July 15, 1969 W. L. JACKSON, JR., ET AL 3,455,193

MATERIAL SHEAR

Filed July 11, 1966 5 Sheets-Sheet 1

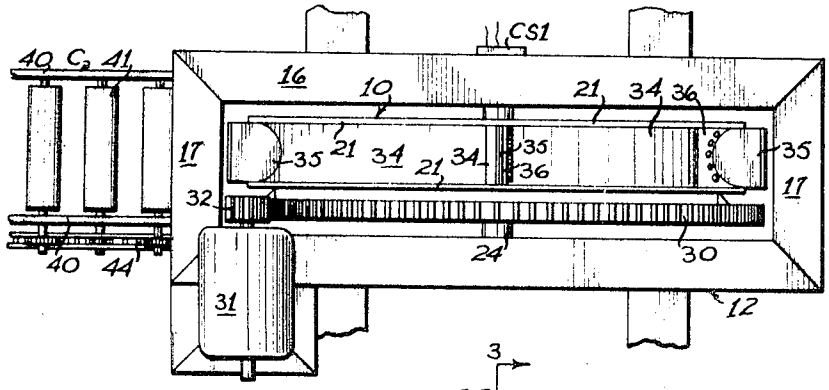


Fig 2

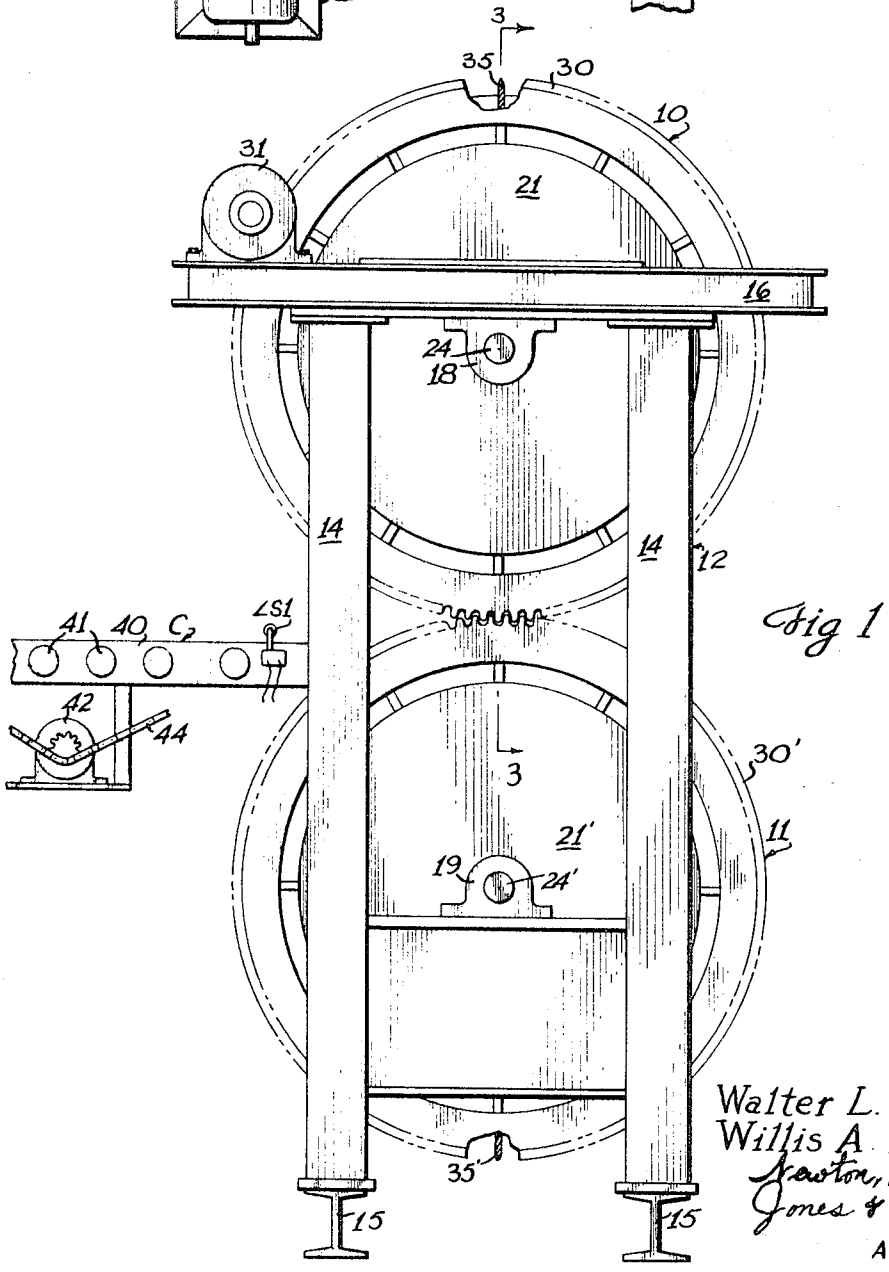


Fig 1

INVENTORS
Walter L. Jackson Jr
Willis A. Head
Braxton, Hopkins, Jones & Ormsby
ATTORNEYS

July 15, 1969 W. L. JACKSON, JR., ET AL 3,455,193

MATERIAL SHEAR

Filed July 11, 1966 5 Sheets-Sheet 2

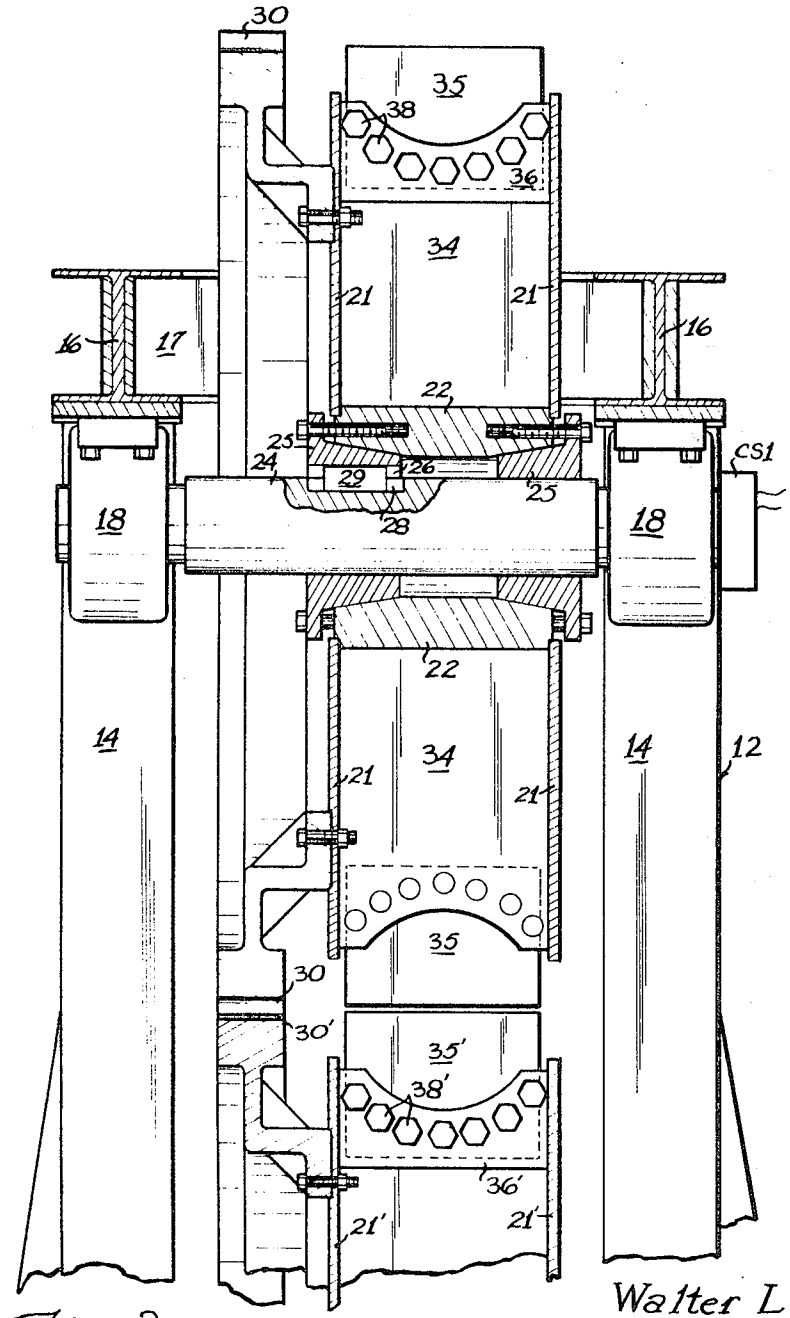


Fig 3

INVENTORS
Walter L. Jackson Jr.
Willis A. Head
Newton, Hopkins, Jones & Ormsby
ATTORNEYS

July 15, 1969 W. L. JACKSON, JR., ET AL 3,455,193

MATERIAL SHEAR

Filed July 11, 1966 5 Sheets-Sheet 3

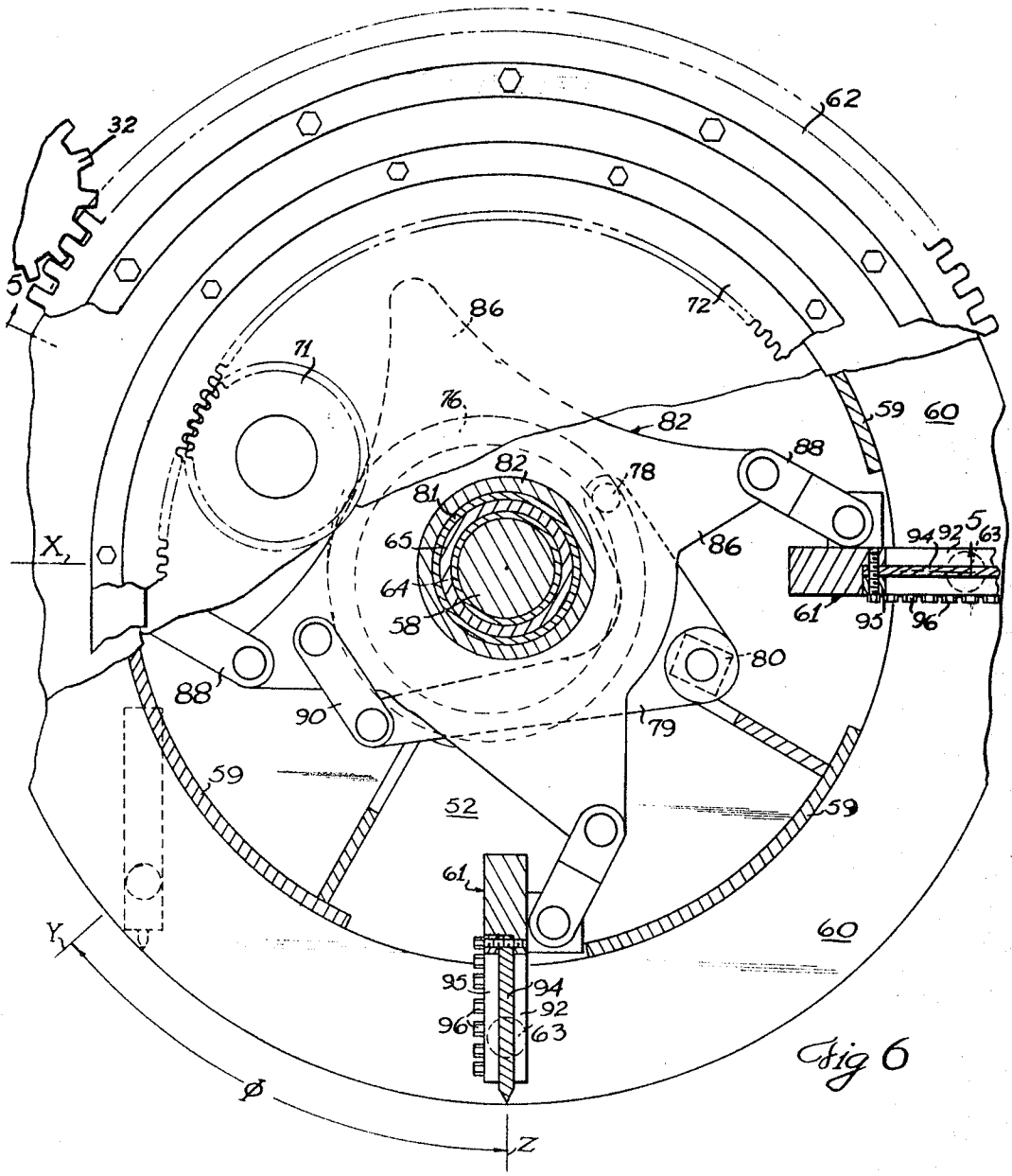


Fig 6

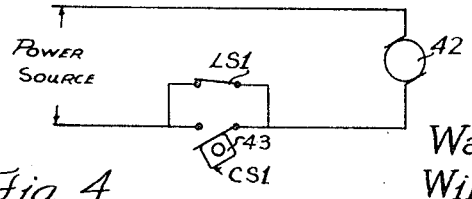


Fig 4

INVENTORS
Walter L. Jackson, Jr.
Willis A Head

July 15, 1969 W. L. JACKSON, JR., ET AL 3,455,193

MATERIAL SHEAR

Filed July 11, 1966 5 Sheets-Sheet 4

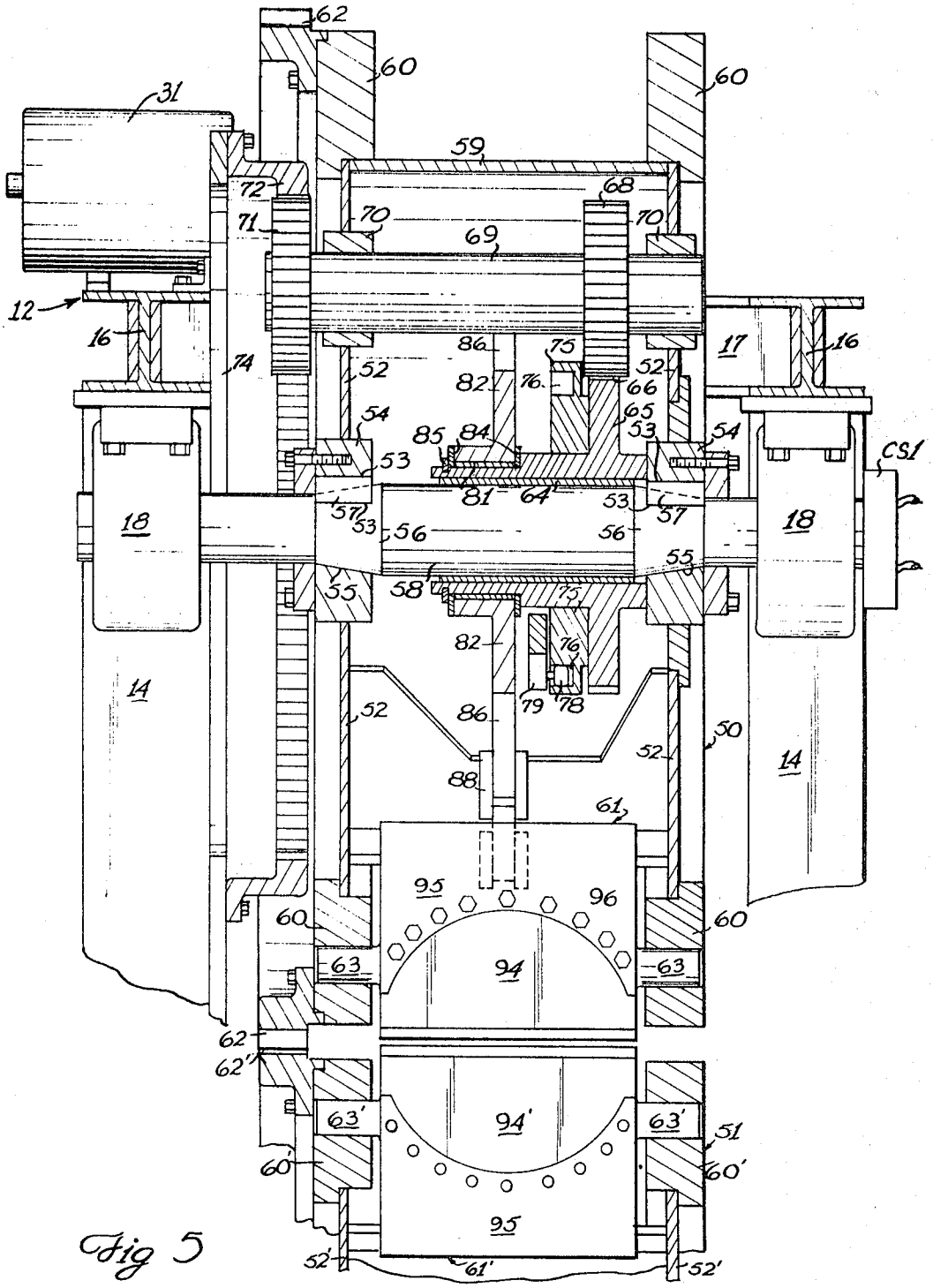


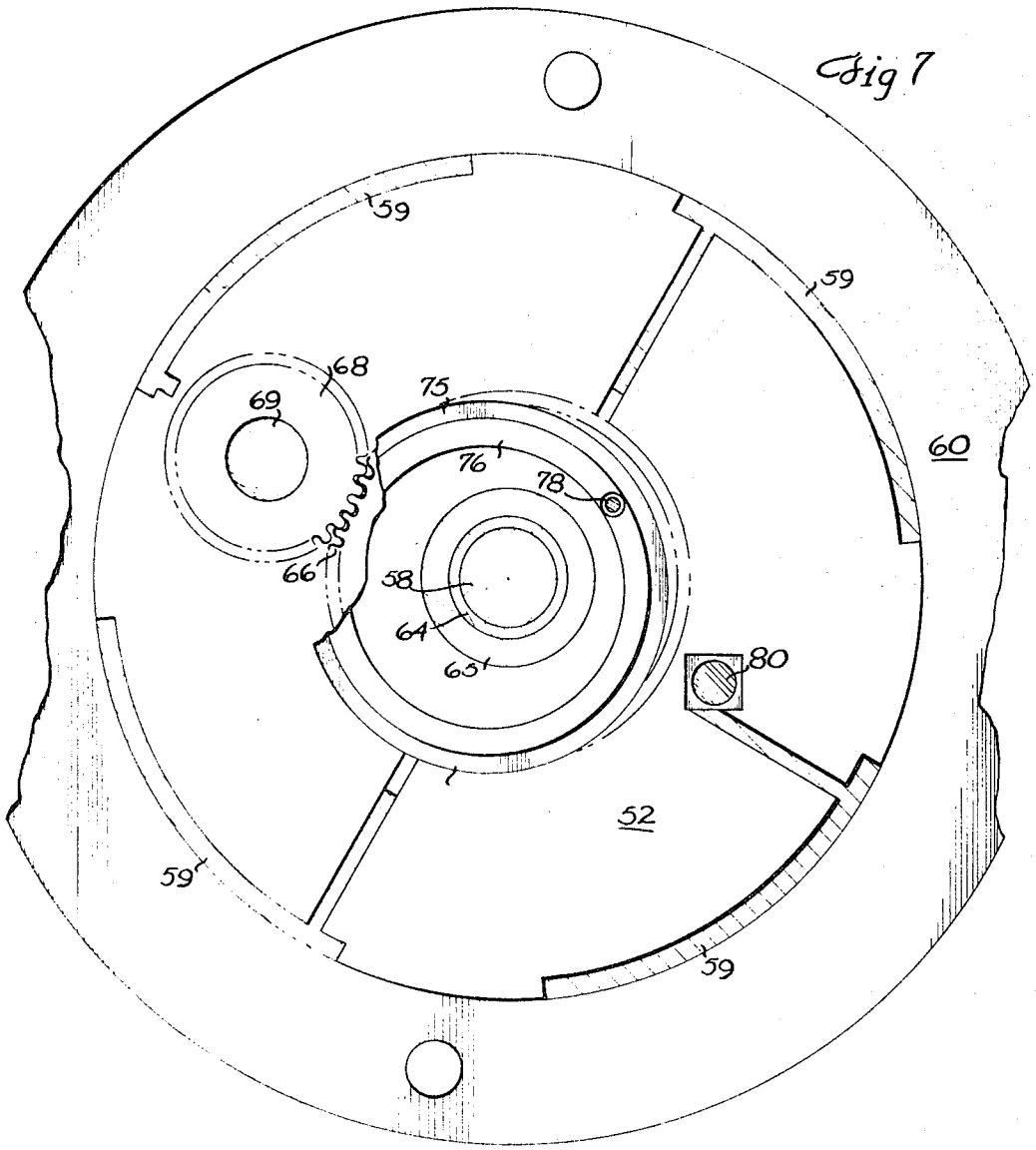
Fig 5

July 15, 1969 W. L. JACKSON, JR., ET AL 3,455,193

MATERIAL SHEAR

Filed July 11, 1966 5 Sheets-Sheet 5

Fig 7



INVENTORS
Walter L. Jackson Jr
Willis A. Head
Newton, Hopkins,
Jones & Ormsby
ATTORNEYS

United States Patent Office 3,455,193 Patented July 15, 1969

3,455,193

MATERIAL SHEAR

Walter L. Jackson, Jr., 3300 Baisden Road 32503, and Willis A. Head, 2015 E. LaRua 32501, both of Pensacola, Fla.

Filed July 11, 1966, Ser. No. 564,375
Int. Cl. B26d 1/40, 1/56
U.S. Cl. 83—337 6 Claims

ABSTRACT OF THE DISCLOSURE

A device for severing logs into predetermined lengths including a pair of driven rotatable members, each pivotally carrying a plurality of knives about the periphery thereof. A cam member having a cam race is carried by each member and a cam follower is positioned in the cam race and connected to the knives of the member to maintain the knives in a vertical attitude during the severing of the log into lengths. A conveyor system is provided which feeds the logs to the device in an end-to-end fashion, and includes a conveyor for moving the logs and a switch means associated with the conveyor and rotating members to cause the log to be fed to a predetermined point, held at this point until the knives are moved to a predetermined point, and then fed into the device synchronously with the rotation of the knives.

This invention relates generally to material handling equipment and more particularly to a device for cutting logs to predetermined lengths by shearing action.

In the past, trees have been cut in the field to certain predetermined lengths before being shipped to a pulp mill for processing into paper and as a result of the receipt of logs of a predetermined length, these pulp mills have designed all of their equipment to handle logs of a predetermined length.

Subsequently, however, it was found to be still more economical to deliever the logs to a pulp mill in a delimbed tree form without being cut to predetermined lengths. This change has created problems in the operation of pulp mills since it is necessary to cut the trees to a predetermined length at the mill before the logs can be processed through the other pulp mill machinery.

This invention is an attempt to overcome this problem by providing a device which will efficiently and effectively cut logs received at the pulp mill to predetermined lengths for feeding to the machinery in the pulp mill. The apparatus embodying the invention will cut logs received at the pulp mill into the predetermined lengths with great rapidity so that the processing equipment of the pulp mill will be continuously fed with these logs to predetermined lengths for processing into paper.

The apparatus of the invention comprises a pair of synchronized rotatable members each further carrying a knife member so that when a log is caught between the synchronously rotating members, the knives will serve to shear the log into predetermined lengths for subsequent feeding to a pulp mill machine since the speed of the logs being fed relative to the speed of the knives is also synchronized. Means are also provided for initially starting the log between the rotating members at a predetermined time so that the first cut of the log will be the desired predetermined length.

One embodiment of the invention includes means for

maintaining vertical attitude of the knives during the shearing operation to prevent binding of the knives and tearing of the log during the shearing operation.

These and other features and advantages of the invention will become more clearly understood upon consideration of the following specification and accompanying drawings wherein like characters of reference designate corresponding parts throughout and in which:

FIG. 1 is a side elevational view of one embodiment of the invention;

FIG. 2 is a top plan view of that embodiment of the invention shown in FIG. 1;

FIG. 3 is a cross-sectional view taken along the line 3—3 in FIG. 1;

FIG. 4 is a schematic representation of the control circuit for the means for supplying logs to the apparatus of the invention;

FIG. 5 is a cross-sectional view of a second embodiment of the invention with means for providing the correct vertical attitude of the knives during the shearing operation;

FIG. 6 is a side elevational view of one of the rotating members of the second embodiment of the invention shown in FIG. 5 with parts thereof broken away to show the internal construction thereof; and,

FIG. 7 is a cross-sectional view taken along the line 7—7 in FIG. 5 showing the cam which maintains the vertical attitude of the knives during the shearing operation.

These figures and the following detailed description disclose specific embodiment of the invention; however, it is to be understood that the inventive concept of the invention is not limited thereto since it may be embodied in other equivalent forms.

Referring to FIG. 1, it will be seen that the apparatus of the first embodiment of the invention comprises of first upper rotating member **10** and a second lower rotating member **11** rotatably mounted on a frame **12**. The frame **12** comprises generally four spaced upright standards **14** fixedly mounted on transverse connecting beams **15** at the base thereof and joined at their upper ends by longitudinally extending support beams **16**. The support beams **16** extend outwardly past each of the upright standards **14** and are joined at their outermost ends by transverse braces **17**. The upper rotating member **10** is rotatably mounted in bearings **18** attached to the underside of the longitudinal support beams **16** and the lower rotating member **11** is rotatably mounted, in bearings **19** carried by longitudinally extending support braces **20**.

Since the rotating member **10** is identical to the rotating member **11** and rotated oppositely thereto, only the rotating member **10** will be described in detail and the corresponding parts of the member **11** will be indicated by primes of the reference numerals applied to the parts of the rotating member **10**. Referring to FIGS. 1–3, it will be seen that the upper rotating member **10** comprises circular side plates **21** fixedly mounted to an inner annular support sleeve **22** fixedly located on an axle **24** by a pair of wedging cones **25**. It will also be seen that one of the wedging cones **25** includes a keyway slot **26** therein which mates with a keyway slot **28** in the axle **24** to receive a key **29** therein to prevent rotational movement of the wedging cones **25** with respect to the axle **24**. Since the axle **24** is rotatably journaled in the bearings **18**, it will be seen that rotation of the side plates **21** will rotate the axle **24** in the bearings **18**.

Mounted on the outside of one of the side plates 21 is a ring gear 30 having an outside diameter slightly greater than the diameter of the side plates 21. The bearings 18 and 19 position the axles 24 and 24' of the upper and lower rotating members 10 and 11 so that the ring gears 30 and 30' thereof mesh at their common point of tangency to synchronize the rotation of the lower member 11 with the rotation of the upper member 10. Therefore, it can be seen that, when the motor 31 rotates the pinion 32 drivingly engaging the ring gear 30 of the upper rotating members 10 both the upper and lower rotating members 10 and 11 will be synchronously driven.

Positioned between the side plates 21 and extending radially outwardly from the annular ring 22 are a plurality of equidistantly spaced blade support plates 34 having a semicircular recess at the outer extending ends thereof to prevent engagement of the plates 34 with a log passing between the rotating members 10 and 11. A blade 35 is carried at the outer extending end of each of the support plates 34 and is fixedly attached to the support plates 34 through mounting plates 36 having bolts 38 extending therethrough and engaging the support plates 34. It will be seen that, in this particular embodiment of the invention, there are four blades 35 mounted ninety degrees apart. It will also be seen that the rotating members 10 and 11 are synchronized so that when one of the knives 35 of the rotating member 10 is in its lower vertical position, the complementary knife 35' in the rotating member 11 is in its upper vertical position so that the knives 30 and 35' are aligned. To insure that the log extended between the rotating members 10 and 11 at their common point of tangency is completely sheared into, the knives 35 and 35' almost engage with each other.

A conveyor C is provided for feeding logs to the common point of tangency between the rotating members 10 and 11 and includes a pair of side support plates 40 attached to the upright standards 14 and rotatably mounting therebetween a plurality of rolls 41. The rolls 41 are driven by a motor drive unit 42 through a conventional chain and sprocket arrangement 44 so that all of the rolls 41 are driven in the same rotational direction, herein shown as clockwise in FIG. 1. A limit switch LS1 is positioned in the conveyor C just prior to entry of the log between the common point of tangency of the members 10 and 11 and serves to stop the motor drive unit 42 until a cam switch CS1, having a cam 43, is activated to again start the motor drive unit 42 and drive the log between the members 10 and 11. The cam switch CS1 is effective to prevent a log from entering between the members 10 and 11 until the proper instance when the first cut of the log will be at the predetermined length for feeding into the machinery at the pulp mill. When the first set of knives 35 and 35' engage the log, they will serve to drive the log forward until the next pair of knives 35, and 35' engage the log to shear it and this process is repeated until the log has been completely cut. If the log is of a small diameter, the conveyor C also assists in driving the log forward at the proper speed between cuts.

Referring to FIGS. 5–7, it will be seen that the second embodiment of the invention comprises a first upper rotating member 50 and a second lower rotating member 51 rotatably carried in the frame 12 by the bearings 18 and 19. Since the upper and lower rotating members 50 and 51 are identical and rotated oppositely, only the upper rotating member 50 will be described in detail and primes of the reference numerals applied to the component parts of the upper rotating member 50 will be applied to the corresponding component parts of the rotating member 51.

It will be seen that the upper rotating member 50 comprises generally a pair of spaced side plates 52 concentrically mounted on inner support rings 54 each having a conically tapering hole 55 therethrough. The support sleeves 54 engage complementary tapering wedge sections 56 of a support axle 58 which is rotatably journaled in the bearings 18.

The rings 54 and wedge sections 56 have appropriate keyway slots 53 therein to receive a key 57 which prevents rotation of the plates 52 with respect to the axle 58. As shown in FIGS. 5 and 6, the outer peripheral edges of the side plates 52 are joined by arcuate spacer segments 59 effective, in conjunction with the support rings 54, to maintain the sides plates 52 in spaced alignment. Also attached to the outer peripheral edge of each of the side plates 52 is an annular support ring 60. The rings 60 pivotally carry knife mountings 61 therebetween on bearing pins 63. There are four knife mountings 61 associated with the rotating member 50 and are equally spaced around the periphery of the support rings 60 so that they are located ninety degrees apart.

Attached to the outside of one of the support rings 60 is a ring gear 62 which is engaged by the pinion 32 of the motor 31 and engages the ring gear 62' of the rotating member 51 at their common points of tangency. It will be seen, then, that the second embodiment of the invention is driven in the same manner as the first embodiment of the invention.

Rotatably mounted on a bearing sleeve 64 fixedly mounted on the axle 58 between the tapered wedge portions 56 is a cam support member 65 having gear teeth 66 around the outer periphery thereof effective to engage a gear 68 fixedly carried on a shaft 69 rotatably mounted in supports 70 in each of the side plates 52. The extending end of the shaft 69 has fixedly mounted thereon a gear 71 which is outside the side plates 52 and is effective to be engaged by a ring gear 72 fixedly mounted on the frame 12 by a support plate 74. Therefore, it will be seen that, as the upper member 50 is rotated, the gear 71 will be rotated with respect to the ring gear 72 so that the gear 68 will be rotated in like manner to drive the rotatable cam support member 65.

A cam race member 75 is fixedly mounted to one side of the cam support member 65 and has a cam race 76 therein for the receipt of a cam follower 78 therein which is rotatably mounted on one end of a connecting link 79 pivotably mounted intermediate its ends to a support 80 attached to one of the side walls 52. Therefore, it will be seen that as the upper member 50 is rotated, the cam race member 75 will be rotated so that cam follower 78 will be moved toward and away from the center of rotation of the upper member 50.

A bearing sleeve 81 is fixedly mounted on one end of the cam support 65 and rotatably carries a web 82 thereon maintained in place between a pair of retaining plates 84 held thereon by a lock ring 85. The web 82 has four extending connecting arms 86 extending outwardly therefrom and equally spaced thereabout which engage the outer extending ends of connecting links 88 which are pivotally connected to the knife mountings 61 and to the extending end of the connecting arms 86, it being seen that each arm 86 is connected to one of the mountings 61.

It will be seen that the connecting link 79 is a V-shaped link having its one end rotatably carrying the cam follower 78 and its other end pivotally connected to one end of a transfer link 90 which in turn is pivotally attached to the web 82. The position of the web 82, then, is determined by the position of the cam follower 78 within the cam race 76.

Each of the knife mountings 61 includes a mounting block 92 carrying therein a knife 94 held in place by a retaining plate 95 through bolts 96. It will be noted that a semi-circular recess is provided in the outer extending ends of the retaining plate 95 and mounting block 92 to allow the knife 94 to cut into a log without contacting the mounting block 92 or retaining plate 95.

It will be seen that the particular configuration of the cam races 76 and 76' will depend on the desired manipulation of the knives 94 and 94' as the members 50 and 51 are rotated. In this particular embodiment of the invention, the cam races 76 and 76' are such that, if the cam members 75 and 75' are rotated four times for each

revolution of the members **50** and **51**, one complete manipulation cycle is accomplished for each ninety degrees of rotation of the members **50** and **51**.

During each manipulation cycle, the cam races **76** and **76'** are such that the knives **94** and **94'** are radially disposed when the knives **94** and **94'** are located at points X and X' but are moved to a vertical position by the cam races **76** and **76'** by the time the members **50** and **51** have rotated to the point Y and Y'. The knives **94** and **94'** are maintained in a vertical attitude through the angles φ and φ' until they reach the points Z and Z' at the common point of tangency of the members **50** and **51**.

It will be noted that the entire shearing of the log passing between the members **50** and **51** takes place as the knives **94** and **94'** rotate through the angles φ and φ'. Therefore, the knives **94** and **94'** are maintained in a vertical attitude during the shearing of the log. Since the cam members **75** and **75'** are rotated four times for each revolution of the members **50** and **51**, it will be seen that the knives **94** and **94'** are radially located at zero degrees, ninety degrees, one hundred eighty degrees and two hundred seventy degrees of rotation of the members **50** and **51** and that a complete manipulation cycle takes place between each of these rotational positions.

Operation

In operation of the first embodiment of the invention, it will be seen that a log is fed on the conveyor C until limit switch LS1 is activated to open the circuit to the motor drive unit **42** and stop the feeding of the log on the conveyor C. As soon as the contacts of the camming switch CS1 are closed, the log is propelled toward the common point of tangency of the rotating members **10** and **11**. It will be seen then that knives **35** and **35'** engage the log and shear the log while simultaneously forcing the log along through the device. Then the next pair of knives **35** and **35'** engage the log and shear the log. This process continues until the log is completely cut to predetermined lengths. By this time another log is in position on the conveyor C to be fed into the device for shearing the log into predetermined lengths.

In the second embodiment of the invention it will be seen that the logs are fed between the common points of tangency of the rotating members **50** and **51** in the same manner as in the first embodiment of the invention. However, the cam members **75** and **75'** are rotated by the gears **68**, **71** and **72** at a speed sufficiently fast to cause the webs **82** and **82'** to be so positioned by the connecting links **79** and **79'** that each of the knives **94** and **94'** will be vertically positioned during travel through the angles φ and φ' during the shearing of the log. In this particular instance, the cam members **75** and **75'** are rotated four times as fast as the rotation of the members **50** and **51** since it is necessary that a manipulation cycle be repeated four times during each revolution of the members **50** and **51** to maintain vertical attitude of the knives **94** and **94'** during the cutting of the log. It will thus be seen that the rotational speed of the cam members **75** and **75'** must be the number of knives **94** or **94'** mounted within the rotating members **50** or **51**. One rotational speed of the members **50** and **51** has been found effective if one shearing operation is completed each second. It will also be noted that the circumferential distance between the knives **94** and **94'** will be the cut lengths of the logs passing therebetween.

Although specific embodiments of the invention have been disclosed in the above specification, it is to be understood that other embodiments of the invention may be used without departing from the scope thereof as defined by the appended claims.

What is claimed as our invention is:

1. Apparatus for cutting material into predetermined lengths including:

a pair of rotatable members;

at least one knife pivotally carried by each of said rotatable members adjacent the circumference thereof, said knives being aligned at least at one point during the cutting of the material;

a conveyor means for feeding the material to the proximity of said knives in synchronized relation to the rotation of said rotatable members; and

positioning means carried by at least one of said rotatable members for maintaining each of said knives in a vertical attitude during the cutting of the material, said positioning means including a cam means and means for connecting said cam means to said knives to maintain the vertical attitude of said knives during the cutting of said material.

2. Apparatus for cutting material into predetermined lengths including:

a pair of rotatable members;

at least one knife pivotally carried by each of said rotatable members adjacent the circumference thereof, said knives being aligned at least at one point during the cutting of the material;

a conveyor means for feeding the material to the proximity of said knives in synchronized relation to the rotation of said rotatable members; and

positioning means carried by at least one of said rotatable members for maintaining each of said knives in a vertical attitude during the cutting of the material, said positioning means including a cam means and means for connecting said cam means to said knives to maintain the vertical attitude of said knives during the cutting of the material, said cam means including a cam member having a cam race therein rotatably mounted in each of said rotatable members and a cam follower positioned in said cam race for selectively positioning said connecting means, said cam member being selectively rotated to properly position said cam follower and said connecting means to maintain said knives in a vertical attitude during the cutting of said material.

3. Apparatus for cutting material into predetermined lengths as set forth in claim **2** and further characterized in that said connecting means includes a rotatable web mounted in each of said rotatable members and operably connected to said cam follower and said knives, said web being effective to position said knives in response to movement of said cam follower.

4. Apparatus for cutting material into predetermined lengths as set forth in claim **3** and further characterized by including means for rotating said cam member in a predetermined relationship to the rotation of said rotatable members.

5. Apparatus for cutting material into predetermined lengths as set forth in claim **4** and characterized by including drive means for synchronously driving said rotatable members and wherein said cut lengths of said material is equal to the circumferential distance between said knives.

6. Apparatus for cutting material fed thereto into predetermined lengths comprising:

support means;

a pair of members rotatably carried by said support means and having a common point of tangency;

means for synchronously driving said rotatable members;

a plurality of knives pivotally carried by each of said rotatable members and equally spaced about the circumference thereof, corresponding knives of each member being aligned at the point of tangency of said members to sever the material; and

positioning means carried by each of said rotatable members for maintaining each of said knives in a vertical attitude during the cutting of the material, said positioning means including a cam defining a camming surface rotatable with respect to said rotatable members, driving means for selectively rotating said cam in a predetermined relation with the rota-

tion of said rotatable members, and cam follower means connected to said knives and responsive to the movement of said cam to maintain the vertical attitude of said knives during the cutting of the material.

References Cited

UNITED STATES PATENTS

1,802,554	4/1931	Hahn	83—337
1,960,814	5/1934	Iversen	83—290
2,193,259	3/1940	Sheperdsen	83—290

2,612,195	9/1952	Rahaim	144—309
3,254,686	6/1966	Boyd et al.	144—3 XR

FOREIGN PATENTS

565,204	11/1932	Germany.
351,211	6/1931	Great Britain.

FRANCIS S. HUSAR, Primary Examiner

U.S. Cl. X.R.

144—2