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05299

Distr. LIMITED

ID/WG.[illegible]
[illegible] July [illegible]

Original: ENGLISH

United Nations Industrial Development Organization

Technical Meeting on the Selection of
Woodworking Machinery, Vienna
[illegible] November [illegible]

SELECTION OF MACHINERY FOR REMANUFACTURING:[1/]

CIRCULAR SAWS

by

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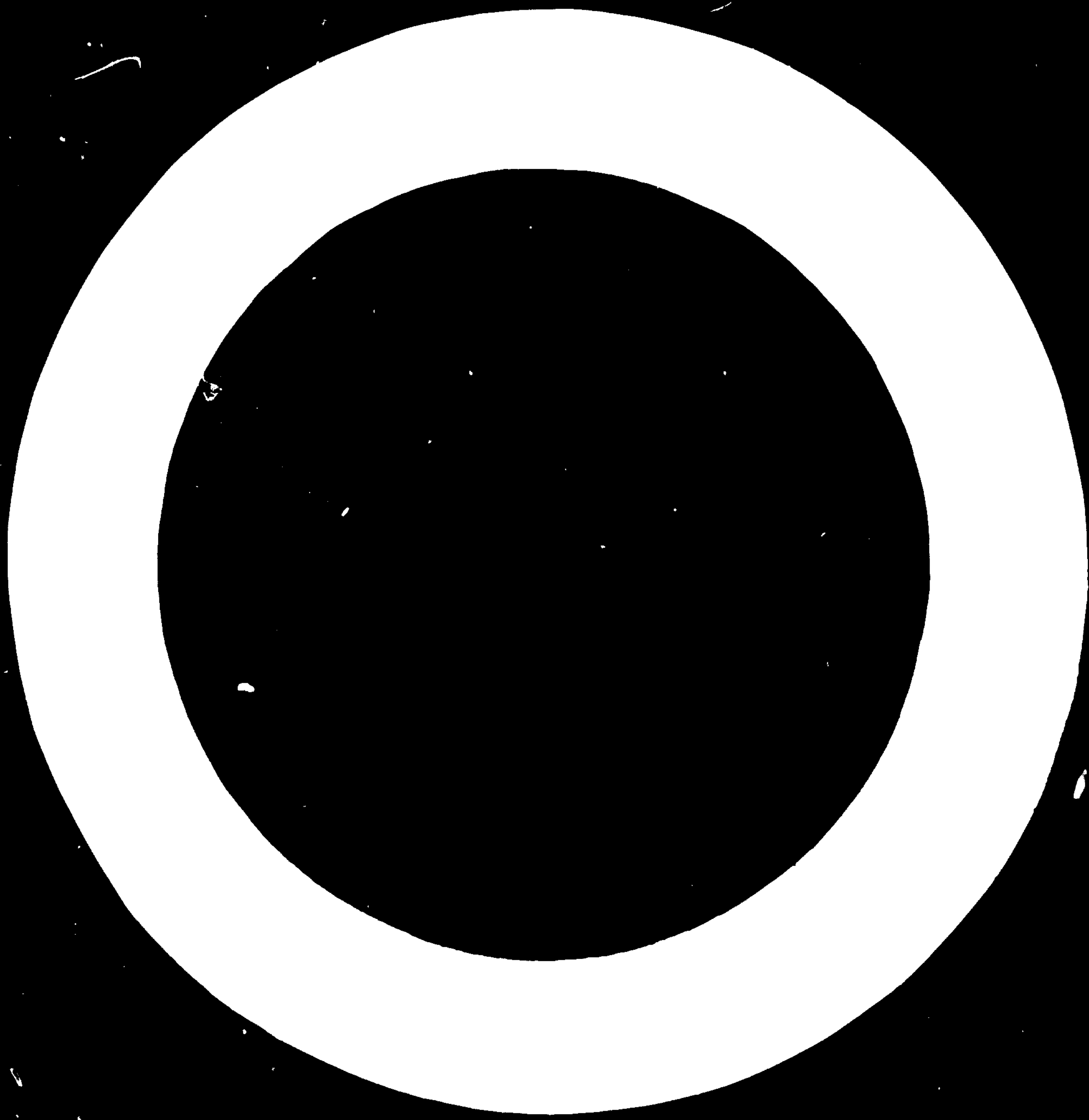

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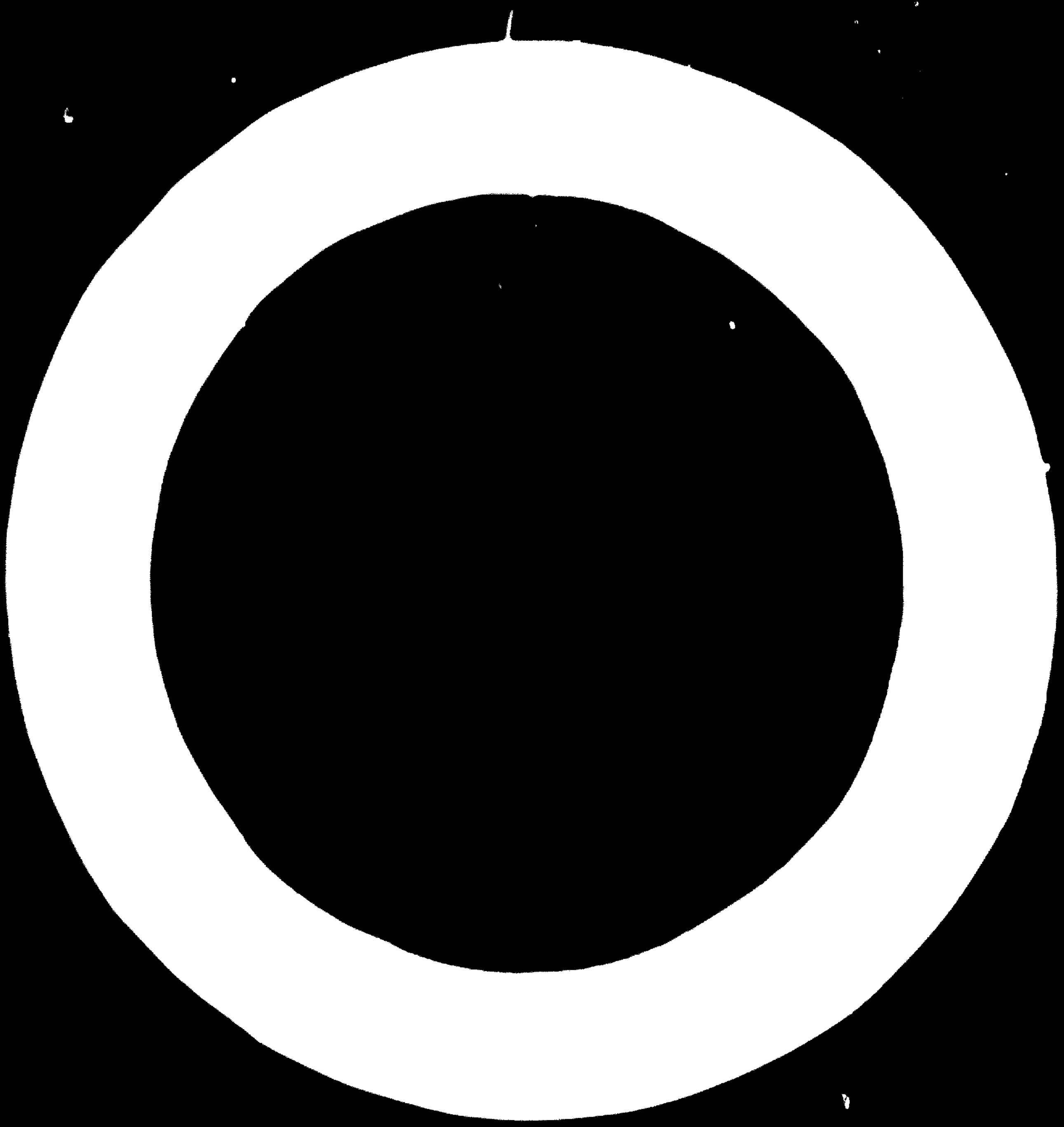


I. INTRODUCTION

1. Cutoff saws and ripsaws, taken together, are of first importance in relationship to overall cost of woodworking production, and also to actual lumber cost, over against the waste factor. Presently, great initial progress is being made in the cutting off operation on a computerized basis, but equipment for this is not universally available at this writing. Therefore, we consider some readily available cutoff saws first, which are applicable to both larger and smaller plants now, before passing on to latest developments, including those pending.

A. Cutoff saws with swinging motion

2. In planing mills which are often (not always) an adjunct of a sawmill, underswinging (but overcutting) cutoff saws are frequently used. One typical machine normally carries a 22-inch-diameter blade. Because it is employed chiefly for smooth trimming work, this blade is hollow-ground to 8-12-8 gauge, and its teeth are designed for smooth trimming. Such blades are furnished by the manufacturer with 130, 150, 160 or 200 teeth. The greater the number of teeth, the smaller those teeth are, and the smoother the cut. But the smaller the teeth, the slower the cut, so the customer is given a choice (for his particular product) between somewhat faster work or somewhat smoother trimming.

3. In any case, the 22-inch-diameter blade can be employed to cut stock as thick as 5-5/8" to a maximum width of 4", stock 4" thick as wide as 14", or material 1", 2", or 3" thick to maximum width of 16". Stock has often been pre-ripped and otherwise worked before coming to this machine. Both lefthand and righthand saws of this kind are available (a lefthand saw is one with its arbor on the left hand of the directly-mounted motor, as viewed from the operator's position.) Making these saws both lefthand and righthand allows them to be used in pairs where desirable.

4. The underswinging saw arm on these units is secured to a trunnion, on which it pivots as it swings. This trunnion is adjustable in a vertical T-slot, allowing the arm to be raised or lowered. Generally,

this consists of lowering it slightly, from time to time, to compensate for the gradual lessening of blade diameter, which results from repeated sharpenings. A suitable air cylinder, also trunnioned, and especially designed to prevent rebound, actuates the stroke of the saw arm.

B. <u>Cutoff saws with straight line motion</u>

5. While saws just described have a swinging motion on the saw arm, those we now consider have a straight-line motion for the blade. A type commonly used in the United States is made in both hand- and hydraulic-feed models. (see figures 1 and 2). The two models are alike in important respects, one of which is based on employment of a heavy cast-iron column. The top portion of this column is open, to receive the saw blade, its driving motor, and a linkage by means of which straight-line blade motion is obtained.

6. Points of similarity between the two models are: The same type of linkage for feeding the saw; the same general type of cast-iron base and column; employment of the same blade diameters, through a range from 14 to 20 inches; the same maximum stroke length, which is 20 inches, and the same thickness-cutting capacity; up to 6'-thick material.

7. Points of difference are: a simple hand pull for actuating the stroke on the manually-operated machine, as against necessary hydraulic equipment on the hydraulic model; a 5hp motor on the saw arbor of the former, as against a 7-1/2 hp motor on the hydraulic model; (except that a 7-1/2 hp motor is recommended for the manually-operated unit if cuts are to be made 4 inches thick or greater); stroke-length adjustment, within the 20-inch range, is incorporated on the hydraulic model, over against a simple hand pull on the manually-operated machine.

Figure 1

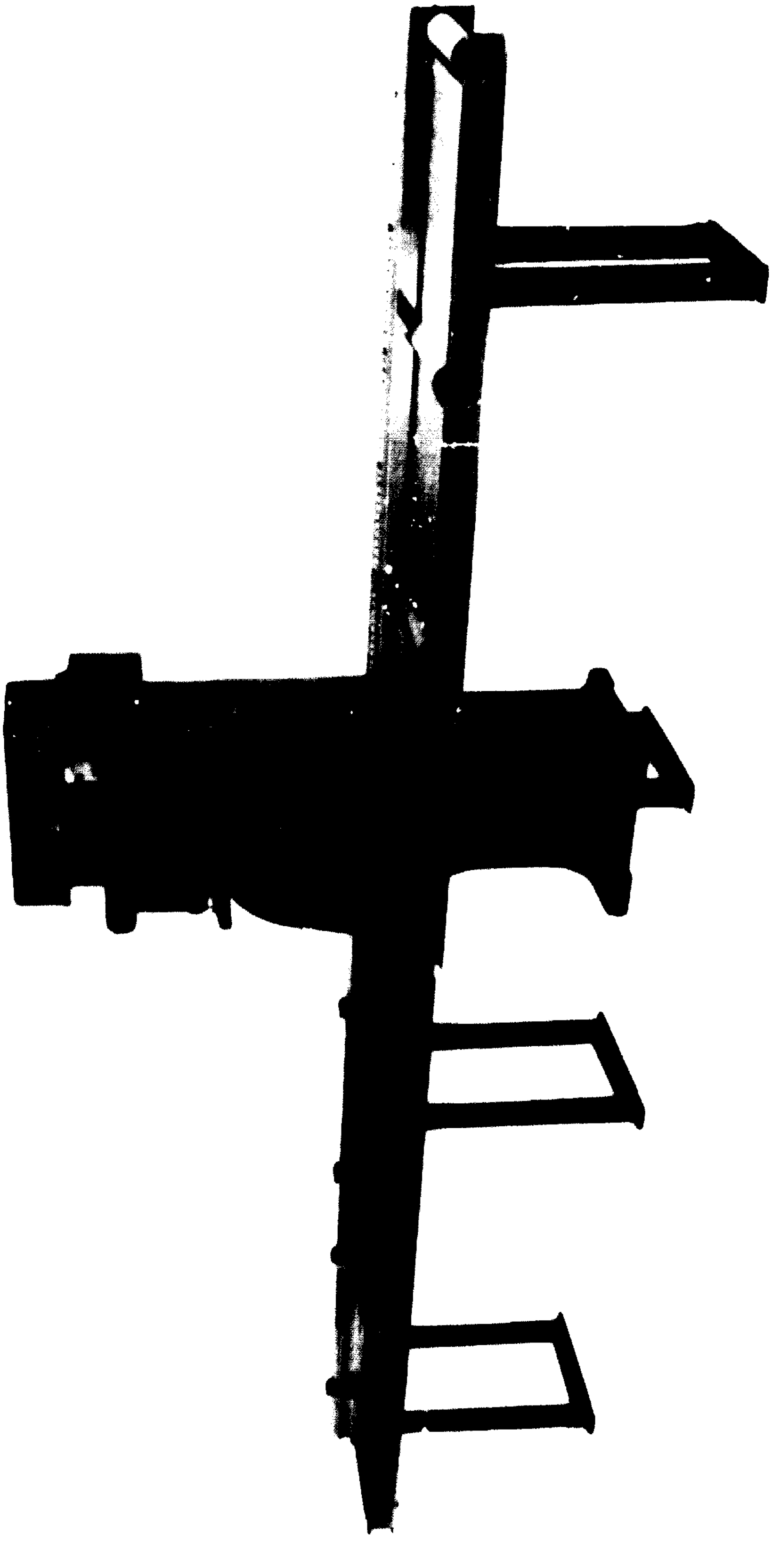
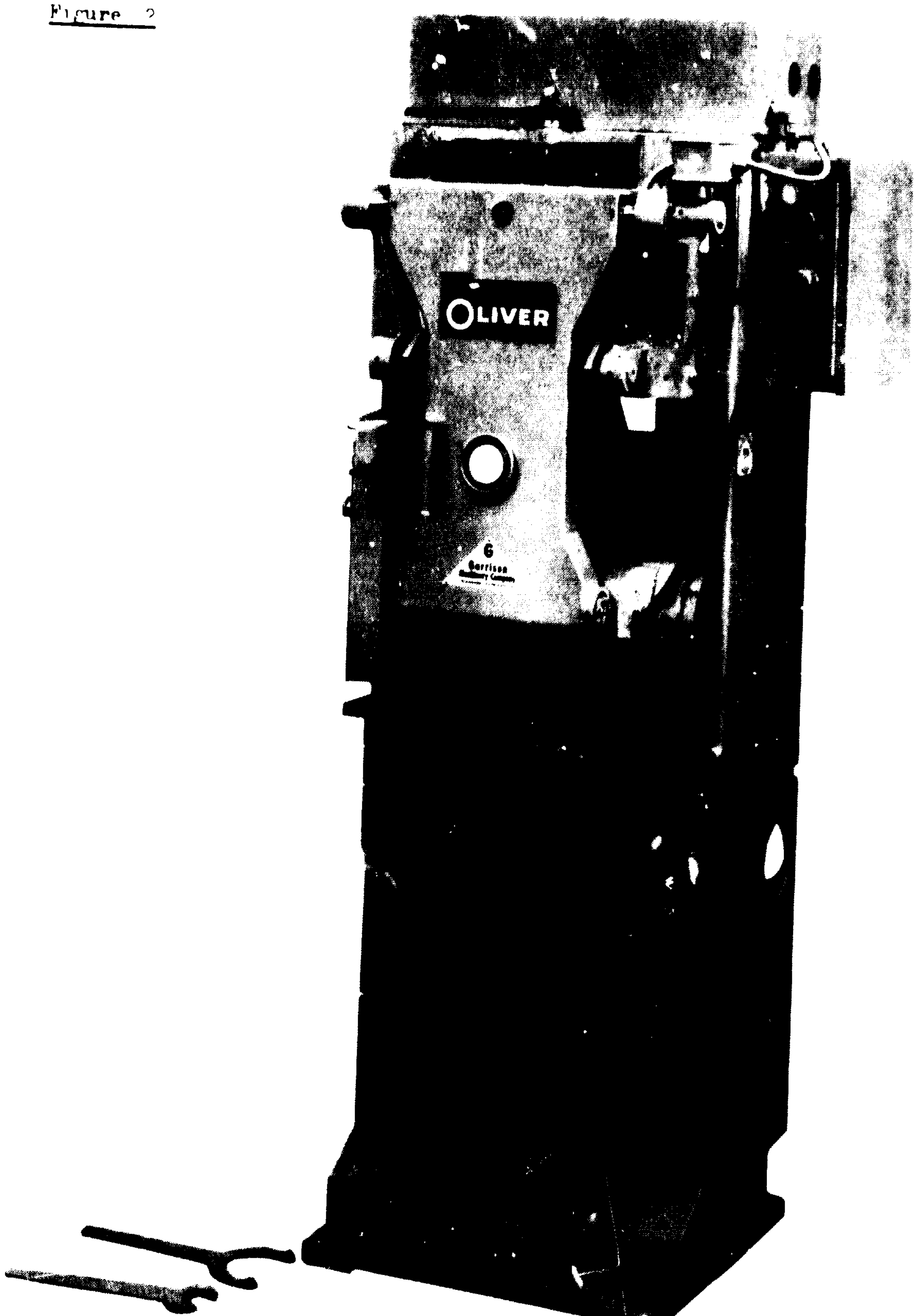


Figure 2



C. Saw stroke on hydraulic model

8. The hydraulic model has a hydraulically actuated stroke, operating at 23 strokes per minute. Stroke-length adjustment can be made (within the 20-inch maximum range) by means of a hand-operated dial. By giving this dial a quick turn, stroke length is changes to any point desired, without interrupting the flow of work through the saw.

9. The first significant step forward in developing improved cutting-off methods and equipment pointing toward obtainment of greater yield from a given amount of lumbe , was taken fairly recently. This step was realization on the part of researchers that if rough reduction of lumber at furniture-factory cutoff saws was to continue being conducted in the same general manner as in the recent past, and was also to be decidedly improved with specific reference to a lower waste factor, it would call for re-alignment of the then present methods. It would be necessary to separate the decision-making process (as to precisely what points at which boards must be cut for best results) fr the actual job of cutting off. This would replace the single overall process with a double-phased one.

II. RESEARCH AND COMPUTER APPLICATIONS

10. Those who at that time had the computer in the background of their thinking, perceived that this apparently could be done only be locating the actual non-allowable defects themselves, marking them, and computer-recording their precise positions along the length of each board. This recorded information could then be utilized by the same computer to govern board feed (with intermittent stoppage at defects) along a cutoff saw bench, and to actuate succeeding strokes of the cutoff saw blade (at such points of stoppage) to obtain greatest possible yield from the board.

A. Forest products laboratory, Madison, Wisconsin

11. The Forest Products Laboratory is usually in the vanguard regarding improvements applicable to wood-using industries, and has a research program in this field. Quoting from Mr. Kent A. McDonald, Wood Scientist at the laboratory involved in this program: "Our research program is directed

toward developing a completely automatic, computer controlled system that will scan a board moving at acceptable mill speeds; sense its defects by using an ultrasonic through-transmission technique that is sensitive to grain direction; determine locations of defects with the computer, and then make the necessary processing-control decision for whatever application is desired.

12. As of March, 1973, Mr. McDonald said "it is estimated that a commercial production machine to electronically sense and locate defects will not be realized for at least 2 or 3 years. However, an ultrasonic scanning technique, developed at the laboratory, showed promise in locating lumber defects so they can be recorded precisely. This technique worked especially well with knots, and steep grain found adjacent to knots. A booklet on this has been issued by and is available from the Forest Products Laboratory. It is entitled "Locating Lumber Defects by Ultrasonics," and is designated as U.S.D.A. Forest Service Research Paper FPL 120.

B. North Carolina State University

13. Another U.S. program in the same field is at North Carolina State University, under the direction of A.C. Mullin and A.J. Barr, of the School of Forest Resources. The efforts of these men, according to Mr. McDonald, have been on a proto-type machine, called a computerized lumber saver, that demonstrates computer control of ripping and cross-cutting operations for maximum yield of furniture dimension stock from rough, dry hardwood boards. Defects in boards are manually marked with light-reflective paint. The boards are then scanned with a light-sensitive scanner that senses the paint marks. Locations of these marks are then fed to a real-time computer, which optimizes placement of clear dimension-stock pieces for removal from each board.

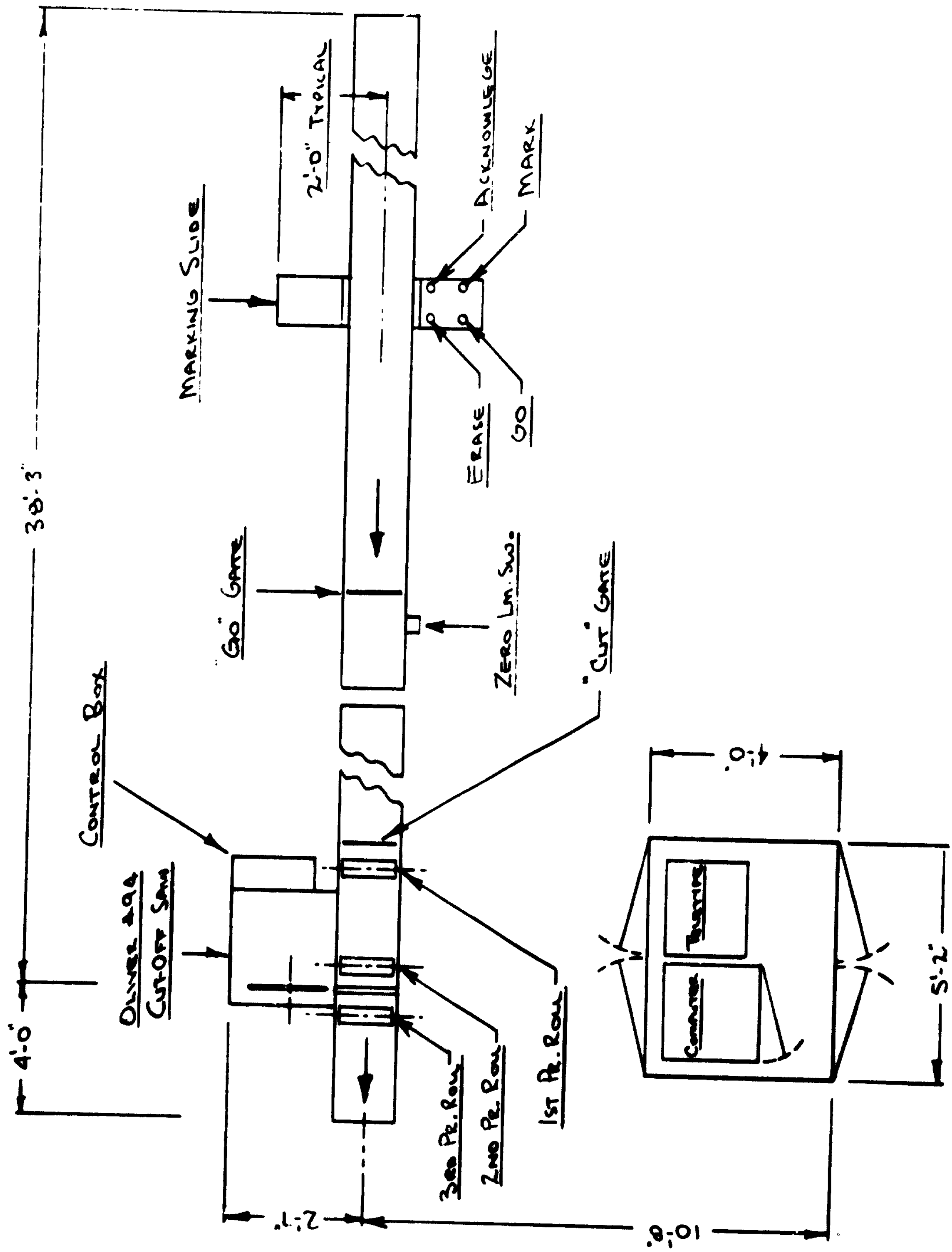
C. Oliver Machinery Company, Grand Rapids, Michigan

14. Since inception of the idea in the minds of careful researchers that more-economical reduction of hardwood lumber in furniture factories must necessarily include some kind of defect marking, plus separation of the marking operation from that of actual cutting off, Oliver Machinery Company has been working in this direction. Having had long previous experience in manufacture of competent cutoff saws, the "basic-machine portion" of progress was (to them) no problem. We express here our grateful appreciation for help and information given us by Mr. Ralph B. Baldwin, President of Oliver.

15. Primarily, this company took one of their 94-DH hydraulic-stroke cut-off saws, and developed it into a unit which employs an electric eye to register pre-applied chalk marks with the plane of the saw blade, so the board will be cut precisely on a chalk mark at each saw stroke. This machine is referrred to as their No. 494. It does not deliver prescribed lengths, as is done at either manually-operated machines or computerized saws, but is called an automatic defecting saw; a true name for it. It does incorporate the basic concept of manual marking and automatic cutting, separately performed. Pieces coming from it are not of standard piece-part length, but are known to be clear, unless so-called one-side cutting is being performed. Even then, one side is known to be clear.

16. Therefore, men who perform a secondary cutting operation on pieces coming from this unit need pay no attention to defects, and are relieved of a major share of the mental labor involved in cutting lumber in its original form. Whenever it appeared expedient in any given plant, drag sorting could be performed on the length mix coming from this machine, or on the major part of that mix, allowing it to be automatically sorted into lots which could be used for obtaining standard piece-part lengths, as a means of further lightening the task of the sawyer who cuts to actual length.

Figure 3


38'-3"
2'-0" TYPICAL
ACKNOWLEDGE
MARK
MARKING SLIDE
ERASE
GO
"GO" GATE
ZERO LM. SW.
"CUT" GATE
CONTROL BOX
CUT-OFF SAW
4'-0"
3RD PR. ROLL
2ND PR. ROLL
1ST PR. ROLL
COMPUTER
4'-0"
5'-2"
2'-1"
10'-8"

17. A special Oliver chalk is employed for marking defects for this cutoff saw. There is a sensing unit, which consists of an ultra-violet light, employed to activate the chalk. When activated, the chalk mark reflects light, which is picked up by the electric eye mentioned above. The resulting signal tells the machine control to stop the belt conveyor which carries the board, and to begin the stroke cycle. When this cycle is completed, the belt conveyor is again started. The next signal, at the following chalk mark, starts this procedure all over again. Because, this machine does employ the concept of marking boards for cutting off, as a separate operation, and then for cutting them off automatically, as the marked lumber is fed, it can be seen, by hindsight, that it was an initial approach toward a computerized unit.

18. At present, we believe that Oliver Machinery Company is the only U.S. machine builder that has at least one computerized rough cutoff saw in operation. The basic cutoff saw in this case is also one of their 94-DH units, modified to make it suitable for this work. This computerised machine also carries each board length-wise to the cuttoff-saw station on a conveyor belt. Momentum is built up in some measure as the board is carried along, but there is a potentiometer which permits compensation to be made (within very close limits) for any slippage of a board on the belt as a mark approaches the "cut" position. This saw, with its auxiliaries, the firm has chosen to call their no. 694.

Major units contained in system

19. Four major units in the No. 694 system should be differentiated (Fig.3). First, there is a teletype. Secondly, there is a marking unit; thirdly, the computer, and fourthly, the cutoff saw itself. The teletype is employed for feeding all necessary instructions and information to the computer that are not sent to it from the marking unit. The marking unit is directly manned by an operator, who sends exact positions of all marks to the computer, using a pushbutton for the purpose. The computer, receiving all that is sent to it, uses it in carrying out all necessary instructions. In addition, it sends a signal to the stroke mechanism of the cutoff saw, each time the board is properly positioned for cutting.

D. Operation and yields of the automatic system

20. At the beginning of a run, before any marking is done, either the Production Manager or operator uses the teletype to feed various piecepart lengths (expressed in feet, inches and fractions of inches) to the computer. As many as ten different lengths can be fed to the computer for simultaneous handling. Considering that on a manually-operated saw, equipped with multiple stops, the best cutoff sawyer cannot advantageously handle over five different lengths, it is seen that ten doubles the number. There is a decided lumber-saving advantage where as many as ten lengths can be handled at once, if desired; the greatly- increased selectivity advantage results in a decidedly smaller waste factor, therefore, a greater yield.

21. The marking unit embodies a horizontal belt conveyor. So also does the cutoff unit. The top surfaces of the two conveyors are located in the same horizontal plane, and the two conveyors are also in lateral alignment, so the marking unit can deliver marked boards length-wise, one at a time, to the cutoff feed belt. Since the marking unit and cut-off-saw unit each occupy approximately 20 lineal feet of floor space, about 40 lineal feet are needed for installation of both. The company also recommends feeding boards lengthwise to the marking conveyor. Thus, (considering that some 16-foot boards will be processed) another approximate 20 feet is required for this purpose, making 60 lineal feet in all. It is possible, but at the present writing difficult, and not as satisfactory, to feed boards transversely to the marking unit. No such pre-arrangements should be made without first consulting the company.

Function of the marking gate

22. The marking unit is fitted with a so-called "marking gate, located at the lefthand end of the marking conveyor, as viewed by the operator. A board, fed onto the marking conveyor, proceeds forward until its leading end contacts this gate, and pushes the gate against a limit switch. This switch functions to stop the conveyor belt. Inertia of the board is such that it does not bounce back from the marking gate, but the farthest projecting point on its forward end remains in intimate contact with the gate. This particular point of contact is the zero point, lengthwise, for both the marking unit and the computer. All marks are made (and recorded) at specific distances from this zero point.

23. In this particular system, the word "marking" has been adopted for its referential convenience rather than for strict grammatical accuracy. No marks are actually placed on a board. The unit incorporates a marking slide. This slide is pushed by the operator along horizontal ways, on which it is mounted. The slide carries a housing, within which an electric light is located. A narrow slit is provided in the housing, through which a narrow line of light is thrown across the board's surface.

24. As the slide is moved along the board, lengthwise, this line of light moves with it, until the operator brings it to the point where a mark would be placed, if actual marking were being done. But the line of light constitutes the so-called "mark". When he has brought the slide to desired marking position, he presses a pushbutton. This feeds the lengthwise position of the mark into the computer, where its distance from the zero point is instantly recorded.

25. The operator of the marking unit can start with the marking slide at either the leading or trailing end of a board. Thus, far less walking is involved, since there is no idle pushing of the slide from one end of a board to the other. He marks one board while proceeding right to left; the next is marked while traveling left to right. However, he is not limited to this precise procedure, but may vary it as some circumstances require. Suppose, for instance, that he has already made one end-trimming mark, and has also made a pair of marks to insure removal of the first defect.

26. Then, pushing the slide along, suppose he absentmindedly goes past the second defect, and proceeds to mark the third one. If it becomes clear in his mind that he has missed defect no. 2, he can simply return the slide and mark defect no. 2, then reverse it again to the original direction of travel; pass over defect no. 3, which he has already marked, and proceed with marking the balance of the board. The computer will compensate. If there is doubt in his mind, however, or if he becomes definitely aware that he has made a marking error, the system incorporates an "erase pushbutton." He simply depresses this button, and starts over again on the board.

27. To insure perfect clarity, let us assume that four defects must be removed from a given board. The operator will need to make ten "marks" across this board. Two of these are end-trimming marks. The remaining eight, or four pairs of marks, are needed for the four defects. He need not take the slightest thought as to where, between defects, specific piece-part lengths will be taken. He need not even know what the piece-part lengths are. Thus, his mental labor and consequent brain fatigue are practically zero. The computer takes care of this part of the operation completely.

28. Boards may be marked while lying flat on the conveyor, if the operator is checking and marking for defects on one side only. But they may also be marked while in a manually-tilted position. In this case, the operator places a board on edge against narrow supports on the back sinde of the marking conveyor. This way, he can see all defects on both sides of a board, by using a mirror on the marking slide.

Advantages of seeing both sides

29. Now and then, knots or other defects show on one side of thb board only. By using the "on-edge" method just described, a light line will be projected on each side of the board. Also, knots often slant as they pass through board thickness, generally slanting in a direction that agrees with board length, rather than in cross-wise fashion. On such defects, this method of marking insures that such knots will be removed in their entirety. After such on-edge marking, the board is laid flat on the conveyor again, before it is sent to the cutoff saw.

30. What we have previously called the "marking gate," which engages the leading end of the board and establishes a zero point while marking is in process, is also called the "Go gate," for the following reason: After the board is fully marked, the operator presses a "Go" push-button. This causes the gate to pivot upward and away from the board end. This motion is powered by an air cylinder. The conveyor also starts, and the just-marked board is carried beneath the Go gate. At this point, the computer "loses" the board until its forward end touches another gate,

called the "cut gate". As the board end touches this second gate, a limit switch is activated which tells the computer that the zero end of the board is now 30 inches from the saw line, and is advancing at a known rate of speed.

31. Behind the second gate is a feed roll, which automatically drops onto the board, to assure constancy of feed rate, and to minimize slippage against the belt. A second and similar feed roll drops onto the board just before the saw line. A third roll, located beyond the saw line, aids in feeding the stock away, after it has been cut.

Three pushbuttons plus one acknowledge light

32. We have mentioned three different pushbuttons used by the operator of the marking unit. First, the marking button, which he presses to send the location of each mark to the computer as it is made. Secondly, the erase button, employed to erase all marks made when an error is discovered, so that marking can begin over again. Thirdly, the Go button he uses for lifting the Go gate, and starting the conveyor to carry the marked board beneath the gate. These three pushbuttons, plus an "acknowledge light", are arranged in convenient, approximately-square formation on the operator's side of the marking slide.

33. There is, then, a pushbutton at each of three corners of the square, and the acknowledge light is at the fourth corner. To use the company's precise language: "An acknowledge light on the marking slide is the computer's constant conversation with the operator. Whenever an input (mark, erase, go or zero) is received by the computer, an acknowledge flash is given." Thus, so long as the operator is receiving acknowledge flashes concurrent with what he is feeding to the computer, he can proceed with continued assurance.

34. "Time out" is taken at this point to observe a fact well known to all experienced cutoff sawyers. It is this: On any cutoff job where it is necessary to obtain a number of different lengths in specific quantities from a given cutting bill, the most difficult part of the job is obtaining a sufficient proportion of the longest parts billed. In many smaller plants,

where multiple stops are not used, (but manual cutting is) the order of procedure (even though it involves handling lumber more than once) is to find the longest pieces shown on the cutting bill, and cut them first. Then, the cutter drops down to the next longest pieces, and cuts them, and so on down until he has only the shortest pieces left to cut. This practice is largely limited to smaller millwork factories, where lumber is always ripped before cutting to length.

Bias incorporated in the system

35. Such practice cannot be recommended, by any means, for large furniture factories, but cognizance must still be taken of the problem posed by the fact that longer pieces are much more difficult to obtain in the majority of instances. To properly over-ride this problem, the Oliver system has introduced what is called a bias, which allows the computer not only to be "influenced", but to be "prejudiced in any specific degree", in the direction of taking a larger proportion of longer pieces out of lumber being processed, and doing this at smallest cost, in the form of somewhat greater waste.

36. Now the "bias", as incorporated in this system, simply means that the operator is willing to accept, in waste, in any length of good wood, up to the amount of the bias for which the computer is programmed, in order to obtain a greater proportion of longer (never shorter) pieces. We quote verbatim, from a high official of the Oliver company:

37. "The bias may be set up to any length in units of 1/16 of an inch. If the bias is zero, the computer will automatically select the "combination of lengths" from the bill of materials which uses the greatest amount of good wood in each section. If the bias is anything greater than zero, the computer will search, starting with longest lengths first, for the combination of lengths which will fit, with less waste than the amount of the bias. If there is no combination with less waste than the bias, it will then select the combination with the least waste.

38. He then explains how the bias may be changed, at the will of the one in charge of the operation, thus: "The bias may be changed, by punching the letter "B" on the teletype, whereupon the teletype will type out "BIAS NOW" 1 in. (for example). You then type in the desired bias: 2 in. (for example). The entire change takes perhaps ten seconds. Employment of a bias does not result in a major length loss, as might at first appear normal. The computer will usually find a combination of lengths where the waste is significantly less than the bias."

Obtaining printed record when desirable

39. At any time after, or during, the course of a run, a printed record of the present status of the present bill of material may be obtained. To get a print-out of the status, turn the teletype power to "line", and press the "L" key. A table is then produced by the computer, giving lengths required, quantity required, number made, and number yet to make. This table provides one with proper arithmetical clues as to whether or not the bias should be changed to a higher or a lower status, to bring the run to a finish with a proper proportion of longer pieces. Correct practice in this respect militates toward faster turnovers on cut-to-length stock than could otherwise be accomplished.

40. Regarding accuracy, dimensions considered by the computer are in increments of 1/16 of an inch. On this basis, the accuracy of cut, per piece, is plus or minus 1/8 of an inch. This is necessarily allowed, because there is some slight slippage of the board on the belt; of the board against the power feed rolls, and of the belt on the conveyor pulleys. This is without doubt considerably less variation than is normally obtained in manual cutoff operations. The company observes that this obtainable accuracy of plus or minus 1/8 of an inch, when compared to the average length of cut pieces (about 24 inches) permits an allowance of about 1/2 inch of excess length (for later double-end trimming) on each cut piece, instead of the present industry practice of programming an additional 1 inch. This, by itself, is the equivalent of a 2% saving of lumber.

41. All computer and cutoff-saw systems in the Oliver layout are set up in 1/16-inch increments. That is, the marking slide marks, the cutting conveyor positions, the saw kerf is calculated, the bias is entered, and the cut lengths of stock required can be entered, in 1/16-inch units. Calculation of saw kerf is interesting from the standpoint that some species of heavy hardwood lumber pinch up much more "violently" on a saw blade during process of the cut than others. The company can set the saw kerf value, in the computer, at any width in increments of 1/16inch. The 1/8-inch and 3/16-inch values are those used in nearly all cases, but it is good to know they can go to 1/4" or more should pinching troubl arise.

How saw kerf width is adjusted

42. The saw-kerf width value can be changed in the computer in a manne identical to that used for changing the bias, except that the letter "K" used instead of the letter "B". Time for the computer change is about 10 seconds. The kerf waste is considered as scrap, and is mathematically taken into account on each board, regardless of the number of cuts involv In connection with kerf consideration, it may be noted that stroke of the cutoff saw blade is variable in length, and also variable in speed, both of which are under control of the operator. At the line of cut, the board lies on a flat metal anvil, containing a narrow slot, through which slot saw teeth travel. This slot also forms part of the dust-collection system and aids in avoiding undue splintering.

42. The entire tenor of this discussion on the 694 computerized saw system, of course, is in line with the fact that its major attraction is increased yield from high-cost lumber, especially in plants where a large volume of lumber is cut. Efficiency of manual operators, without question varies greatly from one plant to another. Therefore, one cannot say just what savings can be made in specific plants. Savings will be greater wher the compuerized system replaces inefficient operators than where cutoff rank highly in lumber-saving skill. It has been said, however, that tests indicate it is entirely reasonable to expect a savings of about 50% of th currently wasted good lumber. This is usually anywhere from 4 to 12% of lumber as a whole.

III. DEVELOPMENTS IN RIPSAWS

43. Turning our attention to ripsaws, it is known that [illegible] and others are working on the proposition of adding computerized ripsaw systems to what has already been accomplished with cutoff saws, partly because cutoff saws and ripsaws have always been natural team mates in rough mills of furniture factories; also in millwork plants and other forms of woodworking establishments. However, nothing of any substance can be reported on computerized ripsaws at this time, other than the fact that such efforts are definitely under way. We must, therefore, confine consideration of ripsaws to what is chiefly important concerning machines we now have.

Straight-line ripsaws

44. We necessarily limit ripsaw consideration, first, to production ripsaws, and then observe, that no production ripsaw should be chosen for any plant (where a considerable amount of material is ripped) other than a straight-line ripsaw. The fundamental feature that makes manufacture of straight-line ripsaws possible is that boards are carried to and through the cut while resting on one or two straight-running feed chains, which are in turn supported on the most solid, unyielding underpinning it is possible to provide.

45. To this feed chain or chains, lumber is snugly held by a series of spring-loaded pressure rolls above the board as it passes through. There are many builders of this general type of unit, and there is a fundamental difference operation-wise, between single-chain and double-chain saws. Since space available forbids considering both, or either one against the other, we simply look into the design of a typical single-chain straight-line ripsaw (see Figure 4).

46. The base of this ripsaw is of heavy cast iron, that will absorb all vibration of the working parts as a whole. It is particularly efficient in providing proper support for the single feed chain. It is utterly impossible for the base itself to get out of alignment, since it is cast in a single piece before machining. This base mounts the V-ways which in turn support the chain. The V-ways, as we speak of them here,

Figure 4

are often referred to as "tracks". The tracks are mounted on the machined top of the base. The method of mounting completely eliminates any possibility of the tracks getting out of line by so much as a hair; no shifting can possibly take place.

Large area track vees

47. Once mounted, the tracks present two large-area male vees, turned upward to provide a runway for the feed chain. Though we have used a plural term in referring to the tracks, both are in fact cast together in a single piece, from carefully-alloyed metal. Each of the two male vees presents a large area for contact with the under side of the feed chain. Large block-type connectors for the two tracks are cast integrally with them.

48. The track vees are machined in precise parallelism. After machining, and mounting, the only possible way for one of them to move would be for both to move together. This they cannot do, because they are installed on the base, using a groove pre-machined in the base. Thus, to all intents, and purposes they are one with the base, and so rigid that deflection, even under heavy strain, is impossible. This is the worthy "foundation" for the feed chain proper. The track vees are carefully hardened, and thus provide far greater wearing life. When they finally do wear to a point where it is wise to replace them, replacement is a simple job. The male vees are a sufficient distance apart to support the two edges of the chain blocks (which blocks form the "links" in the single feed chain) thus giving boards rock-like support as they pass through the ripsaw.

49. The blocks (as necessary in a well-designed single feed chain) are much wider than one might normally suppose; in fact, their width is much greater than their length. The under sides of these chain blocks are milled with two female vees along their length, near their edges, to rest and run upon the two male vees of the tracks. Great care is employed to make these female vees so they fit perfectly on the male vees of the tracks. Like the male vees, the female vees in the feed-chain blocks provide large area, to match those on the tracks.

Chain blocks incorporate integral bushings

50. The chain blocks are cast with lugs at the forward and rearward ends of their length, which serve as integral bushings. These lugs project downward at an angle. Their location is held inside of (that is, between) the femals vees, so they do not interfere with any other necessary function of the chain. These lugs are machined, and drilled axially through lug length, to receive connecting pins when assembling into full-chain length.

51. There are three of thess lugs to each chain block. One widthwise edge of each block has only one lug; the opposite edge has two. The single lug on the one edge, howevsr, is twice ths width of each of the two lugs on ths other, so they present the same amount of wearing surface to ths chain pins. The single and longer lug on one chain block slides between the two lugs on the end of its neighboring block so as to provide simple and easy connection. Full care is naturally taken to insure that width, length, and rectangularity of each block is precisely what is should bs, to make up a perfect chain.

52. In doing everything possible to make certain the machine's maintenance will be economical and trouble-free, the pins employed for connecting ths blocks of the feed chain are subjected to heat treatment which makes them a specific amount softer than the integral bushings of the blocks into which they are placed. Some wear will occur on pins, and in the internal surfaces of the integral bushings, after many years of use, even when lubrication is all it should be. By making the pins somewhat softer than the integral bushings into which they fit, however, wear is "invited" to take place somewhat more rapidly on the pins than in the harder bushings. When a chain must be overhauled, therefore, after many years of use, the problem is usually that of installing a new set of pins, rather than replacing the far-more expensive blocks.

Lubrication of the feed chain

53. How is the feed chain lubricated ? Its lubrication is completely removed from that of other parts of the machine. Oil must be applied in such manner and such quantity that lubrication will never be either underdone or overdone. Lubrication of the chain involves applying a suitable oil in proper quantity, continuously, to (1) the surfaces of the V-ways, and (2) to the pin bushings which connect the chain blocks. To this end, an automatic force-feed lubricator is used, which incorporates an oil-holding tank or reservoir, located under the saw table near the operator, where it is convenient for him to service.

54. To describe the lubricator itself in detail would require too many words. We simply say it is designed and built to automatically pump oil in small, sensitive amounts, into a number of small-diameter tubes. These tubes are bent, positioned, and supported in such manner as to carry oil (in the specific amount in which each tube itself is supplied by the automatic lubricator) to various points, as predetermined by designers of the ripsaw.

55. The lubricator has no independent action. When the machine is started, the lubricator is driven by it, and when the machine stops, it also stops. Oil is applied in suitable amount to the femal V-ways of the chain blocks, as the chain returns underneath the machine table. As the chain blocks ascend at the infeed end of the track, this oil is automatically destributed along the track vees and along the female vees in the blocks, by wiping action. Other tubes coming from the lubricator apply a consistent amount of oil to points from which it finds its way to the connecting pins, and to the inner surfaces of integral bushings in which those pins are held.

56. What takes place if the automatic lubricator is overlooked in rush time, and additional oil is not added to its reservoir ? That would be disastrous to the highly-important feed chain if it happened, but it cannot happen, because the lubricator tank has been fitted with an internal float, held on a lever designed for the purpose. As the oil supply in the

lubricator reservoir gradually lowers, the float also lowers. When it reaches a predetermined "low" point, this action of the float and lever is utilized to break the circuit of the feed motor, whereupon the feed chain stops running. The machine cannot then be operated further until the lubricator has first been provided with additional oil.

Tops of chain blocks serrated

57. It has not yet been mentioned that the lumber-contacting surfaces of the feed-chain blocks are specially hardened to resist wear, and that they are also serrated, by grinding a series of tiny V-grooves, closely spaced, all across their top surface. After grinding such a series lengthwise of the surface of the block, a second series, also extending over its full top surface, is ground widthwise. This treatment results in the entire top surface of each block being covered with tiny, pyramidal points, or near-points, which grip the under surface of boards being ripped, so they cannot slip, and thus introduce inaccuracy from straight-line ripping.

58. Finally, a groove of judicious size for the function it must perform is ground across each chain block lengthwise, at the precise center of block width, and to proper depth. This groove is designed and employed for receiving and anchoring babbitt metal, when poured into it. This babbitt metal, when cool, is approximately flush with the lumber-contacting surface of the chain block. Its function is to allow actual contact of the tips of ripsaw teeth, while the machine is running, so as to score a tiny groove in the babbitt, without damage to the ripsaw teeth. In this way, the saw blade, which is directly over the center of the babbitted groove, can penetrate all the way through lumber carried by the chain.

59. A ripsaw of the type outlined deserves much more description, cover special sprockets which carry the chain; the method by which the outfeed sprocket is driven to power the chain; the fact that a worm-gear set is [illegible] one [illegible] the power train leading from the feed motor to the [illegible]; the fact that either a four-speed motor or a variable-speed [illegible] was employed to vary feed speed; the heavy overarm employed to carry the saw spindle [illegible] the two sections of the pressure-roll housing

means for vertically adjusting the overarm, and, therefore, the saw blade; separate means for adjusting the pressure rolls vertically; the brake by means of which the spindle can be brought to a quick stop at saw-changing time; the saw jointing and side-dressing device which allows saw blades to be jointed and side-dressed on the run, etc. Nothing more than mere mention can be made of these features, due to space limitations, but all of them are important.

IV. DEVELOPMENTS IN DOUBLE-END CUTOFF SAWS AND TENONERS

60. Attention must be given to double-end cutoff saws, which are necessarily used for double-end trimming of piece parts, originally taken out of lumber at cutoff saws in rough mills of furniture plants and similar establishments. The chief reason these machines are used is that it is impossible to cut pieces truly square at the rough cutoff saw, simply because there are no absolutely straight edges to which the ends can sustain a square relationship.

61. Thus, cut-to-length stock in the rough mill is provided with an overlength allowance (in most plants this has been an additional inch). Piece parts taken from this cut-to-length lumber are obtained at the straight-line ripsaw, after which their edges are actually straight. Then, they can be taken to a double-end cutoff saw, equipped with smooth-cutting blades, where the ends can be trimmed square with the straight edges, and to the net required length, at speed.

62. Double-end cutoff saws used for such double-end trimming duty in large and medium-sized plants in the United States, have a low supporting base. Length of this base is made commensurate with the greatest length of material to be trimmed or otherwise worked. Upon this base, two column-type units are mounted. One of these is fixed; usually at the righthand end of the base, and the other is traversible along the base, to provide infinite adjustability within the length scope of the particular machine.

Right hand column in fixed position

63. In describing a typical machine manufactured by a large firm in the United States, the righthand column is the one that remains in fixed position on the base at all times, while the lefthand one is traversible, and can be adjusted along the base with such final sensitivity as to cut piece parts within a fraction of 1/64 of an inch of desired length. Traversal for changing length as necessary is by means of a very heavy horizontal milled screw in the base of the machine, running the full length of that base, and located about midway between the two ways on which the traversible, lefthand unit slides. Use of the terms lefthand and righthand refers to the way these column-type units are seen from the infeed side of the double-end cutoff saw.

64. Each column incorporates its own feed chain and its individual pressure (or hold-down) beam. The two feed chains, which run together in perfect parallelism and time, carry feed dogs in nearly all cases. Piece parts laid with one of their edges against a pair of these dogs on the chains (and also gaged from one end) are, therefore, cut perfectly square on both ends, and to net length. The chains are driven by an electric motor on the outfeed side of the cutoff saw, which motor drives through a suitable horizontal drive shaft, that extends the full length of the machine in each instance.

65. It should be mentioned that double-end tenoners, as made in the United States and elsewhere, have much the same appearance and design as double-end cutoff saws we have been decribing. Taking tenoners made by the same firm, they are equipped with two circular saws at the machine's infeed, which can and often do function as plain double-end trimming saws. Thus, any double-end tenoner of this type can be used simply as a double-end cutoff saw, any part of the time it is not engaged on other necessary work. While the double-end tenoner is a much morecostly machine, the fact that it can be advantageously used both for double-end trimming and a multiplicity of other jobs, makes it a rational consideration for some plants too small to investigate it under other circumstances. (See Figure 5)

Figure 5

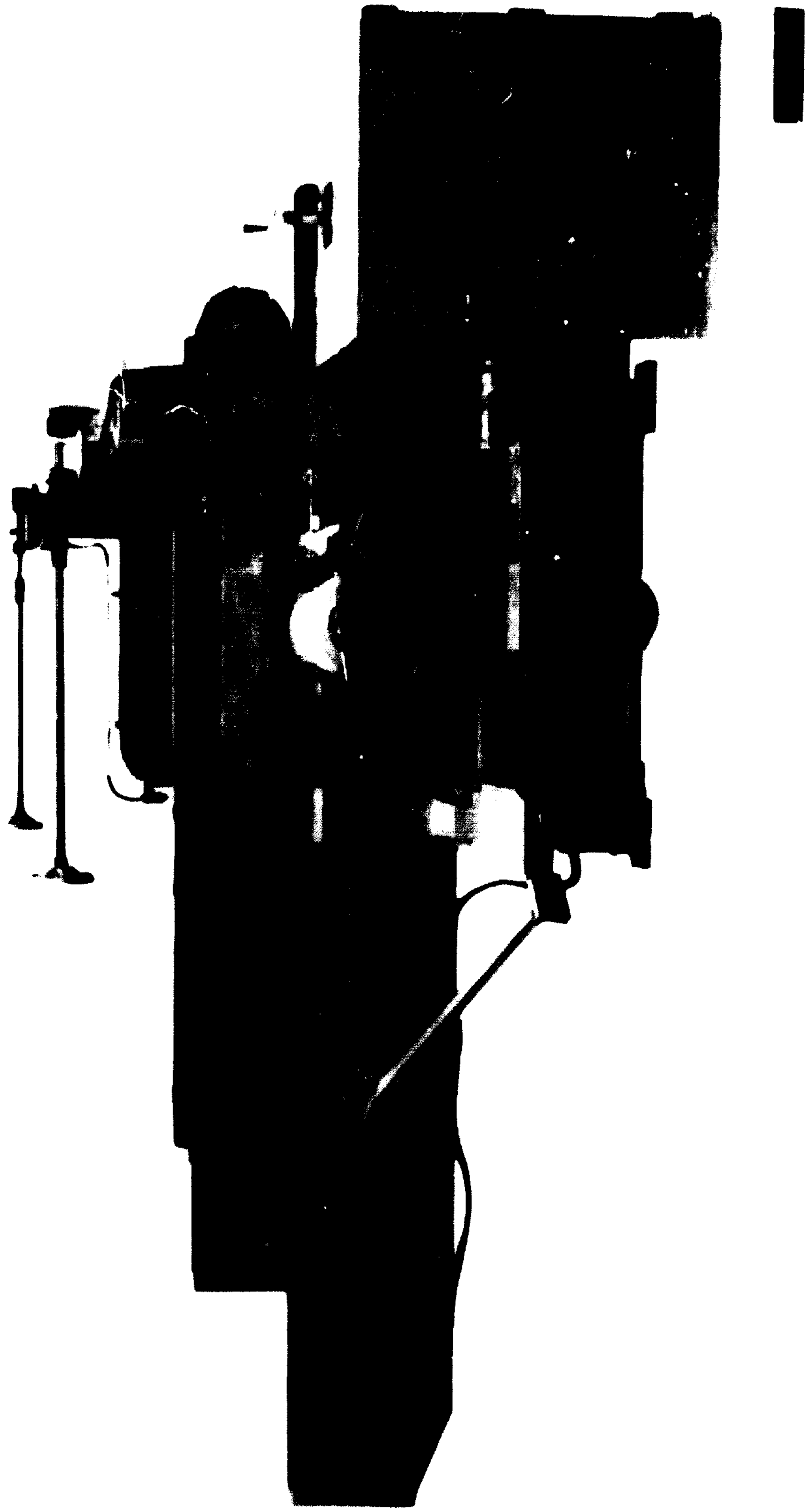
Double-end tenoners use circular blades with efficiency

66. Thinking strictly of circular saw blade applications, consider the following: Double-end tenoners carry that name basically because they have two pairs of opposed "tenoning spindles", which function in approximate registration with the center-length of the machine's pressure beams. When such machines were first built, these tenoning spindles were thought of principally (if not altogether) as means for accommodating opposed tenoning heads in millwork plants, and in other woodworking factories where mortise-and-tenon construction was the rule. With passage of the years, however, these spindles have been found fully adaptable for many other kinds of work which have to do with end-machining, and many such jobs require use of circular saw blades on them. (See document ID/WG.151/16.)

67. The double-end tenoner is almost always equipped with coping spindles near the outfeed (coping spindles can also be installed on a double-end cutoff saw, which has no tenoning spindles, if such specification is included with the order). In either case, these coping spindles can be (and very often are) used to carry saw blades, and their tilting facility makes it possible to tilt such blades for making cuts at many angles, including low-angle cuts. In fact, they are infinite within their tilting scope for this purpose. (See Figure 6.)

68. Thus, we have two spindles at the machine infeed whose function is to carry a pair of circular blades, which may be and usually are employed for double-end trimming to net length. These can nevertheless be tilted through a range from square to a 45-degree setting, up or down, allowing them to cut 45-degree bevels at one or both ends, or to cut bevels anywhere in between square and 45 degrees, either up or down. We have, in addition, four tenoning spindles on which circular blades may be mounted, as need appears, but which must nearly always be limited to square cuts (some departure even from this limitation can be obtained in specially-built tenoners.) Again, we have two cope spindles near the machine outfeed, which can also mount (and tilt where required) a pair of circular saws. Tilting scope on these is from 45 degrees toward the chain beams to 15 degrees away.

Figure 6



Tenoner dado attachments can also carry saw blades

69. If one desires to pay for an extra, he may also have what is called a dado attachment for the tenoner, whose working duty may be varied by mounting circular saws on it, singly or in any desired combination. Some of these dado attachments can be provided with a vertical "jump action", to make saw cuts of prescribed lengths. Cuts made in this way are necessarily normal (or square) with the surfaces of flat workpieces.

70. Beyond and in addition to all these is the proposition of "scoring saws", which are applied to double-end machines on many occasions. Their usual function is to score the surface of a workpiece to predetermined depth, just before that piece is engaged by a tenoning head, but sometimes they are used in advance of another and coarser-toothed saw. When consistently possible, the scoring-saw motor is directly attached to the motor of the unit for which it does advance scoring. This way, any adjustment made to a tenoner spindle, or additional saw, is faithfully followed by the scoring saw. However, the scoring saw also has its independent adjustments, up or down, in or out, to maintain its full versatility.

71. The scoring-saw motor usually (not always) revolves the blade with the feed, thus doing no tearing, while the unit with which it is teamed cuts against the feed. For any who are not aware of the nature of the difference, cutting with the feed puts the wood structure at the point of cut under some compression, so it cannot tear, whereas cutting against the feed puts the wood structure under some tension. Aside from the "tearing consideration", however, cutting against the feed is the most efficient method, especially from the standpoint of power economy. Thus, there are some cases, where a scoring saw is being used for other than scoring duty, where it is installed to cut against the feed.

Other aspects of scoring saws

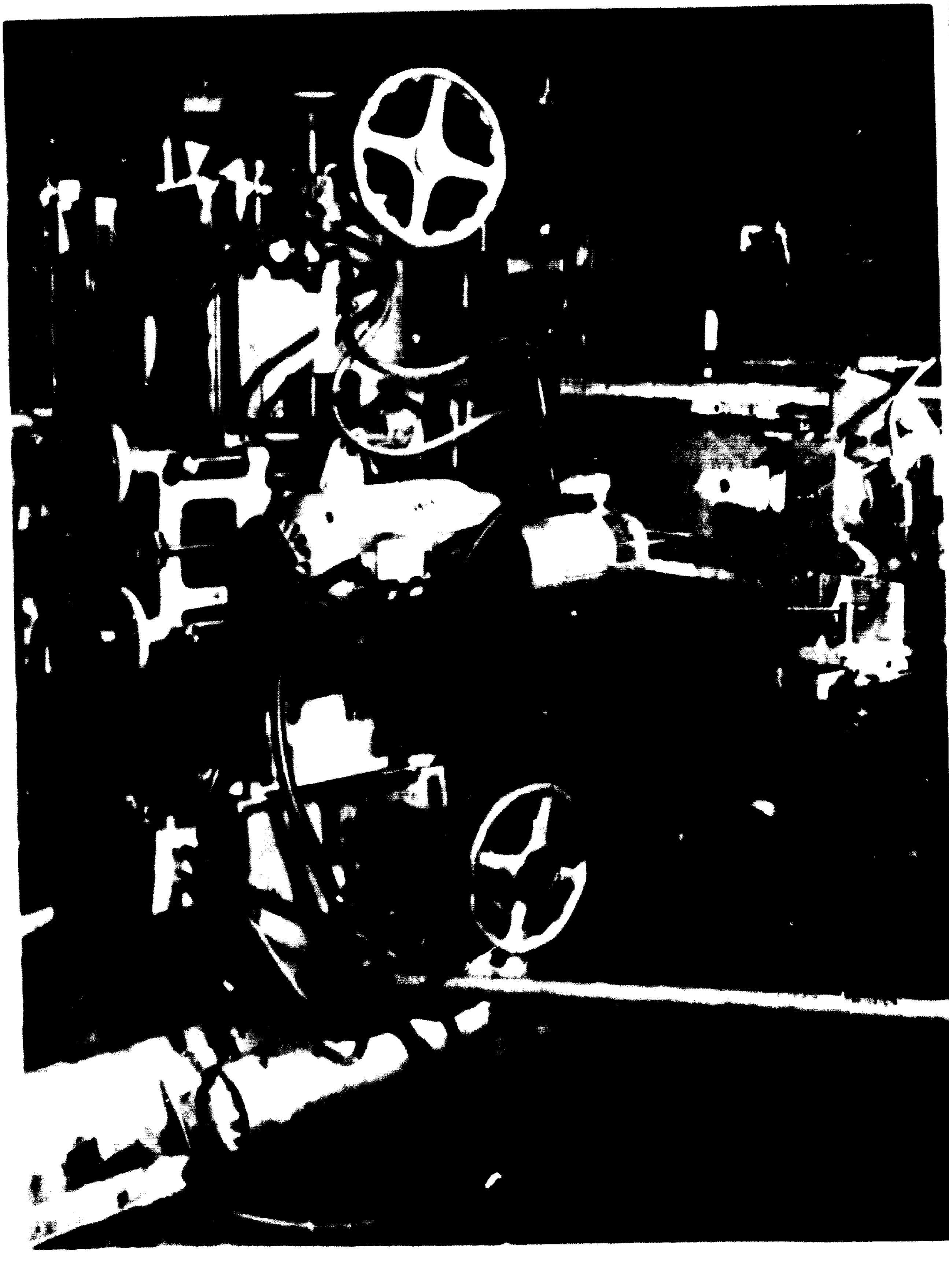
72. Returning to non-tearing, "with the feed" scoring saws, they are found especially good for scoring through wood face veneers and somewhat deeper, to eliminate possibility of the "tensional" action of a tenoner head or other wood-cutting unit tearing the veneers, and thus spoiling the work. Another application is their use to prevent tearing of the external corner of a rabbet (in England, "rebate") as the knives of a cutterhead emerge from the cut at the surface.

73. One more instance will be cited of scoring with the feed. Figure 7 shows part of a double-end cutoff saw, sometimes used in a door factory for final trimming of wood-veneered doors to length. It is a close-up photo, taken quartering from the lefthand side of the chain beams, from the infeed. Prominent in this view, about mid-width and slightly above center, a larger motor is seen leftward and a smaller one rightward, which are a standard cutoff motor and a scoring-saw motor, respectively. We cannot do better at this point than to quote the concise and accurate language of Mr. Walter J. Pacsak, of Greenlee, from whom this information was obtained.

74. "The value of this unit is to score veneers during the cross-grain pass, as when trimming doors to length, to prevent surface veneer tear-out, and also to prevent tear-out on the trailing edge (stile) of the door. The unit can also be used on cabinet and furniture parts to perform the same function.

75. "On a Greenlee #542 machine shown, the scoring saws, with the centerlines of their arbors located below the feed-chain level and rotating with the feed, score the bottom surfaces of the door. As the trailing door end approaches, the scoring saws jump upward to slash the stile up to the upper veneers. Meanwhile, the cutoff saw units, with the centerlines of their arbors located below chain level, and rotation against the feed, cut down through the scored lines, to completely eliminate any tear-out possibilities. The air jump action of the scoring-saw units is controlled through a solenoid and limit switches".

Figure



76. The principle involved here is not peculiar to Greenlee machines, but is used by others also, including, it is believed, some in Europe. Referring to the "air jump action" mentioned by Mr. Paczak, one of the air cylinders which jumps a scoring saw upward is seen above the scoring-saw motor in the picture.

Setting lefthand column for work length

77. Whether circular saws or other cutting units are in use, the system used on these tenoners for setting the lefthand column, incorporates two dials, one of large and the other of small diameter (see Figure 8). These are located in a horizontal plane, convenient to the operator's position, with their graduated faces turned upward in very plain view. Graduations on the large dial are used for initial setting of the column, while those on the small dial are used for final setting.

78. In using this arrangement, the operator first sets a pointer for desired distance between cutters on the two columns, and then pushes a control button. Thereupon, a 1 hp motor, driving througha a worm and worm gear, turns the accurately thread-milled screw located horizontally in the base, traversing the lefthand column toward or from the fixed righthand column, depending on where the pointer on the large dial has been set. If that pointer has been locked, it will automatically stop the motor so that a very close approximation of the desired setting is obtained.

79. The small dial, graduated in sixty-fourths of an inch, is then used in conjunction with a handwheel for final, precise setting. There is sufficient room between graduations on the small dial to allow adjustments as small as .005". Thus, whether one is sawing square with surfaces; sawing miters, or making saw cuts at any angles in between, exactitude in finished length or the machined piece part is insured.

80. Double-end machines made by the other major U S. manufacturer are provided in what are know as medium-duty and heavy-duty units, respectively. (For example, see Figure 9) Their medium-duty machines are furnished in capacities up to 20-foot maximum cutting length, and with 8-foot pressure beams, while their heavy-duty machines have capacities up to 24-foot

Figure 8

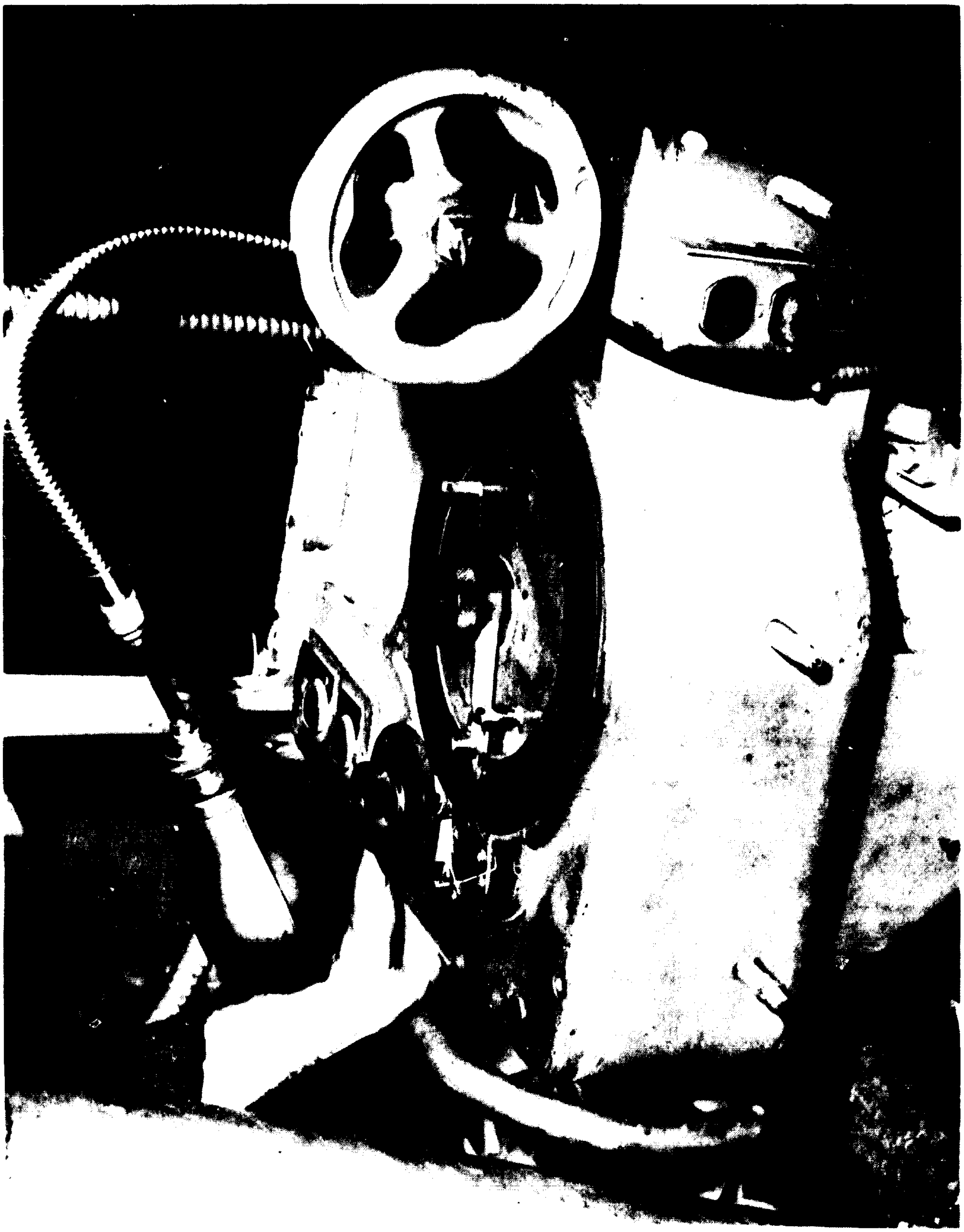
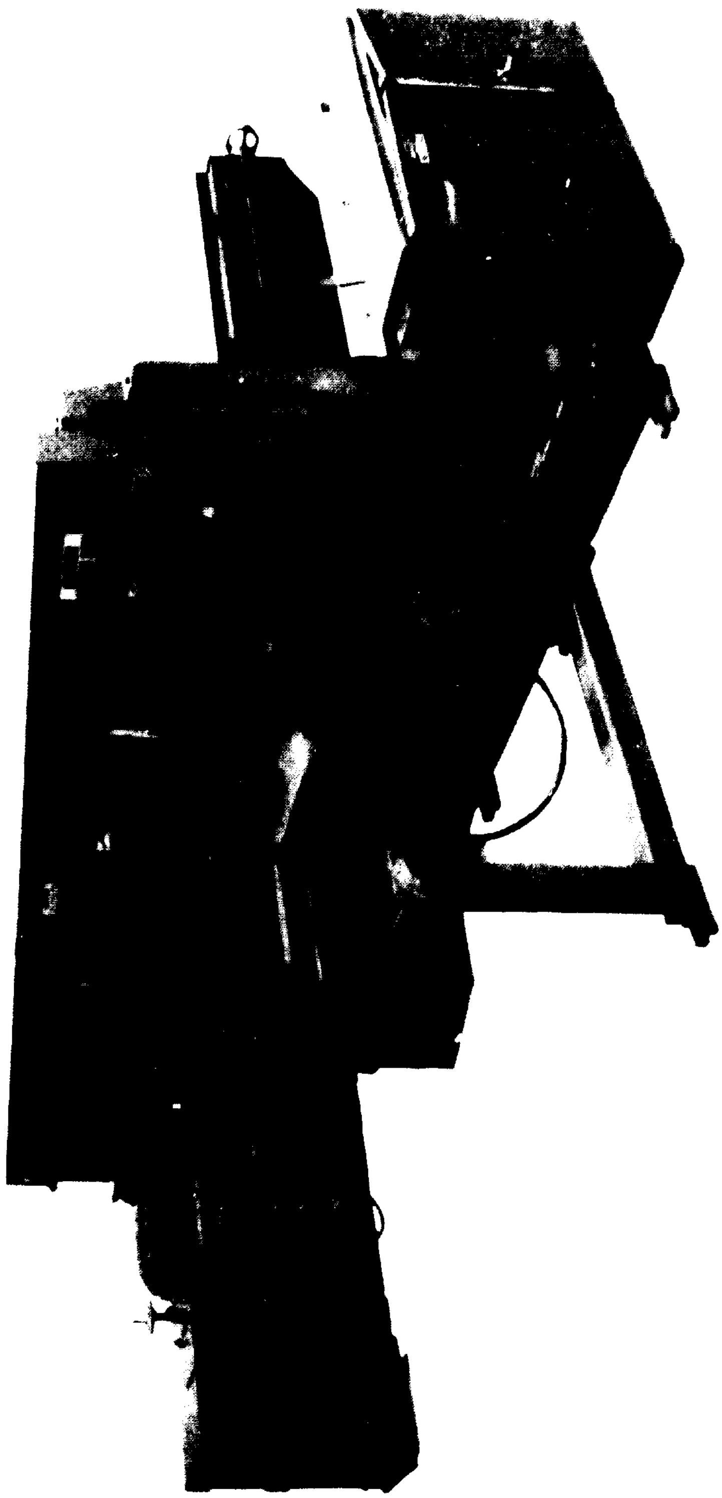


Figure 9



Mereen-Johnson Double End Tenoner

Model #300-2 with tilting trim motors, tilting cope motors and stationary dado arbor assembly. Reference MJ-1967. Photo 321-181.

maximum cutting length, and are equipped with six-foot beams. Medium-duty cutoff saws and tenoners may be equipped with motors up to [illegible] hp at all stations, while their heavy-duty models can accommodate motor h.p. up to [illegible] at all stations. Either block or roller hold-downs may be had on their medium-duty units, while a choice between rubber block, roller, or driven belt hold downs can be incorporated on their heavy duty models.

V. GANG OR MULTIPLE RIPPING

81. Gang or multiple ripping, whichever one chooses to call it, is not employed in so many plants as single-line ripping, but where used, it is highly important. Many are probably not aware that this operation can be performed, in a limited way, on molders equipped with outboard bearing. Limitations are that the same molder can seldom be used steadily for gang ripping, because (1) this would make the machine unavailable for much other important work, and (2) saw-mounting space available is never any greater than working width of the molder itself. Thus, a six-inch molder could only gang-rip material six inches wide maximum, whereas a 12-inch machine would have 12 inches of ripsaw-blade mounting space.

82. However, in plants where the amount of gang ripping is moderate, and where there is enough molder capacity on the floor to handle what gang sawing must be done, it works out well, and saves floor space. In such cases, the bottom spindle of the machine (which is generally the one employed to carry the saw blades), is fitted with a much more powerful motor, of necessity. Sleeves are used which fit the molder spindle properly. On each such sleeve, saw blades and spacers are used, alternately, to build up the ripping pattern desired, so the sleeve with its blades can be put in storage, saving time when the machine setup must be made; also when it is torn down.

83. A given plant may have two or more such sleeves, permanently set up for different ripping patterns. One advantage the molder has, over against any disadvantage, is that the top molder head can be set up for profiling the top surface of stock at the same pass, in such a way that each piece

that each piece produced in the run will have a molded, beveled, or rounded top edge as in cases where heavy thickness stock is being reduced to relatively thin slats, or the like, and what was lumber thickness, prior to gang ripping, becomes width of the slats.

Multiple ripsaws and their design

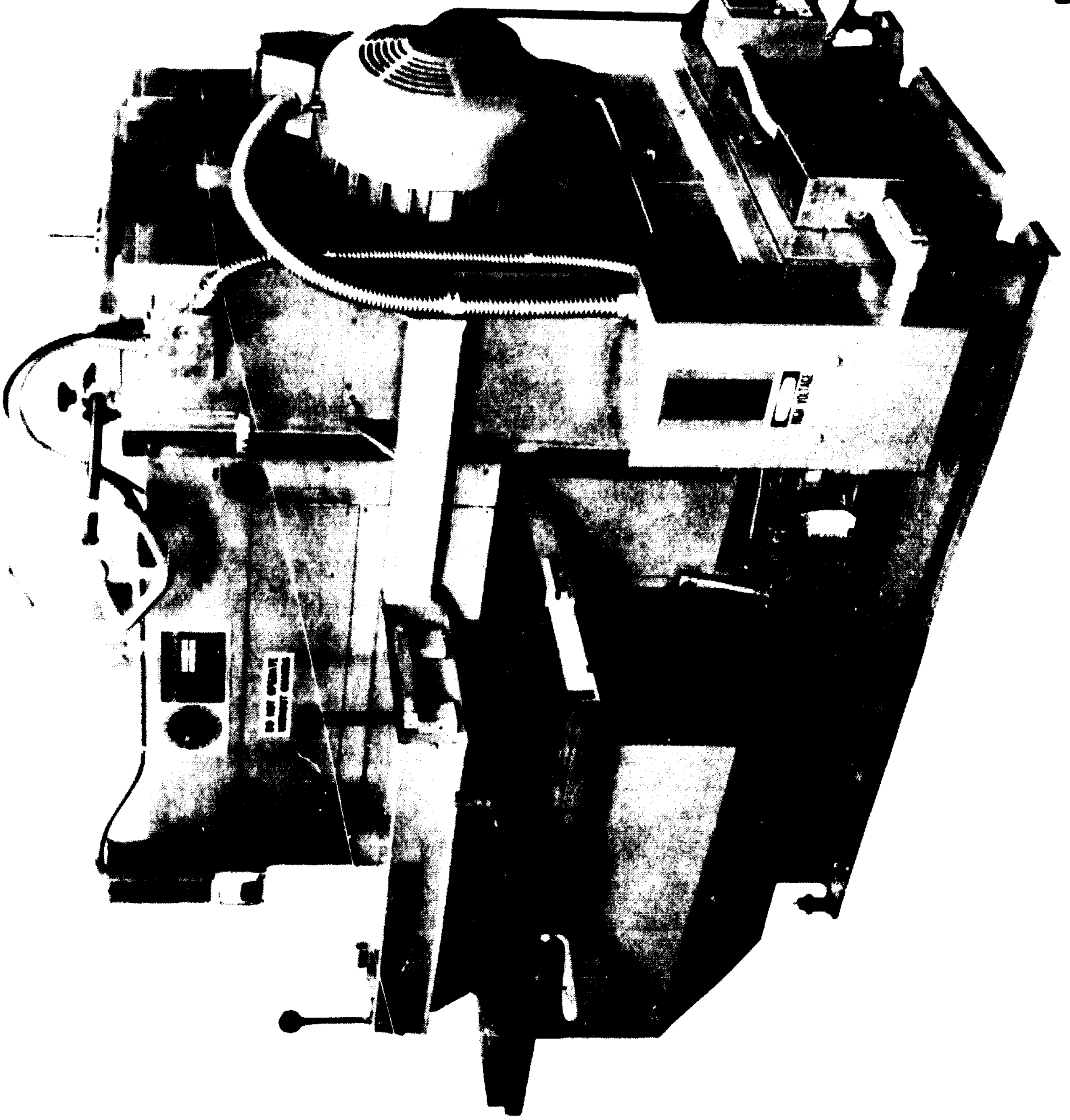
84. Gang ripsaws are made in both roll-feed and chain-feed design in the United States. There can be no doubt about superiority of the chain-feed unit for high-volume work. The first United States manufacturer of chain-feed multiple ripsaws, makes a series of three machines of varying effective saw-mounting space on the arbors; of 12, [illegible], and 24 inches, respectively. Arbor diameter for all three is 2-3/16", complete with a slip-off outboard bearing. All three machines will receive ripsaw blades ranging from 10 to 14 inches diameter.

85. The double -vee feed chains, running on double-vee tracks to match, insure straight-line tracking. This, in turn, provides straight-line ripping. Each "link" in each feed chain is drilled with two vertical holes, making it possible to securely mount bed slats of extruded aluminium across the two feed chains. In operation, the two chains are carried over two pairs of sprockets. The pair of sprockets at the outfeed are driven, and are mounted on the same shaft, so there is no possibility of them getting out of line, or out of time. The result is a straight, level-running bed, except for a short space directly under the spindle. This short space is provided designedly, to "dip" the running bed. (See Figure 10.)

Hardened cams depress bed for blade clearance

86. For this very short space, the machine's running bed is depressed by two, hardened, stationary cams. This permits infinite saw spacing within the arbor range provided for it, and allows the saw teeth to fully penetrate the lumber ripped, without coming into contact with metal bed slats. The feed chains and track are provided with oil mist lubrication. Feed rates are infinitely variable within a range from 50 to 150 feet per minute.

Figure 10



87. This company has also developed a special sleeve-mounting dolly, which greatly simplifies removel and replacement of blade-laden sleeves, and renders this part of the operation as safe as the rest. Another decided convenience is a saw set-up table they provide, which permits simplified "tearing down" of saws and spacers from a given sleeve after the finish of a run; then setting of saws and spacers (on the same sleeve) for an on-coming run that is scheduled, with different saw spacing.

Other multiple straight line ripsaws

88. Another producer of straight-line ripsaws in the United States produces three models of chain-feed units with actual width of their feed chains of 10, 14 and 24 inches. The drive motor for the chain in each case is of stepless, variable-speed type, built in, and provides a 4:1 speed range. The particular range considered standard is 50-200, but one may specify the range when ordering, so long as it is on a 4:1 basis.

89. Either 10 or 12-inch-diameter blades may be used. 10-inch blades, with standard saw spacers, rip to a maximum thickness of 2-9/16 inches, while 12-inch-diameter saw blades will rip maximum thickness of 3-9/16". By using special spacers, smaller in diameter, maximum thickness ripped can be increased to 3 and 4 inches, respectively. The saw-spindle diameter on the smaller machine is 2 inches; on the two other models it is 2-1/2 inches. Importance of maximum width dimension on these machines centres around occasional ripping of panels, and ability to split them down the center. The 10-inch machine has throat clearance, beyond the extreme outboard saw-blade setting, of 27-1/4 inches. This is more than half of 48 inches .... the machine will, therefore split 4-foot-wide panels. The 14-inch machine has throat clearance, in the same type of setting, of 31-1/4 inches, and will, therefore, split 5-foot-wide panels, as will also the 24-inch machine.

Length aspects of material ripped

90. There is no practical limit, of course, to the maximum length of stock that any of the units will rip, provided necessary floor space is left at both infeed and outfeed. There is a short limit, however; this corresponds to the gap between the pressure rolls close to the saws on their infeed and outfeed sides. This short-length limit is 16 inches on all three models. Should circumstances in any given plant require, however, optional addition can be made of two, short-stock, hold-down roller assemblies, which make it possible to rip stock as short as 9-1/2 in., without pressure shoes. The machines have six, overhead, idle, ball bearing, pressure rollers, which properly distribute feed pressure.

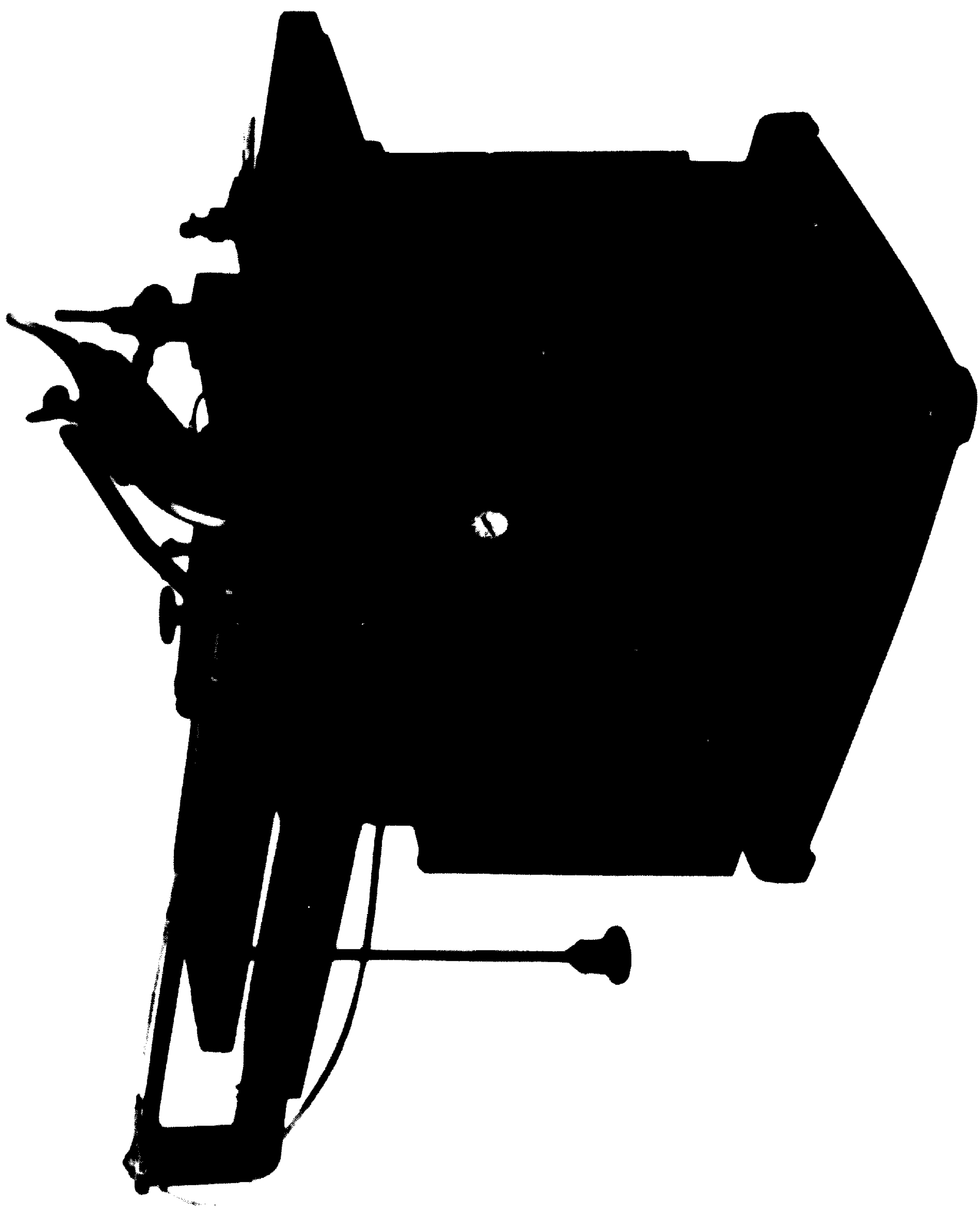
91. These pressure rollers may be adjusted to feed for either straight-line or glue-joint ripping. They are properly retained in an overhead pressure assembly. This pressure assembly can be raised, by means of an overhead power hoist, to an opening of 8 inches, through emplyoment of a built-in, 3/4 h.p. motor. When so raised, adequate room is provided for fast set-ups and adjustments. The same company also furnishes a lower cost, roller-feed gang ripper, which space allowance forbids describing

VI. TILTING ARBOR SAW BENCHES

92. These are sometimes called variety saws. A major United States manufacturer has two models, one is unique because it incorporates two separate motors, any one of which can be used at a time. One carries a cutoff blade; the other a ripping blade. Thus, constant changing from rip to cutoff blades on a single arbor is eliminated, with large saving in operator and machine time. (see Figure 11).

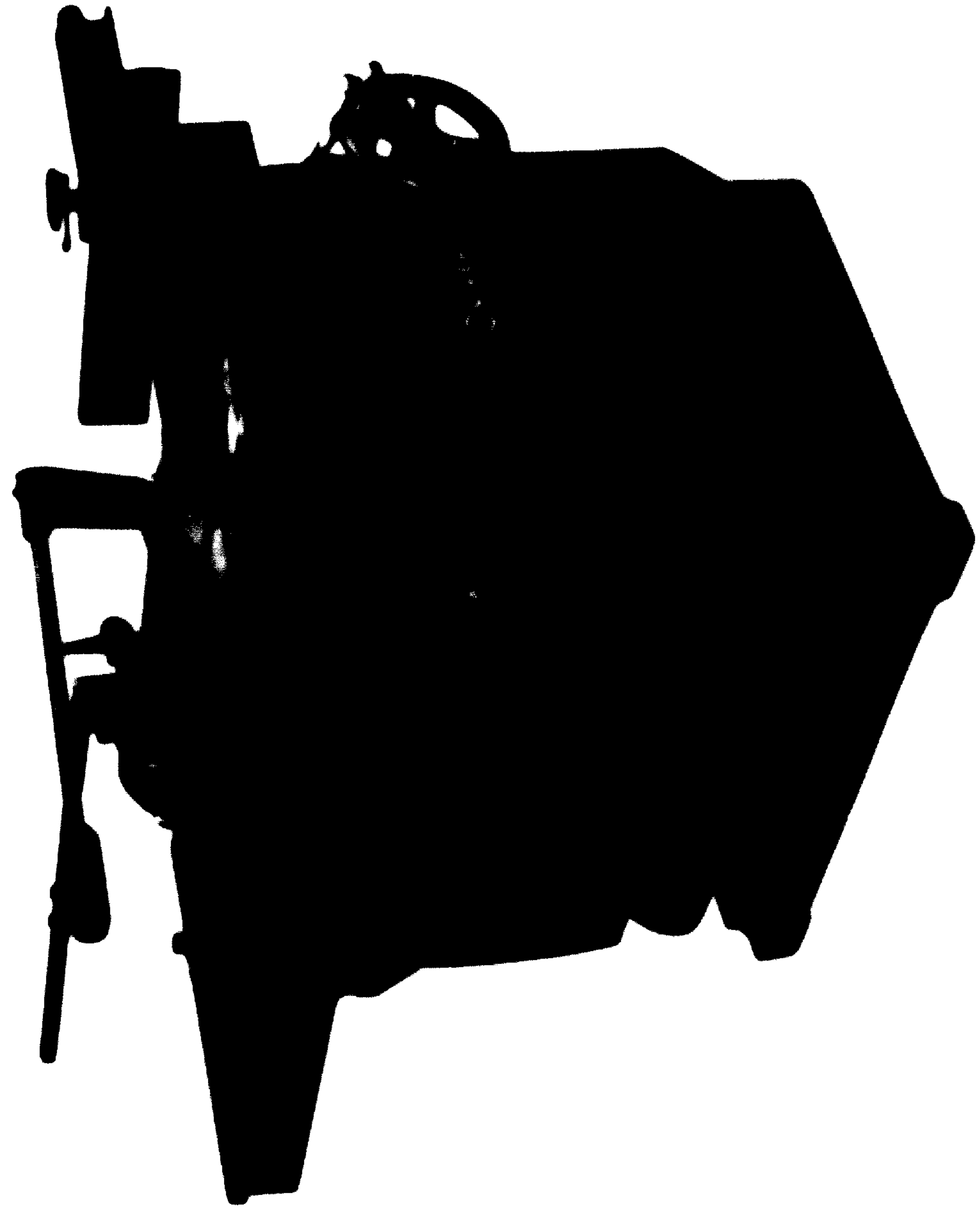
93. Their machine carries saws up to 18-inches in diameter. A blade this size will project 4-3/4 inches through the table, and cut material of approximately this thickness, either cross-cut or rip. The machine rips material up to 32 inches wide with a non-tilt fence having micrometer adjustment; up to 30 inches with a tilting-type micrometer fence. Mitres or dadoes are cut square, or at any angle up to 45 degrees. Special table extensions are available on special order, which allow ripping widths up to 72 inches. Dado heads up to 3/4 inch wide can be mounted directly on the arbor; wider dadoes can be machined by using a wider head, mounted on a dado sleeve.

Figure 11



94. T-slots are cut in the top surface of the machine table, on each side of saw position, to accommodate universal miter gauges, with which square cutting off, miter cutting bevel cutting, or combination miter and bevel cuts may be performed, across grain. When a universal miter gauge is not in use, T-slots employed to retain it may be filled in with metal strips, to avoid pinching finger tips, etc. Practically any kind of sawing job is done here that cannot be economically performed elsewhere. (See Figure 12.)

Figure 12



United Nations Industrial Development Organization

[illegible] Summary

[illegible]

ORIGINAL: English

[illegible]

[illegible]

SUMMARY

Cutoff saws and [illegible] are [illegible] of the [illegible] important and common wood-working machines for furniture and [illegible] production.

Cutoff saws include those [illegible] swing, straightline, and hydraulic motion and are used for selecting and cutting rough lumber to length. The blades are usually 22 inches in diameter, [illegible] and with 100, [illegible], [illegible] or 200 teeth.

Research into means of automating the operation to increase productivity and yield is being carried out at the Forest Products Laboratory, Madison, Wisconsin, North Carolina State University, and the Oliver Machinery Co., Grand Rapids, Michigan, all in the U.S.A. The components of the Oliver No. [illegible] system and

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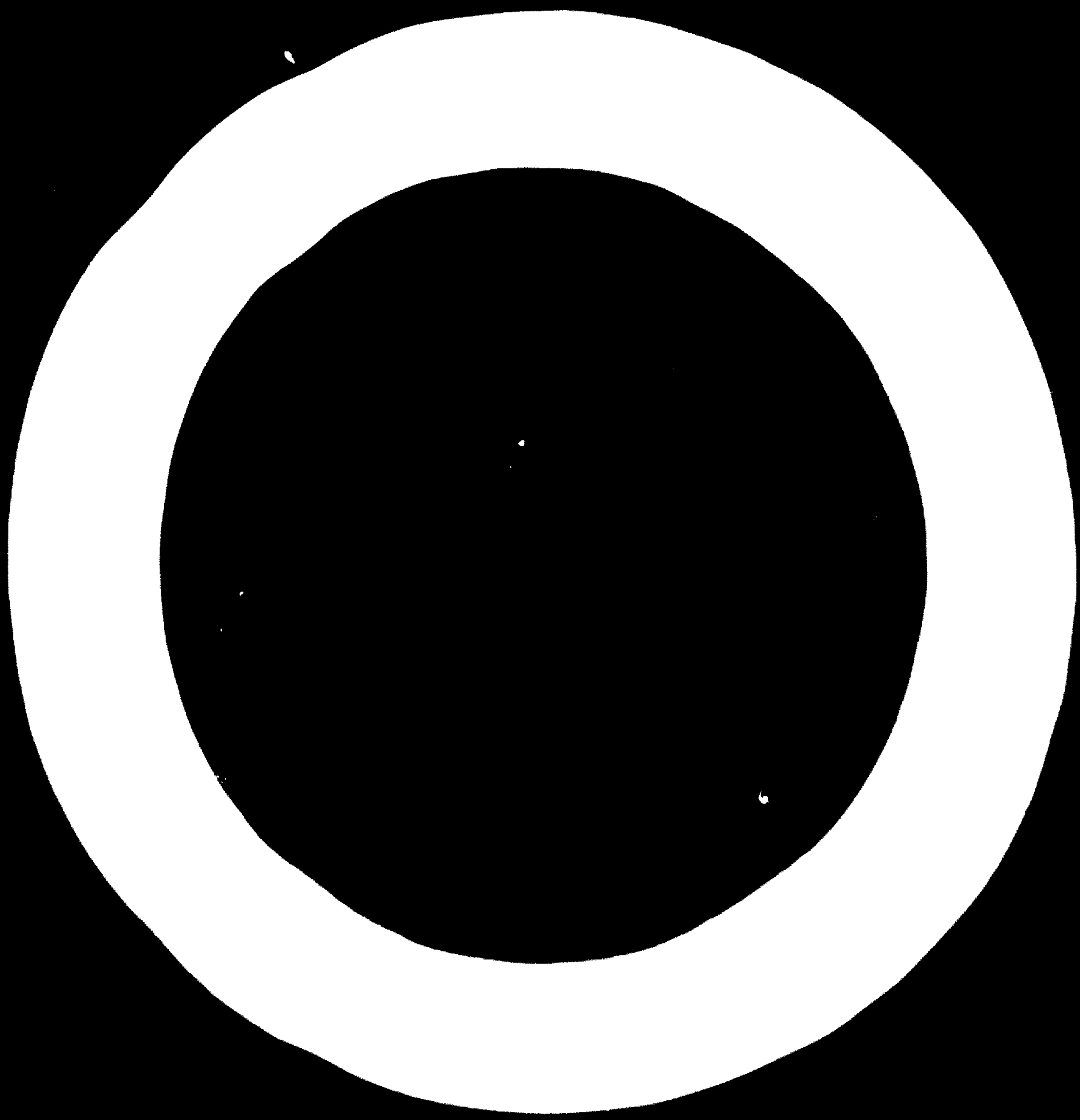

its operation is described in detail. Its main features are a computerized defect locating system which is programmed to maximize cutting yield and fill any cutting bill of several different lengths.

Ripsaws have not yet seen computerization in this sense but work is underway.

The feed chain and the precision casting for its bearing surfaces is gone into in detail. Extreme rigidity and control are of the essence here. Lubrication and other maintenance advice is given as well.

Double-end cutoff saws and tenoners also employ circular saws and can be extremely useful in workshops. Tilting spindles increase their versatility and so can be used for a wide variety of jobs. Dado attachments and scoring saws may also be added. The setting of these machines must be very precise - to accuracies of 0,005 inch- to ensure consistently uniform [illegible].

Gang or multiple ripsaws can be replaced to some extent by moulders with circular saws, but their capacity is limited by width. Multiple ripsaws can be made wide enough to be used as panel splitters with throat clearances of up to 31 1/4 inches. There is practically no length limitation to material being cut.

Tilting arbor saw benches, or variety saws, can have both cross cutting and ripping blades, can niches or dadoes and do virtually any cutting job that cannot be done economically elsewhere.

Distr. LIMITEE

ID/WG.151/17 RESUME
8 août 1973

FRANCAIS
Original : ANGLAIS

Organisation des Nations Unies pour le développement industriel

Réunion technique sur le choix des machines dans l'industrie du bois

Vienne, 19-23 novembre 1973

RESUME

SELECTION DE MACHINES DE REPRISE : SCIES CIRCULAIRES[1/]

par
Alan C. Mattison
Président du Conseil d'administration et Directeur financier
Mattison Machine Works
Rockford, Illinois
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Les scies à tronçonner et à déligner sont probablement les machines à bois les plus importantes et les plus répandues dans l'industrie du meuble et la menuiserie.

Les scies à tronçonner peuvent être à mouvement pendulaire, à mouvement d'avance rectiligne et à mouvement hydraulique. Elles sont utilisées pour l'élimination des défauts et pour le débitage des grumes à la longueur désirée. Les lames utilisées ont généralement un diamètre de 22 pouces (0,55 m environ), une épaisseur de 3,25 mm/2 mm/3,25 mm (normes américaines : 8-12-8) et ont 130, 150, 1[illegible]0 ou 200 dents.

Des recherches en vue d'automatiser les opérations de coupe afin d'améliorer la productivité et le rendement sont menées actuellement aux Etats-Unis par le Forest Products Laboratory, de Madison (Wisconsin), l'Université d'Etat de Caroline du Nord et la firme Oliver Machinery Co. de Grand Rapids (Michigan). L'auteur décrit en détail les éléments du système No 694 de la Société Oliver et son fonctionnement. Sa caractéristique principale est un système de repérage des défauts par ordinateur qui est programmé de manière à maximiser le rendement des opérations de sciage, quelle que soit la longueur des coupes.

1/ Les opinions exprimées dans le présent document sont celles de l'auteur et ne reflètent pas nécessairement les vues du Secrétariat de l'ONUDI.

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On n'a pas encore réussi à asservir les scies à déligner à un ordinateur comme les scies à tronçonner, mais des recherches sont menées dans ce sens.

La chaîne d'alimentation et les pièces coulées de précision pour les surfaces de roulement du bois sont étudiées en détail. Il importe que la rigidité et le contrôle soient parfaits. Les procédures de graissage et d'entretien sont indiquées par l'auteur.

Les machines doubles à tronçonner et à tenonner utilisent des scies circulaires et peuvent être extrêmement utiles dans les ateliers de menuiserie. L'adjonction de porte-outils inclinables permet de les utiliser pour une grande variété de travaux. Des accessoires pour rainurer peuvent également être montés sur ces machines. Leur réglage doit être extrêmement précis; les tolérances sont de 0,005 de pouce afin d'assurer l'uniformité dimensionnelle des pièces façonnées.

Les scies à déligner alternatives ou multiples peuvent être remplacées, dans une certaine mesure, par des machines à moulurer équipées de scies circulaires, mais leur capacité est limitée en largeur. Les scies à déligner multiples peuvent être suffisamment larges pour être utilisées pour le débitage des panneaux ayant jusqu'à 31 ½ pouces (0,78 m environ) de largeur. Il n'y a pratiquement aucune limitation en ce qui concerne la longueur des bois à couper.

Les scies d'établi à arbre inclinable, ou scies spéciales, peuvent être équipées de lames pour coupe latérale et pour délignage, elles peuvent exécuter des rainures et pratiquement tout travail de coupe qui ne peut être réalisé économiquement sur une autre machine.

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