cut on the face and positively insuring that all excess will be removed from the back of the stock. Therefore, openings at the seams, very often appear in the top surface of a floor made of stock, cut by the prior art machines, when the moisture content is later reduced. Such seams ruin the floor or other finished work made up from such stock.

Throughout the drawings we have illustrated rotating cutter heads for purpose of planing the stock as rotating cutter heads are the most usual method of planing stock. However, we wish it expressly understood that other planing devices may be substituted in place of rotating cutter heads, without departing from the principles of our invention.

Lumber stock, which is to be surfaced, is often substantially longitudinally curved or bent. If such stock is surfaced with the curve or bend pointing downwardly, then in the prior art machines, the lower cutter head cuts too deeply into the trailing end of the stock, causing end snipping. If such stock is surfaced with the curve or bend pointing upwardly, then in such prior art machines, the upper cutter head cuts too deeply into the forward end of the stock, again causing end snipping. In our device this end snipping, even on badly bent stock, is eliminated by placing the lumber under longitudinal strain or the flexing of the lumber. For example, if the trailing end of a piece of lumber stock is downwardly curved, the stock will be held up against bed plate 11 by pressure means 27 and 28 and by the longitudinal stiffness of the lumber which is utilized because of flexing action. As soon as the trailing end passes off the pressure means 27, the longitudinal stiffness of the board which is utilized by the flexing action will keep such trailing end in its proper position against bed plate 11. Likewise if the lumber is bent upwardly at the leading end, the flexing will maintain such end portion against bed plate 12 and prevent end snipping at the forward end.

It is preferable in most fully realizing the benefits of our invention to have the pressure means following the first cutter, as pressure member 28, in the form of a resilient member. This provides for adapting the apparatus to operate on boards which are of such thinness that they may not

be cut at all by the cutter head 13. This also permits automatic takeup for wear of cutting knives 19 and thereby provides the desired looseness of feed at all times.

As the longitudinal passageway formed between bed plates 11 and 12 may be substantially greater than the size of the lumber passing therebetween, our device not only provides for flexing the lumber stock but provides for free feeding. As previously pointed out, the cutter head 13 sizes the lumber stock to a preliminary predetermined maximum thickness. In other words, this cutter is operating under adverse conditions, in that the cut may be very thick and the work thereon increased or the cut may be thin so that the knives 19 of the cutter head 13 are operating to scrape off the dirt and grit accumulated on the stock, both of which conditions cause considerable wear on the knives of the cutter head 13. As the knives of the cutter head 13 wear, the maximum predetermined preliminary thickness of the board will increase. By providing a maximum preliminary predetermined thickness of the board, which is substantially less than the size of the longitudinal passageway between bed plates 11 and 12, considerable wear may be had on the knives of the cutter head 13 without any tendency of the board to pinch or feed tightly through said passageway. In case of tight feeding the following objectionable results occur: (*a*) The operation of the machine must be frequently periodically interrupted to provide for adjustment of the cutter head 13; (*b*) If you attempt to force the lumber through a tight feed by the use of sufficient pressure to grip the lumber, there results a compression of the fibers of the wood which results in a raised grain subsequent to the planing operation. It should be noted that stock to be planed or finished is ordinarily kiln dried and is more readily injured than lumber from which the moisture has not been removed; (*c*) If you don't increase the pressure of the feed rolls on the stock, so as to provide uniform travel of the lumber through the machine, despite the tight feeding due to the growth in the thickness incident to the wearing of the knives, then there results the usual defects of such non-uniform feeding, such as burnishing and unevenness of finish.

As pointed out, the knives on the cutter head 13 may wear considerably without requiring sharpening thereof, adjustment of the machine, or effecting the looseness of feed of the machine. Also as the cutter head 14 is operating under ideal conditions, it will continue for long periods, without sharpening or adjustment, to accurately size the lumber to the final predetermined thickness, even though the preliminary predetermined thickness may increase. In other words, the cutter head 13, which operates under adverse conditions, may wear therefrom but such wear and the consequent increase of the preliminary predetermined thickness does not substantially vary the ideal conditions under which the cutter head 14 is operating, and consequently the cutter head 14 will accurately finish lumber to a predetermined final thickness for long periods of time without adjustment or sharpening.

Our invention in providing for flexing and the utilizing of the longitudinal stiffness of the stock not only prevents end snipping and provides loose feeding but provides for better grade of face surfacing. This is accomplished in part by the ideal conditions under which cutter head 14 operates. Furthermore, less pressure is required on the feeding mechanism thus preventing raised grain. Also as the longitudinal stiffness of the lumber urges the lumber stock against the bed plates, no fluttering occurs and the quality of the surfacing far surpasses that of prior art surfacing machines.

This is a continuation in part of our now pending application Serial No. 738,821 filed August 7, 1934, and is to be substituted therefor with the express understanding that the invention disclosed in said co-pending application is in nowise abandoned hereby.

Obviously, changes may be made in the forms, dimensions and arrangement of the parts of our invention, without departing from the principle thereof, the above setting forth only preferred forms of embodiment.

We claim:

1. A planing machine embodying an upper fixed bed and a lower fixed bed positioned in spaced relation and forming therebetween a longitudinal passageway for moving lumber, said beds forming means for limiting the upper and lower vertical positions respectively of lumber passing through said passageway; a cutter head operatively positioned below and in spaced relation to said upper bed, said cutter cutting in a plane above the supporting surface of said lower bed; pressure means operatively positioned as respects said cutter head urging moving lumber against said upper bed at the time said lumber is passing said cutter head; another cutter head longitudinally spaced as respects said first cutter head and operatively positioned above and in spaced relation to said lower bed; and other pressure means longitudinally spaced as respects said first mentioned pressure means and operatively positioned as respects said last mentioned cutter head urging moving lumber against said lower bed at the time said lumber is passing said last mentioned cutter head, said respective pressure means being spaced longitudinally a sufficient distance as required by the thickness of the lumber to permit flexing of the lumber therebetween and said respective pressure means being positioned on opposite sides of said longitudinal passageway and each acting toward said longitudinal passageway, whereby lumber may be flexed and transferred from one of said beds to the other.

2. A planing machine embodying a main frame; an upper fixed bed adjustably mounted on said frame; a lower fixed bed mounted on said frame in spaced relation from said upper bed and forming a longitudinal passageway for moving lumber, said beds forming means for limiting the upper and lower vertical positions respectively of lumber passing through said passageway; means for moving lumber through said passageway; a cutter head operatively positioned below and in spaced relation to said upper bed, said cutter cutting in a plane above the supporting surface of said lower bed; pressure means operatively positioned as respects said cutter head urging moving lumber against said upper bed at the time said lumber is passing said cutter head; another cutter head adjustably mounted on said frame and positioned in longitudinal spaced relation as respects said first mentioned cutter head and operatively positioned above and in spaced relation to said lower bed; other pressure means adjustably mounted on said frame and operatively positioned as respects said last mentioned cutter head urging moving lumber against said lower bed at the time said lumber is

passing said last mentioned cutter head; and vertical adjusting means operatively connecting said upper bed, said last named cutter head and said last named pressure means with said frame, whereby the relative position of the upper bed and the lower bed, together with their respective planing devices, may be adjusted to permit flexing of the lumber from one bed to the other.

3. A planing machine embodying longitudinally spaced apart first and second beds forming therebetween a longitudinal passageway for moving lumber; a planing device positioned in spaced relation to the first of said beds for planing the back face of said lumber and cutting said lumber to a predetermined initial thickness, said planing device cutting in a plane more adjacent the first bed than the distance between beds; resiliently supported first and second pressure means operatively positioned respectively upon each side of said planing device, urging moving lumber against the first bed at the time said lumber is passing said first planing device, the second of said pressure means, while urging said lumber against the first bed, also functioning to hold the lumber above the first end portion of the second bed; a planing device to plane the face of the lumber longitudinally spaced as respects the first planing device and in operative spaced relation to the second bed; a third resilient pressure means operatively positioned immediately in front of said second planing device urging said lumber against the second bed at the time said lumber is passing said second planing device, the oppositely directed pressures of said second and third pressure means functioning to impart a flexing to said lumber, whereby the longitudinal stiffness of the said lumber is utilized to assist in holding the same firmly against fluttering and vibrating; and means positioned immediately behind said second planing device limiting the upper vertical position of said moving lumber, while said lumber is passing said second planing device.

4. A planing machine embodying an upper bed and a lower bed positioned in vertically spaced parallel relation and forming therebetween a longitudinal passageway for moving lumber, said beds forming means for positively limiting the upper and lower vertical positions respectively of lumber passing through said passageway; a planing device operatively positioned below and in spaced relation to said upper bed for planing the back face and cutting the lumber to a predetermined initial thickness, said cutter cutting in a plane above the supporting surface of said lower bed; a first and second resilient pressure means operatively positioned respectively upon each side of said planing device urging moving lumber against the upper bed at the time said lumber is passing said planing device, the second of said pressure means, while urging said lumber against the upper bed, also functioning to hold the lumber away from the first end portion of the lower bed, a second planing device longitudinally spaced as respects the first planing device and in operative spaced relation to the other of said beds for planing the face of the lumber; a third resilient pressure means operatively positioned immediately in front of said second planing device urging said lumber against the lower bed at the time said lumber is passing said second planing device, the oppositely directed pressures of said second and third pressure means functioning to impart a flexing to said lumber, whereby the longitudinal stiffness of the said lumber is utilized to assist in holding the same firmly against fluttering and vibrating; and means positioned immediately behind said second planing device limiting the upper vertical position of said moving lumber while said lumber is passing said second planing device.

5. The method of planing lumber having a rough thickness greater than the finished thickness, comprising subjecting traveling lumber to a planing device to remove all excess over an initial predetermined maximum thickness from the back face of said lumber while said lumber is urged in one direction against a fixed bed; progressively longitudinally flexing said lumber during its travel; and subjecting said lumber during its travel to a planing device to remove all excess over a final predetermined maximum thickness while said lumber is urged in the opposite direction against a fixed bed.

6. The method of planing lumber having a rough thickness greater than the finished thickness comprising planing one face of traveling lumber at one area on the line of advance of the traveling lumber, progressively flexing said traveling lumber at another area in the line of advance of the traveling lumber, and planing the opposite face of said traveling lumber at still another area in the line of advance of the traveling lumber.

7. In a planing machine, the combination of a first bed and an opposite second bed forming therebetween a longitudinal passage for moving lumber, said beds forming means for limiting the movement of lumber in opposite directions; a planing device operatively positioned opposite one of said beds, said planing device cutting in a plane more adjacent the said one bed than the distance between beds; a second planing device operatively positioned opposite the other of said beds; a pressure means in advance of each of said planer devices to hold the work against the beds respectively; and a resilient pressure means located opposite the rear portion of the first of said beds and between the first planer device and the front end of the second bed, the said resilient pressure means and the pressure means in advance of the second planer device acting to flex the lumber as it passes from one bed to the other bed.

8. In a planing machine, the combination of upper and lower beds forming a longitudinal passage for moving lumber; a lower cutter opposite the upper bed, said cutter cutting in a plane above the supporting surface of said lower bed; an upper cutter opposite the lower bed; a pressure means in advance of each cutter to hold the work against the beds respectively; and a resilient pressure means located under the rear portion of the upper bed and between the lower cutter and the front end of the lower bed, the said resilient pressure means and the pressure means in advance of the upper cutter acting to flex the lumber as it passes from one bed to the other bed.

9. A planing machine embodying a first fixed bed; a first cutter head operatively positioned in spaced relation to said first bed; pressure means operatively positioned as respects said first cutter head urging moving lumber against said first bed at the time said lumber is passing said first cutter head; a second fixed bed positioned in spaced relation to the first fixed bed and forming between said beds a longitudinal passageway for moving lumber, said beds forming means for limiting the transverse positions of lumber passing through said passageway, said second fixed bed being transversely positioned more remotely as respects said first bed than the plane of cutting

of said first cutter head to thereby permit lumber to be placed under a longitudinal strain as it is transferred from one of said beds to the other; a second cutter head longitudinally spaced as respects said first cutter head and operatively positioned in spaced relation to said second bed; and another pressure means operatively positioned as respects said second cutter head urging moving lumber against said second bed at the time said lumber is passing said second cutter head, said respective pressure means being longitudinally spaced and acting in opposite directions.

10. A planing machine embodying an upper fixed bed; a cutter head operatively positioned below and in spaced relation to said upper bed; pressure means operatively positioned as respects said cutter head urging moving lumber against said upper bed at the time said lumber is passing said cutter head; a lower fixed bed positioned in spaced relation to the upper fixed bed and forming between said beds a longitudinal passageway for moving lumber, said beds forming means for limiting the upper and lower vertical positions respectively of lumber passing through said passageway, said lower fixed bed being positioned below the plane of cutting of said lower cutter head to permit lumber to be placed under a longitudinal strain as it is transferred from one of said beds to the other; another cutter head longitudinally spaced as respects said first cutter head and operatively positioned above and in spaced relation to said lower bed; and another pressure means operatively positioned as respects said last mentioned cutter head urging moving lumber against said lower bed at the time said lumber is passing said last mentioned cutter head, said respective pressure means being longitudinally spaced and acting in opposite directions.

11. In the method of planing opposite surfaces of lumber the steps of providing a longitudinal passageway for moving lumber, between opposed bed plates, said passageway being of a size substantially greater than the thickness of the lumber passing therethrough; and longitudinally flexing the lumber to engage a portion of the moving lumber against one bed plate and to engage a longitudinally spaced portion of the moving lumber against the other bed plate whereby minimum frictional resistance to travel of the lumber obtains.

12. The method of preventing end snipping of lumber in double surfacing machines comprising, providing a longitudinal passageway for moving lumber between opposed bed plates having longitudinally spaced lumber supporting surfaces; longitudinally flexing the lumber between the two bed plates having longitudinally spaced lumber supporting surfaces causing the lumber in one portion of its travel to engage one surface thereof with one bed plate and in another portion of its travel to engage the other surface thereof with the other bed plate; and subjecting the non-engaging surface of the lumber to a planing device at that portion of the travel of the lumber when the opposite surface is engaging one of the bed plates.

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