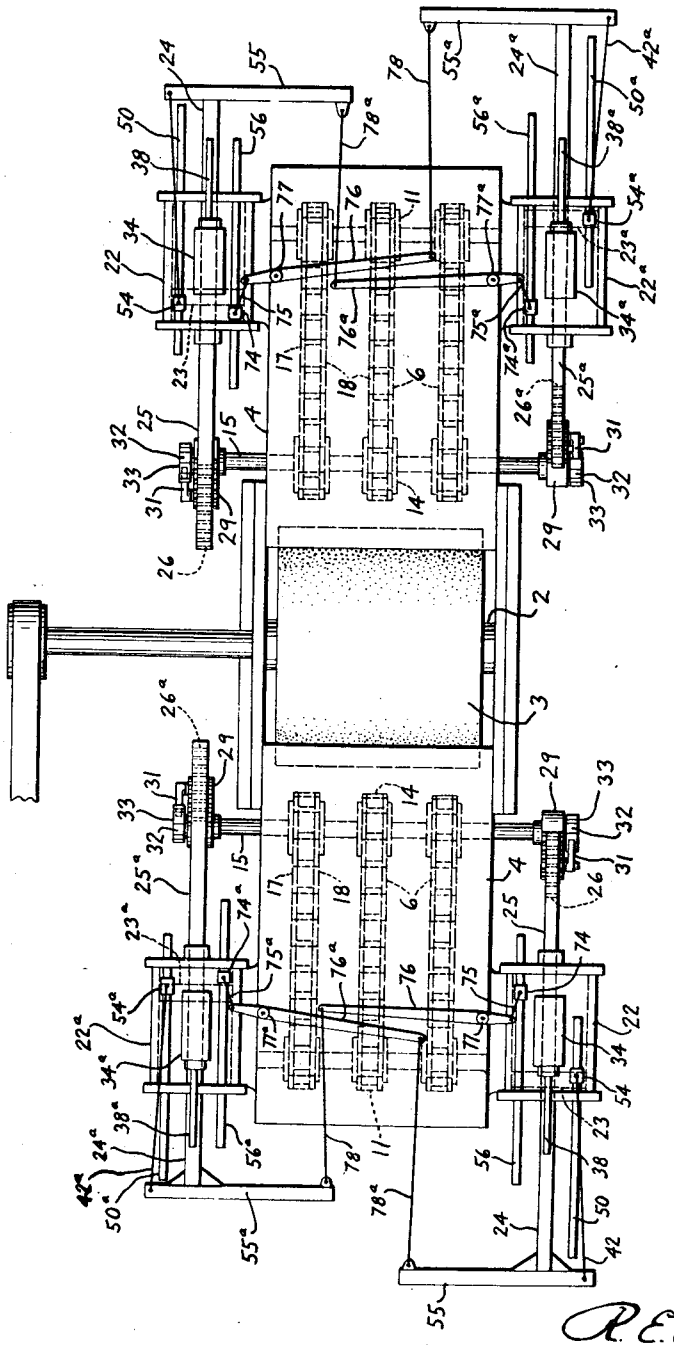
March 12, 1929. R. E. READ 1,705,097

WOOD GRINDING MACHINE

Filed July 22, 1927 12 Sheets-Sheet 1

Fig. 1.



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WOOD GRINDING MACHINE

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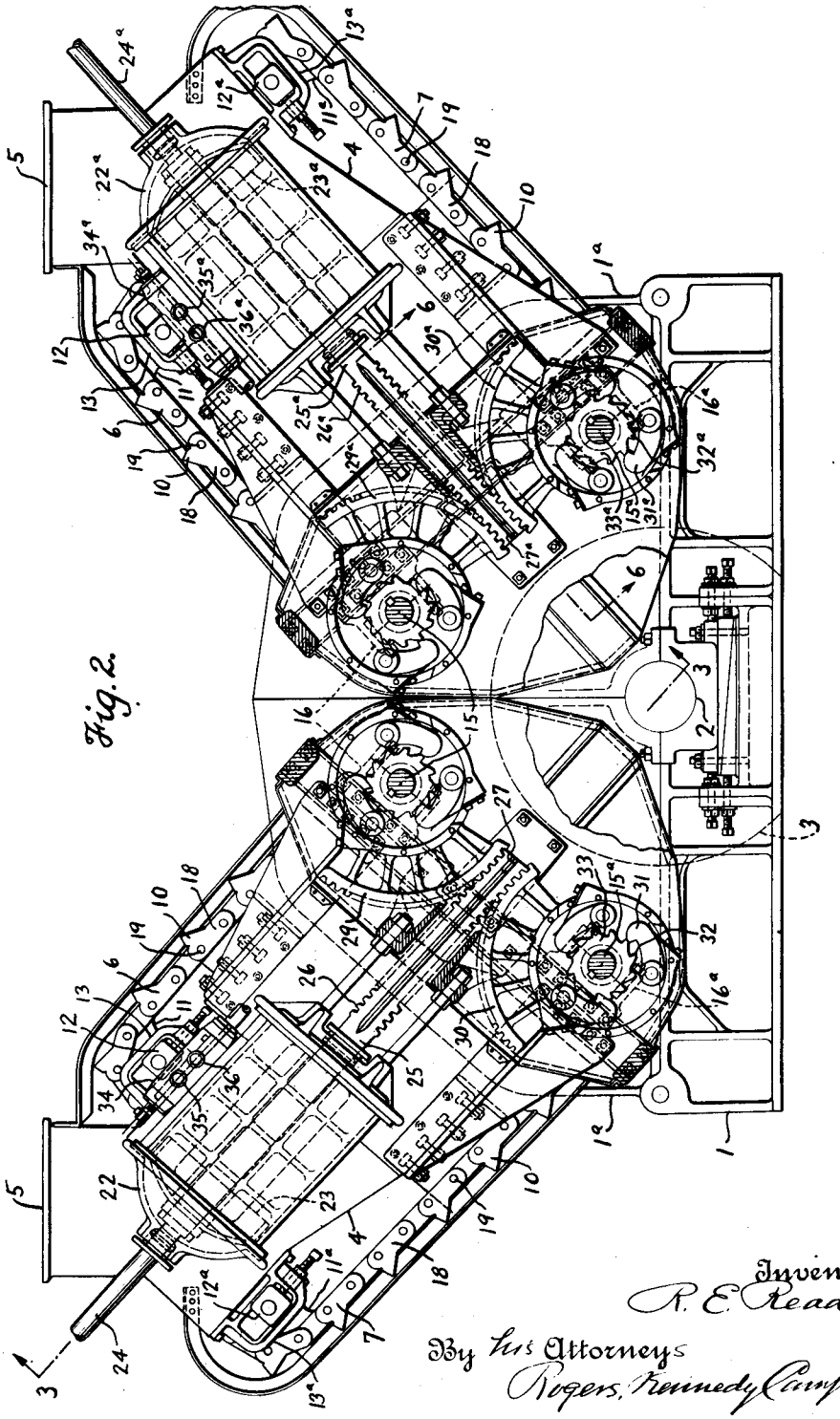


Fig. 2.

Inventor
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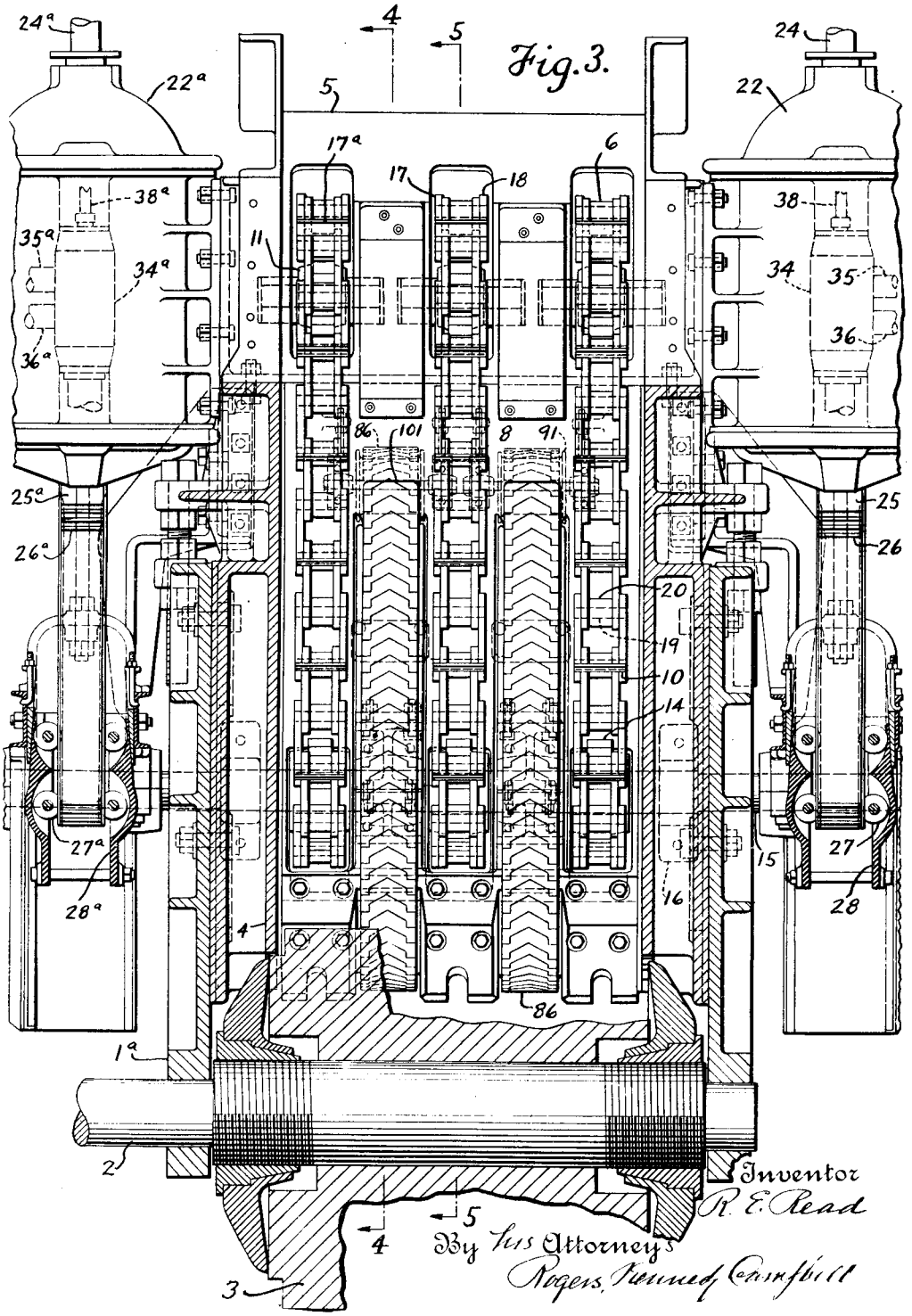
By his Attorneys
Rogers, Kennedy & Campbell

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WOOD GRINDING MACHINE

Filed July 22, 1927 12 Sheets-Sheet 3

Fig. 3.

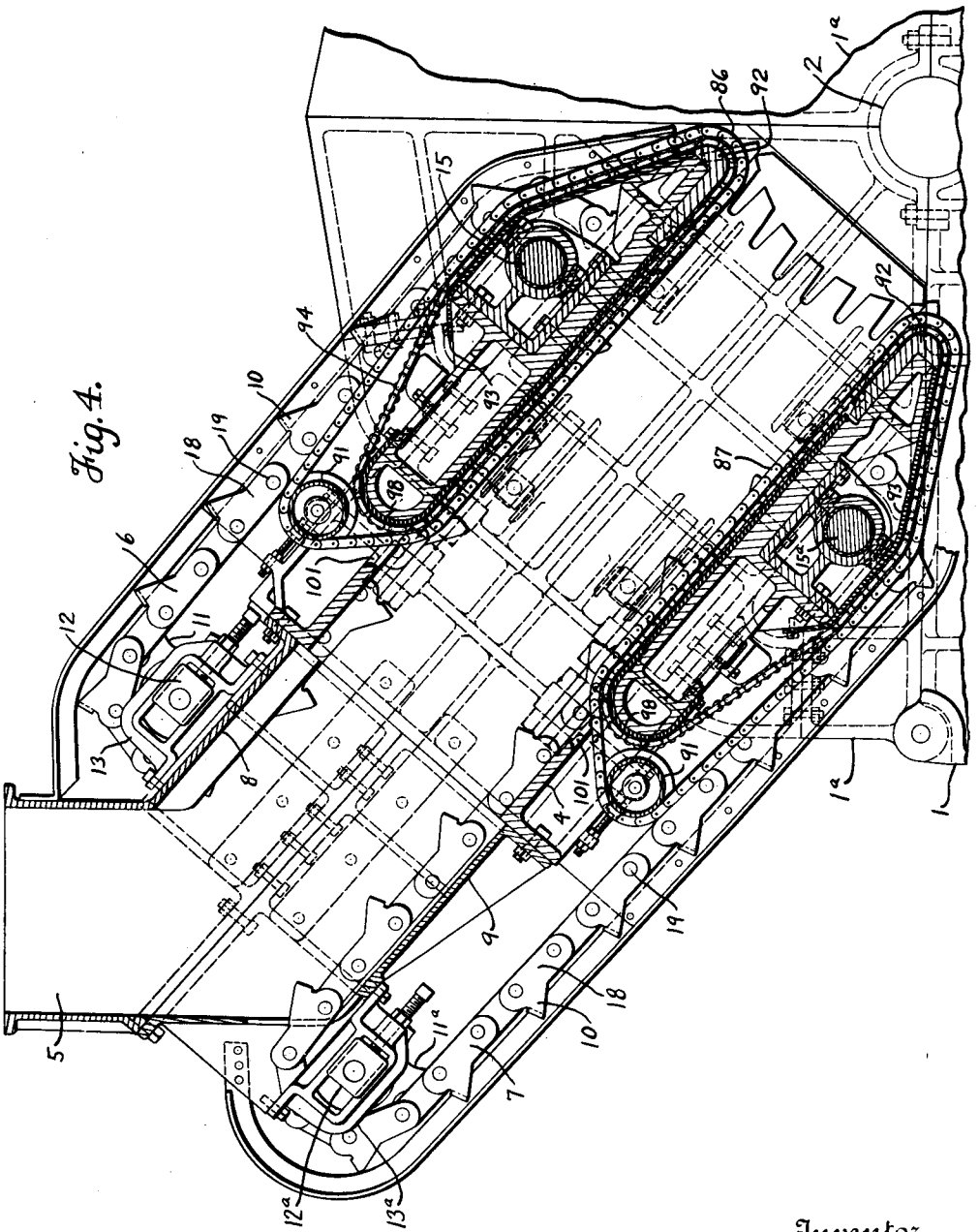


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WOOD GRINDING MACHINE

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Fig. 4.




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WOOD GRINDING MACHINE

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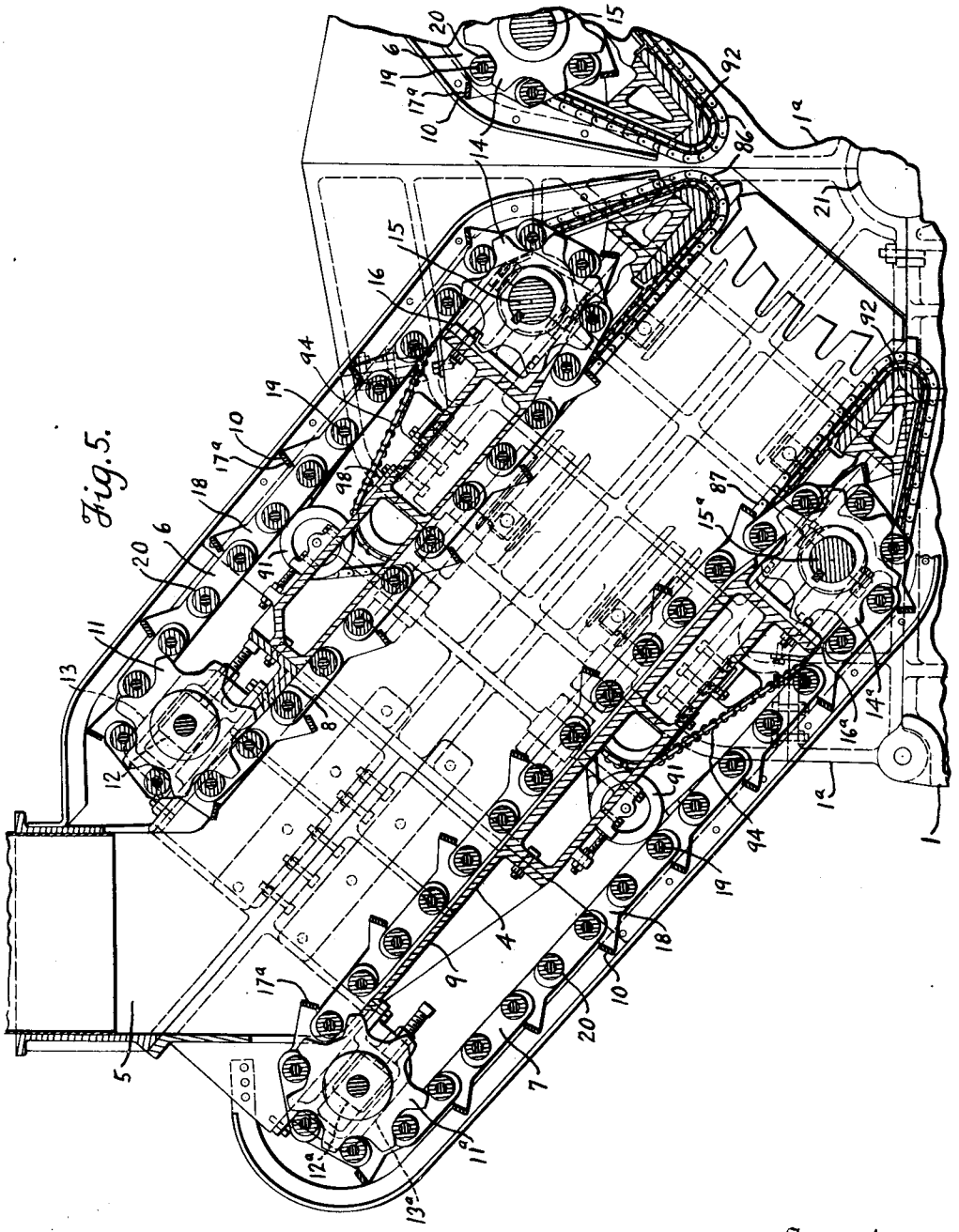


Fig. 5.

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WOOD GRINDING MACHINE

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Fig. 6.

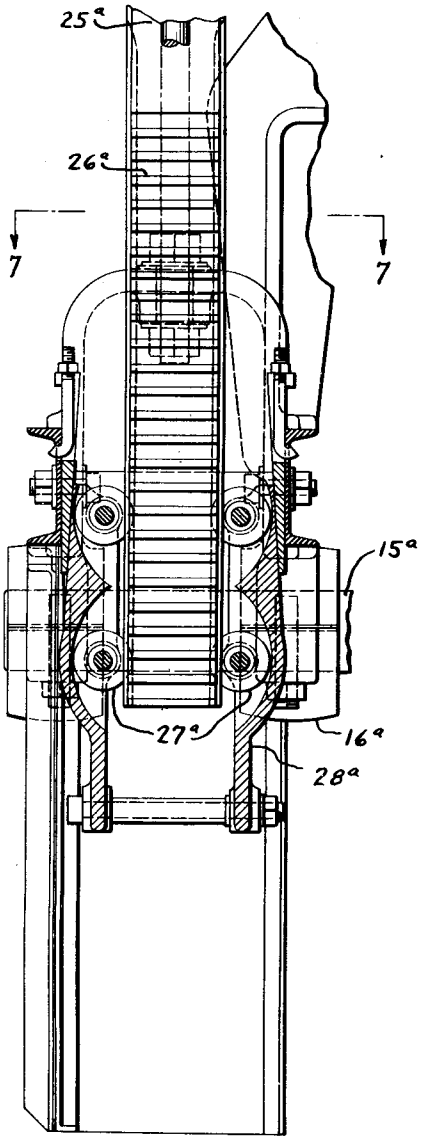
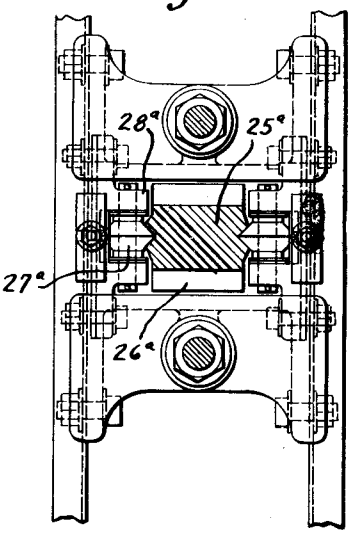



Fig. 7.




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March 12, 1929. R. E. READ 1,705,097

WOOD GRINDING MACHINE

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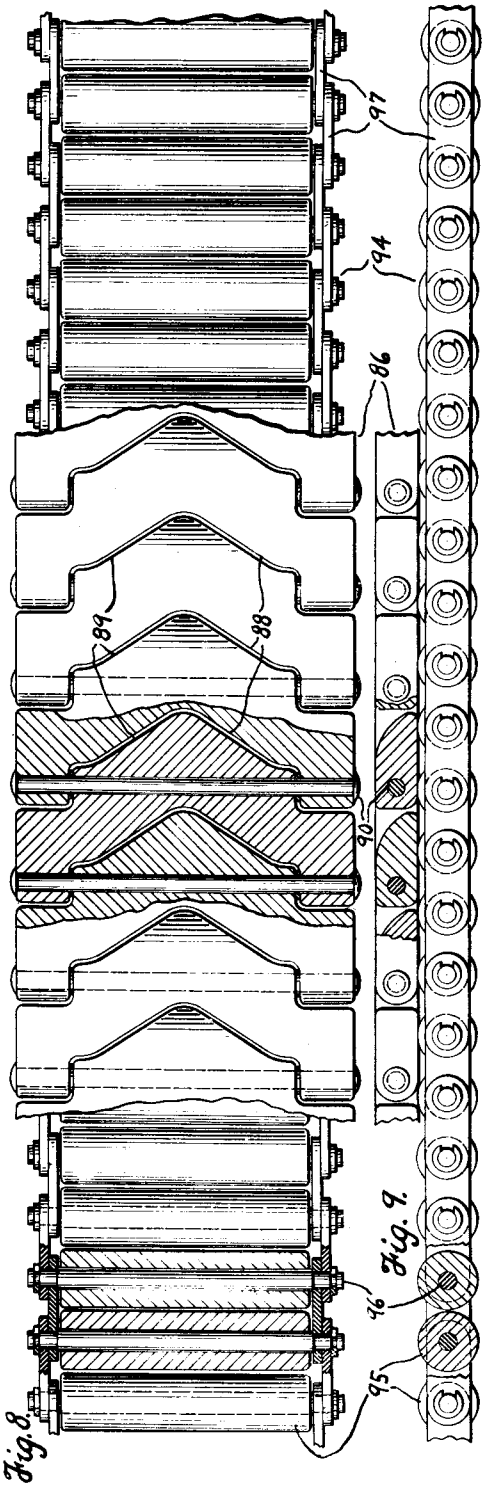



Fig. 8.

Fig. 9.

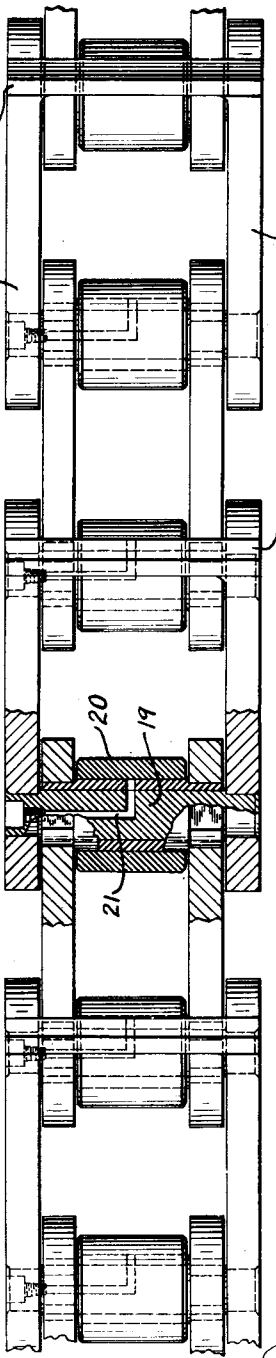



Fig. 10.

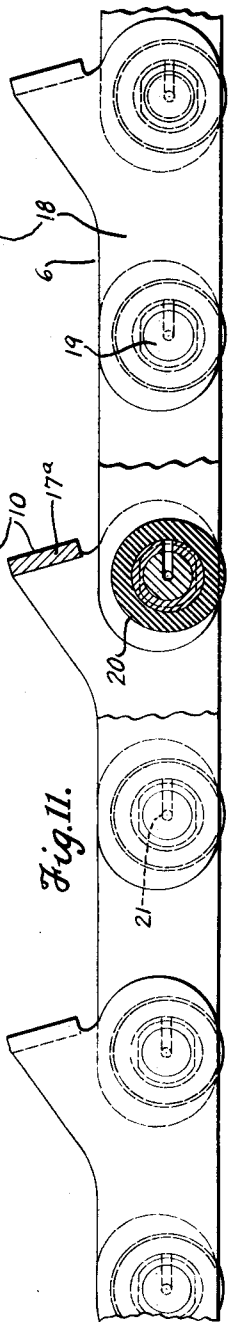



Fig. 11.

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WOOD GRINDING MACHINE

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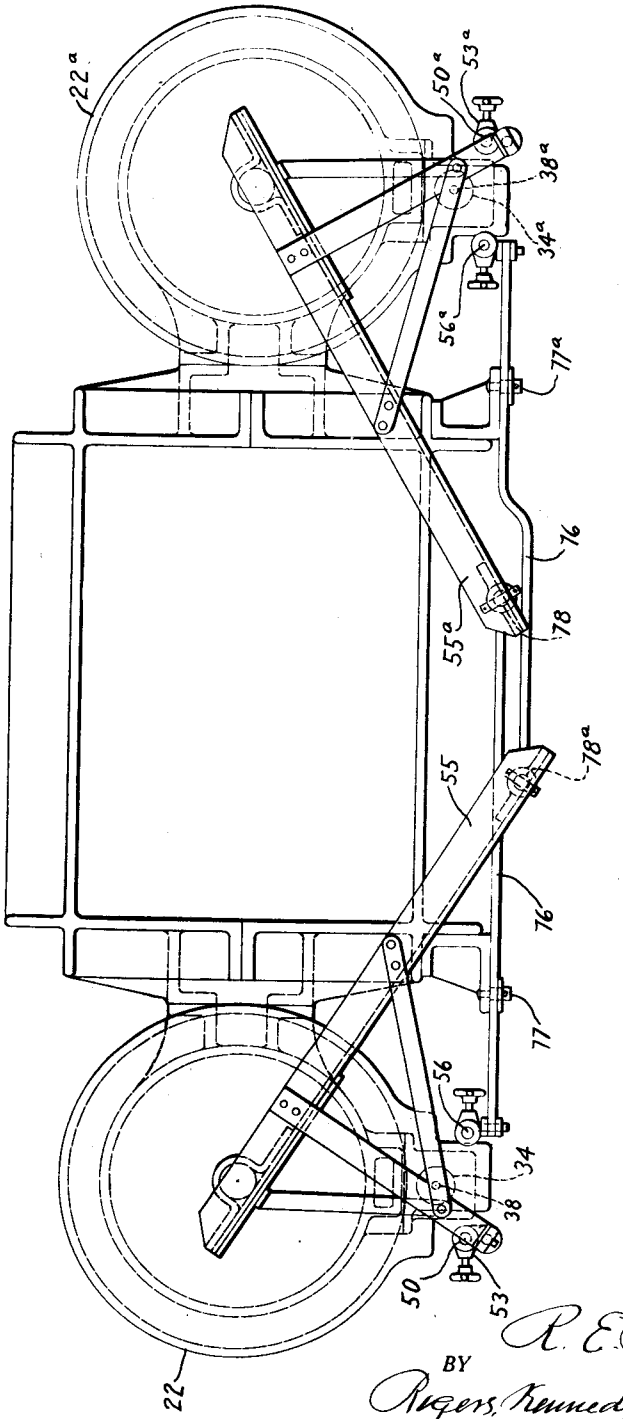



Fig. 12.

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WOOD GRINDING MACHINE

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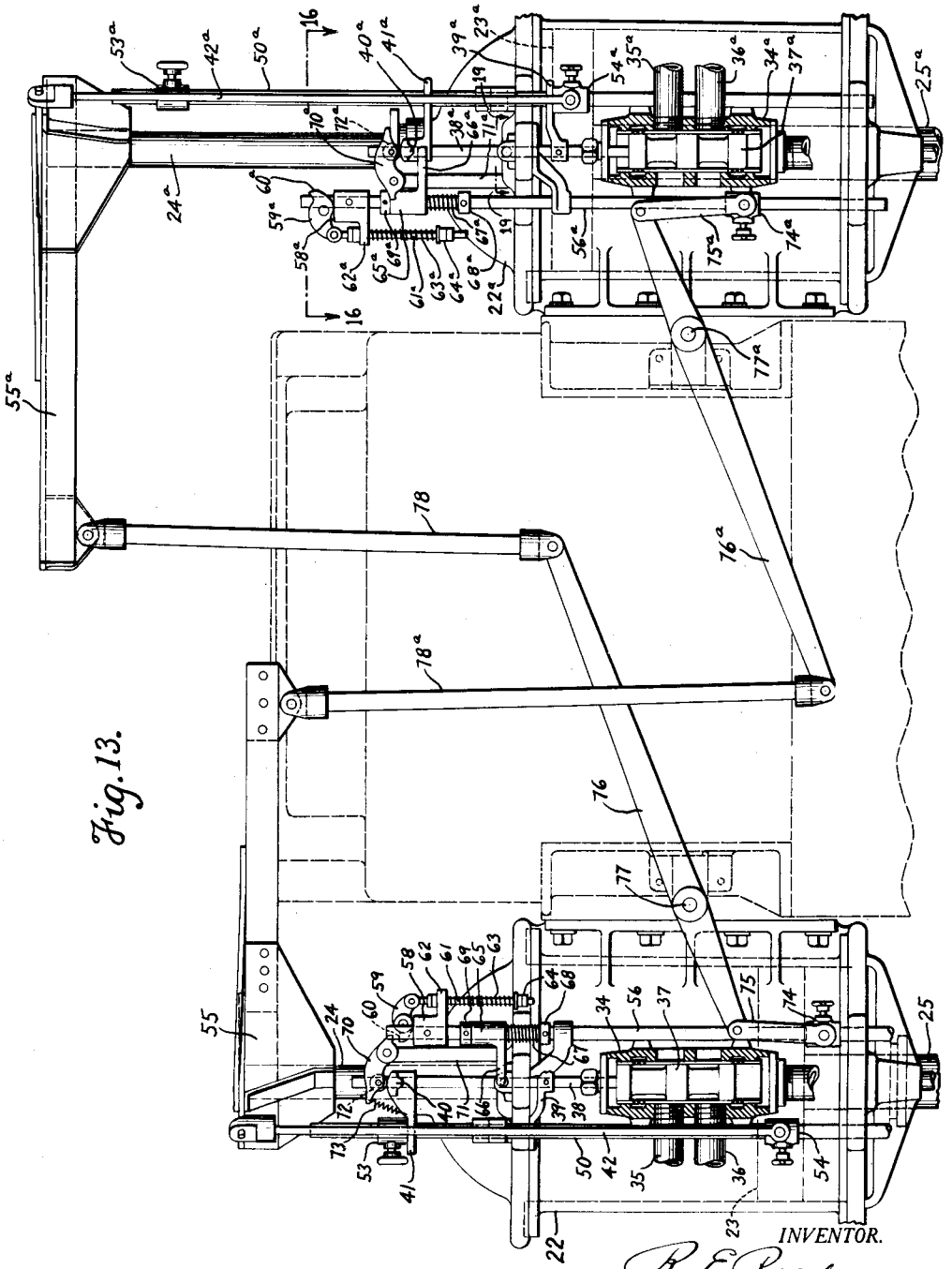


Fig. 13.

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WOOD GRINDING MACHINE

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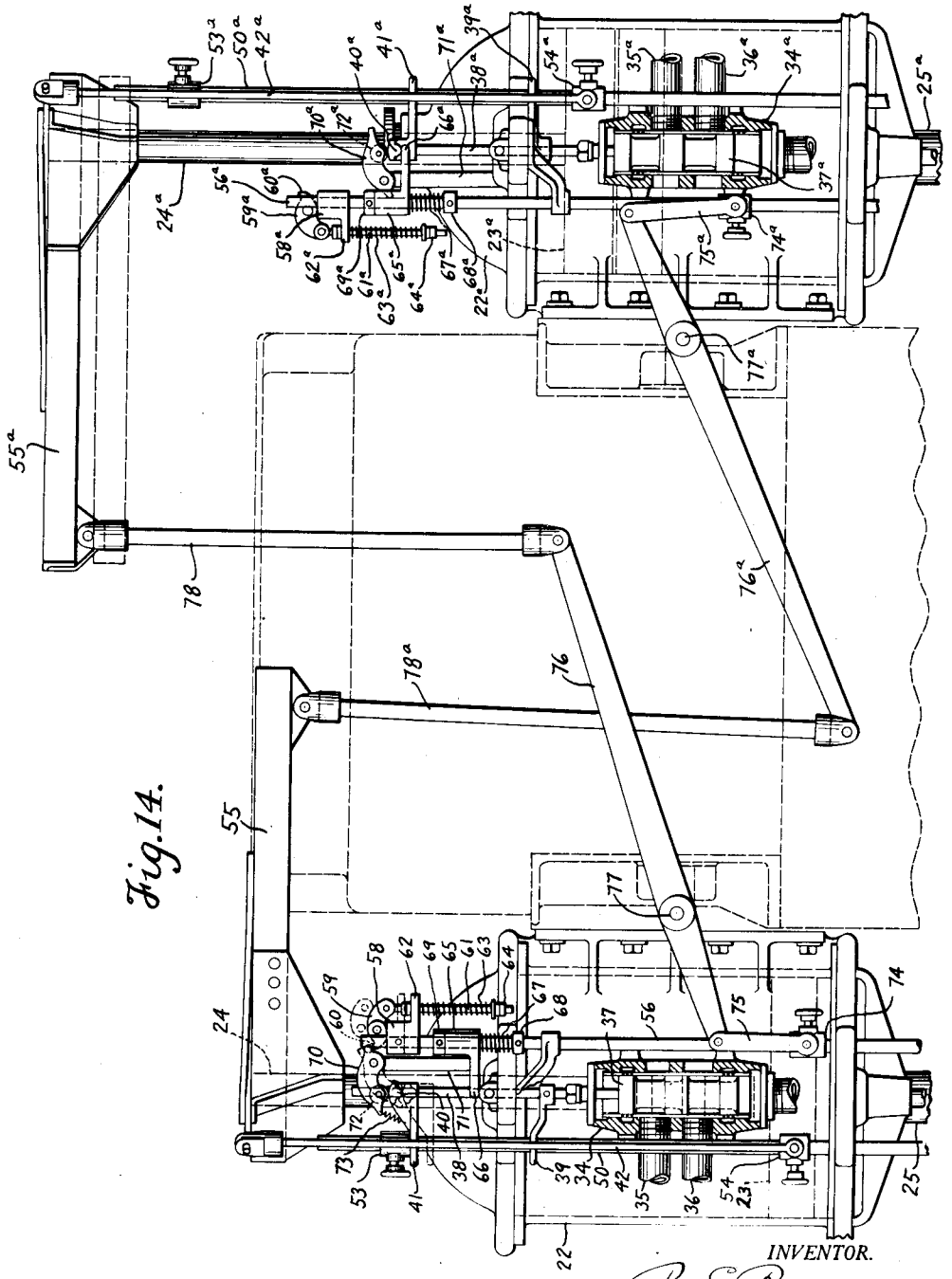


Fig. 14.

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WOOD GRINDING MACHINE

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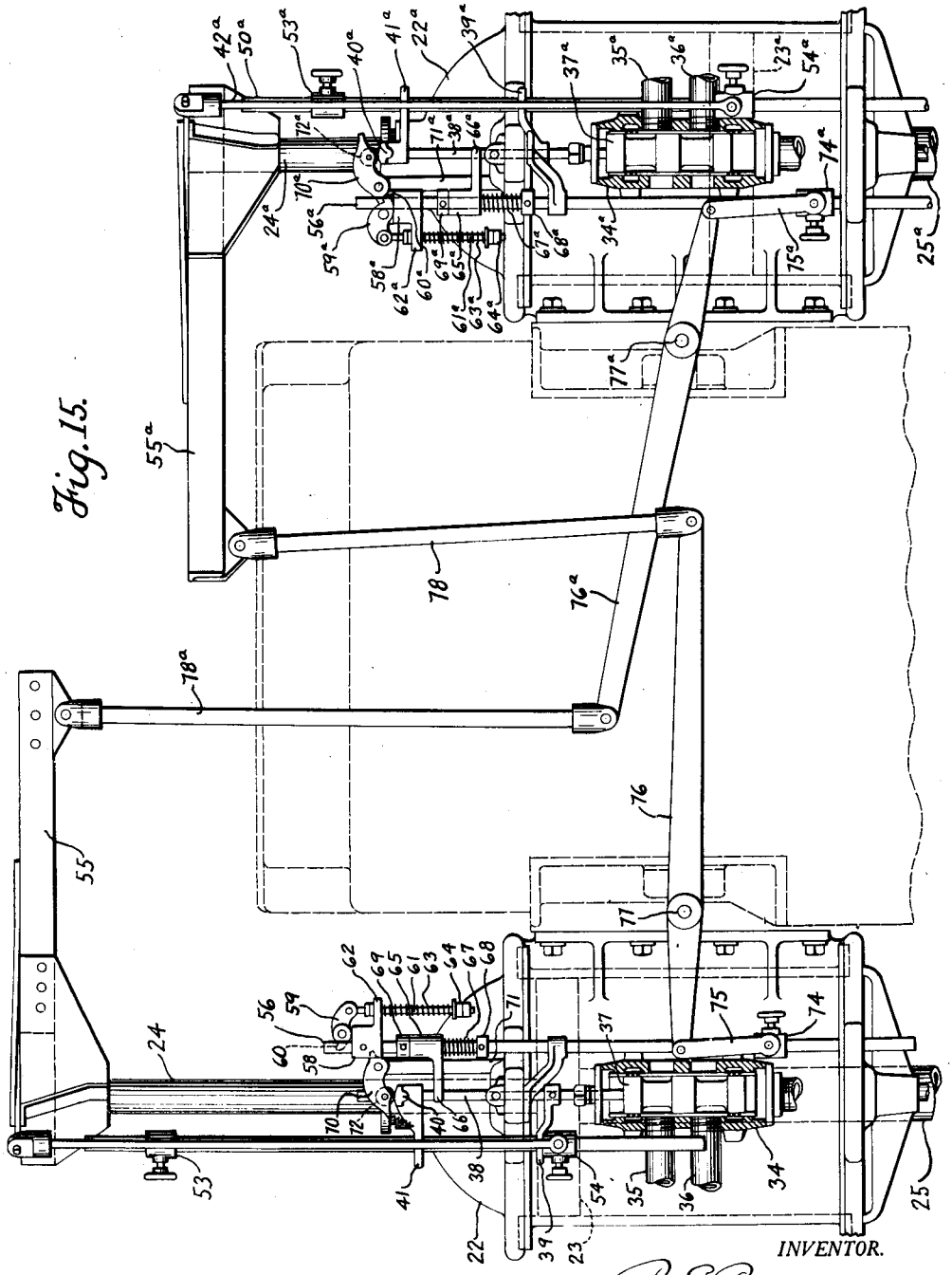


Fig. 15.

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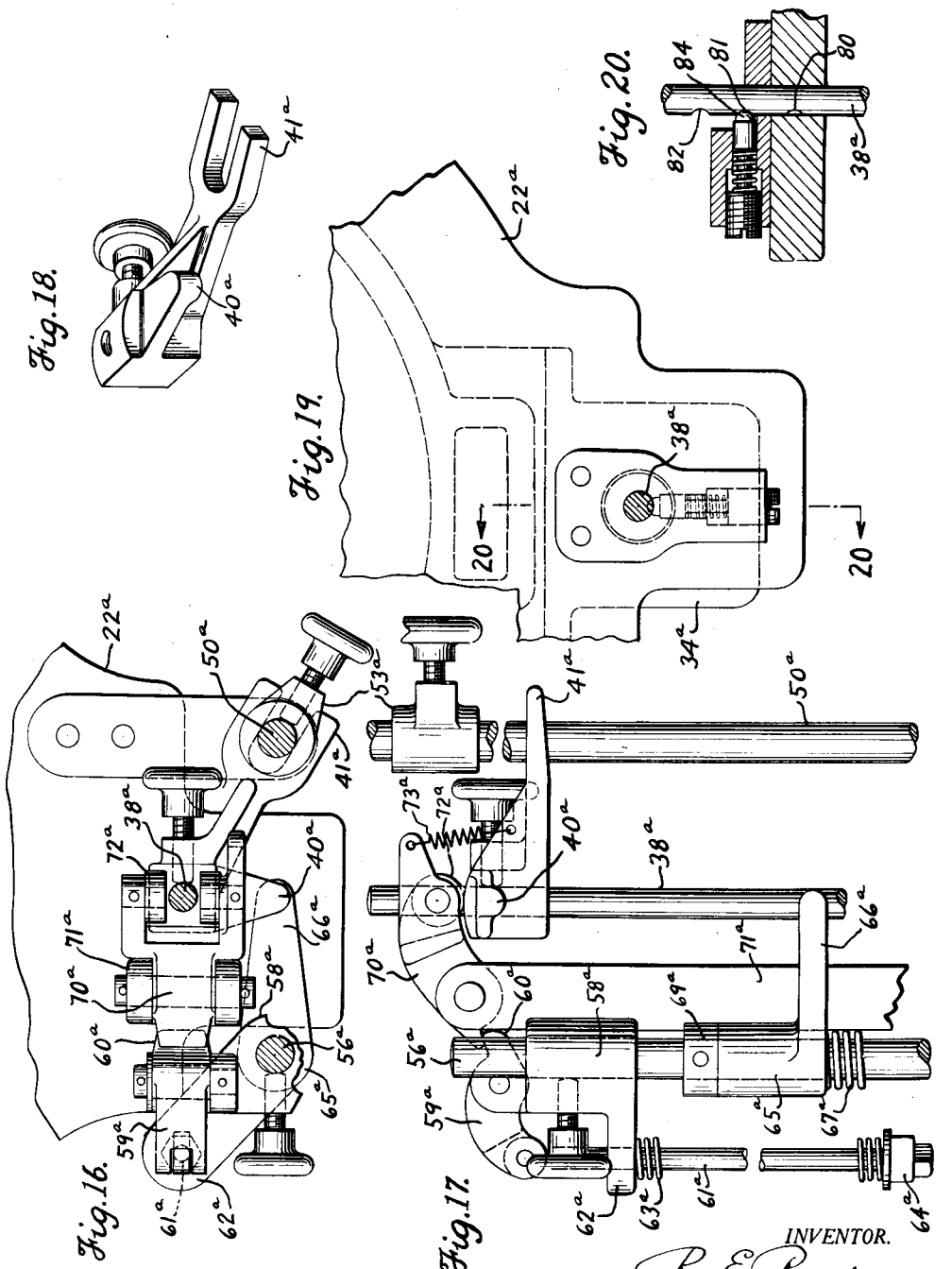
BY Rogers, Kennedy & Campbell

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March 12, 1929. R. E. READ 1,705,097

WOOD GRINDING MACHINE

Filed July 22, 1927 12 Sheets-Sheet 12



Patented Mar. 12, 1929. 1,765,097

# UNITED STATES PATENT OFFICE.

ROBERT E. READ, OF WHITE PLAINS, NEW YORK, ASSIGNOR TO INTERNATIONAL PAPER COMPANY, A CORPORATION OF NEW YORK.

## WOOD-GRINDING MACHINE.

Application filed July 22, 1927. Serial No. 207,593.

This invention relates to wood grinding machines of the type in which the wood, in the form of billets or logs, held in pockets is forced against a grindstone, to the end that the wood may be disintegrated or ground for conversion into pulp for use in making paper.

In some machines of this type, the wood is forced against the stone by means of so-called pressure feet actuated by pressure fluid (usually water), and after all the wood in the pocket has been reduced to pulp, the pressure feet are retracted so that the pocket may be refilled. Other types of these machines have chains driven continuously by electric motors or fluid turbines through gear reduction. With the pressure-foot type of feed, the grinding action on the full area of the mass of wood is discontinuous and intermittent, due to the necessity of retracting the pressure foot at intervals for refilling the pocket, and it is not possible therefore to secure the maximum efficiency in the operation of the grinder. The types of machine employing continuously driven feed chains actuated electrically or by fluid turbines, are unsatisfactory, in that the slow rate of the feed of the wood which must necessarily prevail, makes it impossible with such driving means to apply the great degree of pressure which is necessary for the grinding operation, electric motors under such conditions being liable to "kick out", and fluid turbines to "stall".

The aim of the present invention is to overcome these objections and to provide a type of continuous feed of the wood in which the full area of the mass of wood will be subjected continuously and without interruption to the grinding action, and in which the wood may be advanced slowly to the grinder without liability of the failure of the feeding pressure, and under conditions of maximum economy and efficiency, and with these and other objects in view, the invention consists in the combination with wood feeding means adapted to act on the mass of wood in the pocket and force the same against the grinder, of fluid pressure actuated cylinder and piston mechanisms having operative connection with the wood feeding means for actuating the same, the said mechanisms being operated to apply their driving forces consecutively to the feeding means so that there will be no cessation or interruption in the grinding operation, this result being brought about preferably by the provision of automatically operating controlling means for the cylinder and piston mechanisms acting to bring one into action to apply its power stroke before the completion of the power stroke of the other mechanism, the operation of the feeding means as effected by one of the cylinder and piston mechanisms thus overlapping that effected by the other mechanism, so that there will be no break in the continuity of the feed.

In the more specific embodiment of the invention, sets of endless feeding chains are mounted in the pocket at opposite sides of the same, and are provided with wood engaging members or lugs to act on the opposite sides of the mass of wood between the chains, the wood being introduced into the open upper end of the pocket continuously, and being advanced continuously by the feeding chains and thereby forced against the stone under continuous sustained pressure. The chains pass around idler sprockets at the upper end of the pocket, and around driving sprocket wheels at the lower end of the pocket, and pressure fluid operated cylinders and pistons are employed, for rotating the driving sprockets and thereby operating the chains, suitable controlling means for the cylinders and pistons being provided to cause them to operate in sequence consecutively, and the pistons being so operatively connected with the driving sprocket wheels that the wheels will be rotated continuously by the two cylinders and pistons operating consecutively with each other.

In the specification to follow the invention will be described in detail, and the novel features thereof will be pointed out in the appended claims.

In the accompanying drawings:

Fig. 1 is a diagrammatic plan in horizontal development of the improved machine;

Fig. 2 is a side elevation of the machine;

Fig. 3 is a vertical sectional elevation on an enlarged scale on the line 3—3 of Fig. 2;

Fig. 4 is a similar view on the line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 4 on the line 5—5 of Fig. 3;

Fig. 6 is a section on an enlarged scale of the chain drive operating rack and the

guides therefor, the section being taken on the line 6—6 of Fig. 2;

Fig. 7 is a transverse section on the line 7—7 of Fig. 6;

Fig. 8 is a plan view on an enlarged scale partly in section, of a portion of one of the guard chains and a portion of the underlying supporting chain therefor;

Fig. 9 is a side elevation of the same partly in section;

Fig. 10 is a plan view on an enlarged scale partly in section, of a portion of one of the wood feeding chains;

Fig. 11 is a side elevation of the same partly in section;

Fig. 12 is a plan view showing the cross heads on the piston rods and the parts operated by said heads;

Fig. 13 is an elevation of the two cylinder and piston mechanisms for operating the feeding chains, and the connecting devices for controlling the alternate action of the two machanisms;

Figs. 14 and 15 are views similar to Fig. 13, but showing the parts in different positions respectively;

Fig. 16 is a horizontal sectional plan view on the line 16—16 of Fig. 13 of one of the valve controlling mechanisms;

Fig. 17 is a side elevation of the same;

Fig. 18 is a perspective view of a detail of the valve controlling mechanism;

Fig. 19 is a horizontal sectional plan view on the line 19—19 of Fig. 13, showing a further detail of the valve controlling mechanism; and

Fig. 20 is a section through the same on the line 20—20 of Fig. 19.

Referring to the drawings:

1 designates a base or supporting frame from the ends of which extend upwardly frame members $1^a$ in which is journaled a shaft 2 carrying a grindstone 3. Suitably supported between the frame members $1^a$ are two wood holding pockets 4 disposed as usual on either side of the perpendicular center line of the grindstone at opposite angles thereto. At their upper ends the pockets are provided with receiving hoppers 5 into which the wood to be ground is introduced, and at their lower ends the pockets are open so that the wood may be forced against the peripheral surface of the stone by a feeding mechanism now to be described, and as the two pockets and the wood feeding mechanisms are identical in form and construction and wholly independent of each other in their operation, a detailed description of one will suffice.

Two sets of endless feeding chains 6 and 7 are mounted respectively on the upper and lower side walls 8 and 9 of the pocket in such position that the inner adjacent stretches of the chains will extend along the inner sides of said walls and be supported thereby. The chains are provided with wood engaging members or teeth 10 so that when the chains are driven, as will be presently described to cause said inner stretches to move continuously downwardly toward the grindstone, the teeth 10 engaging the opposite side of the mass of wood between the chains, will advance the wood toward and press the same against the stone with continuous sustained pressure. In the present example of the invention illustrated there are three feeding chains in each set, spaced apart at equal intervals in the width of the pocket wall, but it will be understood that the number of chains may be increased or diminished without departing from the spirit of the invention.

The upper chains 6 pass around idler sprocket wheels 11 journaled in independently adjustable bearings 12 supported on the outer side of a throat 13 fixed to and constituting an upward continuation of the four side walls of the pocket, which throat terminates at its upper end in the hopper 5 before alluded to; and said chains pass also around driving sprocket wheels 14 keyed to a horizontal shaft 15 mounted in bearings 16 supported on the outer side of the wall 8 adjacent the grindstone. The lower chains 7 are similarly guided and driven by idler sprocket wheels $11^a$ mounted in adjustable bearings $12^a$ supported on the outer side of the throat 13, and driving sprocket wheels $14^a$ keyed to a shaft $15^a$ mounted in bearings $16^a$ on the outer side of the lower wall 9 adjacent the grindstone and extending parallel with the shaft 16.

As best shown in Figs. 10 and 11 the feeding chains are made up of pairs of outer and inner links 17 and 18 pivoted together by pivoting pins 19, the outer links of each pair being connected together by a cross plate $17^a$, which cross plates constitute the wood engaging members or teeth 10 before referred to, and which are disposed at a slight rearward inclination to the travel of the chains as best shown in Fig. 4. The pivoting pins 19 are surrounded by rollers 20 which engage between the teeth of the sprocket wheels, and the pins are cored as at 21 for the supply of a lubricant to the relatively moving parts of the chains.

The driving sprocket wheels are operated by fluid pressure actuated cylinders 22 and $22^a$ and pistons 23 and $23^a$ as before referred to, which cylinders are fixedly sustained in substantially upright positions at the outer sides of the side walls of the pockets as shown in Figs. 2 and 3, and as the cylinders and pistons and connected parts at both sides of the pocket are the same in construction and operation, the same reference numerals have been applied to the corresponding parts, with the exponent *a* for the cylinder $22^a$ and associated parts, and one only

of said sets of mechanisms will be described.

The piston 23 has connected with it two piston rods, an upper rod 24 which extends upwardly through the upper end of the cylinder, and a lower rod 25 which extends downwardly through the lower end of the cylinder. The lower rod is formed on opposite sides with rack teeth 26, and it is guided in its reciprocating movements between two guide rollers 27 journaled on opposite sides of the rod in a housing or frame 28 fixed to the side wall of the pocket, which rollers engage in longitudinal grooves in the rod as best shown in Figs. 3, 6 and 7. The rack teeth on the opposite sides of the rod extend between and mesh respectively with an upper segment rack 29 and a lower segment rack 30, which racks are mounted to rock respectively on the shafts 15 and 15a, so that when the piston rod moves downwardly the segment racks will be swung downwardly and inwardly toward each other on the shafts as axles, and when the piston rod is moved upwardly, the segment racks will be swung upwardly away from each other. The segment racks are clutched to the respective shafts by means of ratchet pawls 31 pivoted at intervals to the sides of the segment racks and spring pressed into engagement with ratchet teeth 32 on ratchet wheels 33 keyed to the respective shafts, the relation of the ratchet pawls to the ratchet teeth being such that when the segment racks are swung inwardly and downwardly by the descent of the piston rod, the pawls will engage with the teeth and the shafts will be rotated, the upper shaft referring to the mechanism at the left in Fig. 2 counterclockwise and the lower shaft clockwise, and when the segment racks are swung upwardly by the rise of the piston rod, the pawls will click over the ratchet teeth without affecting the shafts, whereby in the reciprocating motion of the piston rod the two shafts will have driving impulses imparted to them.

The piston and cylinder and clutch mechanism on the opposite side of the pocket are as before stated similar in form and construction to those just described, but the two mechanisms are arranged to operate consecutively, so that one mechanism will take up the drive of the shafts on the completion of the driving action of the other mechanism, and vice versa, with the result that the shafts will receive from the successive actions of the two mechanisms, a continuous rotation, whereby the wood in the pocket will be advanced to and pressed against the stone with continuous and sustained pressure.

The control of the operation of the two chain driving mechanisms as described, is effected automatically by mechanism operative on valves controlling the flow of the pressure fluid respectively to the two cylinders, the valve of one cylinder being operated by connection with the piston of the other cylinder to admit pressure to one side of the piston of said cylinder to advance said piston on the completion of the active stroke of the other piston, and vice versa. This controlling mechanism is best shown in Figs. 13 to 20, and will now be described.

The cylinders are provided respectively with valve chests 34 and 34a to which the pressure fluid, in the present instance water, is admitted by two pipes 35 and 36 respectively from a source of high pressure to operate the piston on its active or chain-driving stroke, and a source of lower pressure to operate the piston on its idle or return stroke. The valve chest is provided with ports communicating with the cylinder to admit pressure fluid to the opposite ends, and is provided with exhaust ports adapted to communicate with the cylinder to permit the exhaust of the pressure fluid, and a piston valve 37 is mounted in the valve chest and is provided with ports so related to the ports in the valve chest that when the valve is in upper position as shown to the left in Fig. 13, high pressure will be admitted to the upper side of the piston and its lower side will be opened to exhaust, and the admission of low pressure will be cut off, whereby the piston will be moved down; and when the valve is in its lower position as shown by dotted lines in Fig. 14 to the left, low pressure will be admitted to the lower side of the piston, the upper side of the piston will be opened to exhaust, and high pressure will be cut off and the piston will move up; and when the valve is in a neutral position, as shown in Fig. 13 to the right and in Fig. 15 to the left, both pressures will be cut off from the cylinder and the piston will remain in neutral position and at rest.

The piston valve 37 has connected with it a valve rod 38 extending through the upper end of the valve chest, which rod carries near its lower end a horizontal finger 39 and near its upper end two horizontal fingers 40 and 41, the finger 41 being forked at its extremity to receive a vertical rod 50 extending at one side of the valve chest and mounted to reciprocate in guides at the opposite ends of the cylinder. A collar 53 is connected adjustably to the rod 50 near its upper end so that the collar can be set in different positions on the rod, and a similar collar 54 is connected in a similar manner to the rod 50 near its lower end, which collars are adapted in the endwise movements of the rod to engage respectively with the arms 39 and 41 and thereby shift the valve rod endwise. A link 42 is pivoted at its lower end to the collar 54 and at its upper end to a cross head 55 on the upper end of the piston rod 24, whereby the rod 50 will be re-

ciprocated by the movements of the piston in its cylinder.

A vertical rod 56 extends at the other side of the valve chest and is movable endwise in upper and lower guides at the opposite ends of the cylinder. A collar 58 is connected adjustably with the rod 56 near its upper end so that it can be set in different positions thereon, and has pivoted to it a dog 59, the inner end of which terminates in a tripping nose 60. The outer end of the dog has pivoted to it the upper end of a vertical rod 61 which extends loosely through a lug 62 on the collar 58 and is encircled by a spiral spring 63 bearing at its upper end against the lug, and at its lower end against a head 64 on the rod 61. Below and adjacent the collar 58, the rod 56 carries a sleeve 65 from which projects a finger 66 disposed in the path of movement of the finger 40, which sleeve is movable to a limited extent on the rod and is acted on by a spiral spring 67 encircling the rod 56 between the lower side of the sleeve and a collar 68 fixed to the rod, which spring tends to force the sleeve 65 yieldingly upwardly against a limiting stop 69 on the rod 56 above the sleeve.

The nose 60 of the dog 59 is adapted, in the upward movement of the rod 56 to engage beneath the inner end of a horizontal rocker lever 70 pivoted between its ends to a fixed bracket arm 71 extending upwardly from the cylinder, and after rocking said lever on its axis the dog will disengage and move past the same, as will be more particularly described later on. The rocker lever 70 has journaled on its outer end rollers 72 in position to engage on the upper side of the finger 40 on the valve rod when said rod is in its upper position as shown in Fig. 13 to the left, and a spring 73 is connected with the outer extremity of the lever and to a fixed point and acts to pull the outer end of the lever down with yielding force so that the arm 40 can move up to the lever at the limit of the upward movement of the valve rod and take a position where it will be operated by the rocker lever 70 on the upward movement of the rod 56, which action of the parts will be presently described more in detail.

A collar 74 is connected adjustably with the rod 56 near its lower end so that it can be set in different positions thereon, and a link 75 is pivoted at its lower end to the collar and has its upper end pivoted to the outer end of a lever 76 pivoted between its ends as at 77 to the cylinder structure. A vertical link 78 is pivoted at its lower end to the inner end of the lever 76 and is pivoted at its upper end to an inward extension of the cross head $55^a$ carried by the piston $23^a$ of the cylinder $22^a$, it being noted that there is a like connection of the corresponding cross head 55 with the rod $56^a$ through the medium of the collar $74^a$, link $75^a$, lever $76^a$ and link $78^a$.

Due to the interconnection of the two cylinder and piston mechanisms as above described, the active stroke of one piston in imparting a driving action to the feeding chains is initiated automatically before the completion of the active stroke of the other piston, so that as before stated, the shafts carrying the chain feeding wheels will be rotated continuously, and the operation of the parts in bringing about this action is as follows.

In the position of the parts shown in Fig. 13 the piston 23 is descending and has nearly completed its active stroke, valve 37 being in its upper position admitting high pressure to the upper side of the piston and cutting off low pressure, and opening the lower side of the piston to exhaust. In this action of piston 23 its rack is swinging the associated segment racks down, and the shafts are being turned by the ratchet wheels, thereby actuating the endless chains and feeding the wood.

Piston $23^a$ at the same time is at the upper limit of its stroke and is wholly neutral, the associated valve $37^a$ being in its intermediate neutral position and cutting off both pressures to the cylinder. The piston is ready to descend and take up the feed of the chains when and just before piston 23 ceases to act on the chains, the operation of the chains by one piston thus overlapping the operation by the other piston to the end that there will be no break in the continuity of the feed.

Piston 23 in moving down carried with it its cross head 55 and through the medium of link $78^a$, lever $76^a$, link $75^a$ and rod $56^a$ actuated valve stem $38^a$ on valve $37^a$ by means of the engagement of the tripping nose $60^a$ on dog $59^a$ which on the upward movement of the rod $56^a$ engaged the rocker lever $70^a$ thereby rocking said lever and causing its roller $72^a$ to act on finger $40^a$ and move the valve stem $38^a$ downwardly from the position shown in Fig. 15 to the right to the neutral position shown in Fig. 13 to the right. Such action occurred immediately on the start of piston 23 downwardly, and in the continued movement the rod $56^a$ was carried up, thereby disengaging the nose of dog $59^a$ from lever $70^a$ and carrying the dog upwardly to the position shown to the right in Fig. 13. In this upward movement of rod $56^a$ the finger $66^a$ is brought up nearly in contact with the underside of the finger $40^a$ on the valve stem ready in the further upward movement of the rod $56^a$ to move said stem upwardly.

As piston 23 completes its descent and takes the position shown in Fig. 14, rod $56^a$ is lifted a little further and forces arm $66^a$

against finger 40ª, thereby moving valve stem 38ª upwardly and shifting valve 37ª to the position shown in Fig. 14 and admitting pressure to the upper side of piston 23ª. The pressure is still acting on the upper side of piston 23 as its valve has not yet been shifted to cut off the pressure so that piston 23ª will begin to descend before piston 23 has reached the limit of its downward active stroke, thus bringing about an overlapping of the actions of the two pistons. As piston 23 completed its descent, collar 53 on rod 50 was engaged with finger 41 on the valve rod 38 and moved the valve down to neutral position, thereby cutting off both pressures to the cylinder.

Piston 23ª will now begin to descend and in doing so will carry cross head 55ª with it, and through the medium of link 78, lever 76, link 75, rod 56, and tripping nose 60 (which had by the previous upward movement of piston 23ª been brought beneath lever 70) will trip lever 70 and thereby move valve 38 to the dotted line position shown in Fig. 14, whereby pressure to the upper side of piston 23 will be cut off and the same opened to exhaust, and pressure to the lower side of the piston will be admitted, and the parts will be in the position shown in Fig. 14 with the valve 37 in the dotted line position.

Piston 23 will now begin to rise and simultaneously piston 23ª will be descending, and through the medium of its rack and the segment racks operated thereby will apply a feeding action to the feeding chain, and the rack of piston 23 by moving its segment racks upwardly will cause the ratchet disk to click by the ratchet teeth on the shaft. As the piston 23 goes up its cross head 55 will rise with it and through the medium of link 78ª, lever 76ª, link 75ª and rod 56ª, the nose of dog 59ª will move downwardly and will trip past the inner end of lever 70ª, and by the time piston 23 reaches the limit of its upward stroke nose 60ª will be beneath lever 70ª as shown to the right in Fig. 15 ready for another action on lever 70ª. As piston 23 completes its upward return stroke its valve will be moved to a neutral position so as to cut off the two pressures, and allow the piston to remain stationary, which is effected by means of the engagement of the collar 54 on rod 50 with finger 39 on the valve stem 38, whereby the valve will be moved upwardly from its dotted line position as shown in Fig. 14 to its neutral full line position as shown in Fig. 15. During this action piston 23ª is moving down and through the medium of its rack is applying a feeding force to the chains, and in going down it will carry its cross head 55ª with it, and through the medium of link 78, lever 76, link 75 and rod 56, dog 59 will be carried upwardly to the position shown in Fig. 15, and on the continued downward movement of piston 23ª in completing its stroke, finger 66 on rod 56 will finally be engaged with finger 40 on the stem of valve 37 and the latter will be shifted to admit pressure above piston 23 and open its lower side to exhaust, so that the piston will be forced down as before and in so doing it will through the medium of its cross head 55, link 78ª, lever 76ª, link 75ª, rod 56ª, dog 59ª and lever 70ª cut off pressure to the upper side of piston 23ª and will admit the same to its lower side so that the piston will be moved upwardly again as hereinbefore described.

From the foregoing description it will be understood that collars 53 and 53ª by acting respectively on arms 41 and 41ª will move the valves from upper to neutral positions; that trip dogs 59 and 59ª acting respectively on levers 70 and 70ª will move the valves from neutral to their lower positions; that collars 54 and 54ª acting respectively on fingers 39 and 39ª will move the valves back to neutral positions, and that fingers 66 and 66ª acting respectively on fingers 40 and 40ª will move the valves back to their upper positions. These actions as above explained take place alternately in respect to the two cylinder and piston mechanisms, and automatically, due to the interconnection of the two mechanisms by the two sets of links and levers connecting the respective cross heads 55 and 55ª with the rods 56 and 56ª, the result being that the chain driving shafts will be acted on in succession by the two pistons and will impart a continuous driving force to the feeding chains.

In order to retain the valves in the different positions described so that when set they will be held without danger of accidental shifting or displacement, each valve rod is provided as shown in Fig. 20 with three sockets 80, 81 and 82 adapted to receive the end of a spring-pressed detent 84 sustained by the cylinder structure, the detent when engaged in the central socket 81 acting to hold the valve yieldingly in its neutral position, and when engaged in the sockets 80 and 82 acting to yieldingly hold the valve respectively in its upper and lower positions.

From the foregoing description of the construction and operation of the parts, it will be seen that the entire mass of wood in the pocket will be urged constantly and uninterruptedly with sustained pressure against the grindstone, so that the whole cross sectional area of the mass will be subjected continuously to the disintegrating and reducing action of the stone. The character of the motor devices employed for driving the wood feeding chains, as exemplified in the two pressure fluid operated cylinder and piston mechanisms, operated as described so that one mechanism will take up the drive of the chains before the

driving action of the other mechanism ceases, insures the application of the degree of force necessary to feed and hold the wood against the stone to bring about the proper reducing action of the wood, while the feed is progressing at the slow rate of speed characteristic of the operation in these machines, and this without danger of the driving mechanism stalling or becoming inoperative; and as there is no need for interrupting the grinding operation to enable the pockets to be refilled since the grinding operation is carried on continuously and the wood is introduced into the upper end of the pocket from time to time so as to keep the pocket filled, the grinding machine will operate with the maximum of efficiency and capacity, and under the most favorable conditions for economy.

In order to prevent any projecting parts of the mass of wood from engaging the portions of the walls of the pockets between the feeding chains and thereby interfering with the feed of the wood, I arrange in the intervals between the three feeding chains on the upper wall two endless guard chains 86, and between the two feeding chains on the lower wall I arrange similarly two endless guard chains 87, which chains are so mounted that their inner stretches will be opposed to each other and may travel toward the stone with the mass of wood as the latter is advanced by the feeding chains, thereby avoiding any relative motion between the wood and chains and preventing friction or resistance to the advance of the wood. These chains are in the present instance of the form shown in Fig. 8 consisting of flat links each having in one edge a cavity 88 and on its other edge a projection 89, the links, being interfitted with the projections of one link engaging in the cavity of the next and being jointed together by transverse pivot pins 90 extending through the links.

At their upper ends these chains pass around and are guided by idler rollers 91 journaled in suitable bearings in the frame of the pocket at the outer side of the upper and lower walls respectively, and at their lower ends the chains pass around curved guiding surfaces 92 at the lower edges of the side walls, the inner stretches of the opposed chains extending parallel to each other and being supported by the walls of the pocket, and the outer stretches being guided outwardly of and around the outer sides of the two shafts 15 and 15a by inclined guiding plates 93 sustained by the pocket framing, all as best shown in Fig. 5. Each of the guard chains runs on a supporting chain 94 so that the movement of the guard chains will be as free as possible from friction, each of the supporting chains consisting of rollers 95 rotatable on transverse axles 96 jointed together at their ends by links 97 as shown in Figs. 8 and 9. The supporting chains move in direct contact with the walls of the pocket, passing at their upper ends around curved guiding surfaces 98 extending outwardly from said walls and at their lower ends around said guiding surfaces, the outer stretches of the chains passing over and being gudied by the inclined guiding plates. The guard chains surround the supporting chains and are supported thereby extending from their upper ends inwardly through slots 101 through the walls of the pocket and thence downwardly along said walls so that they will give moving support to the mass of wood as it is advanced by the feeding chains, will relieve the advancing mass of friction against the side walls of the pocket, and will prevent any portion of the mass from coming in contact with the walls; whereby the mass of wood will be fed forward downwardly by the feeding chains without any danger of obstruction being offered to the feed of the wood, so that a uniform and continuous pressure of the wood against the stone will be assured.

Having thus described my invention, what I claim is:

1. In a wood grinding machine, the combination of a grinder, a pocket for holding wood to be ground, wood feeding means adapted to engage the wood in the pocket to force the same against the grinder, a plurality of driving devices acting to apply driving forces to the feeding means, and controlling means operative automatically to bring the driving devices into action on the feeding means consecutively.

2. A wood grinding machine as in claim 1, characterized by the fact that the feeding means is in the form of endless chains provided with wood engaging members.

3. A wood grinding machine as in claim 1, characterized by the fact that the driving devices are in the form of power cylinders and pistons.

4. A wood grinding machine as in claim 1, characterized by the fact that the feeding means is in the form of endless chains provided with wood engaging members, and that the driving devices are in the form of power cylinders and pistons.

5. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket to force the same against the grinder, driving mechanism operative on the feeding means, said mechanism comprising a plurality of driving devices acting to apply a driving force to the feeding means, and controlling devices acting automatically to bring the driving devices into action consecutively on the feeding means.

6. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket and operative to force the wood against the grinder, driving mechanism operative on the feeding means, said mechanism comprising a plurality of driving devices acting to apply driving force to the feeding means, and controlling devices acting automatically to bring one driving device into action before the cessation of the driving action of the other driving device; whereby the wood will be continuously fed to the grinder.

7. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, endless chains operative on the wood in the pocket to feed the same against the grinder, two cylinder and piston mechanisms operatively connected with the feeding chains to apply driving impulses to the same, and controlling means for said cylinder and piston mechanisms acting automatically to initiate the driving impulses of one mechanism before the cessation of the driving impulses of the other mechanism; whereby the feeding chains will be driven continuously.

8. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket and operative to force the same against the grinder, driving mechanism operative on the feeding means, said mechanism comprising a plurality of driving devices acting to apply driving forces to the feeding means, and controlling devices operative on the driving devices and acting automatically to bring said driving devices into action consecutively.

9. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket to force the same against the grinder, two cylinder and piston mechanisms operative on the feeding means to apply a driving force to the same, and controlling devices for said cylinder and piston mechanisms acting to bring said two mechanisms into action consecutively.

10. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, opposed endless wood feeding chains adapted to act on the mass of wood in the pocket, opposed driving sprocket wheels around which the feeding chains pass, a power cylinder and piston at each side of the pocket, piston rods on the pistons clutched to the sprocket wheels, means for controlling the operation of the pistons to cause them to apply driving impulses consecutively to the sprocket wheels.

11. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, opposed endless wood feeding chains adapted to act on the mass of wood in the pocket, opposed driving sprocket wheels around which the feeding chains pass, a power cylinder and piston at each side of the pocket, piston rods on the pistons clutched to the sprocket wheels to cause a driving force to be applied to said wheels on the advance of the piston, and means for controlling the operation of the pistons to retract one piston as the other is advanced; whereby the sprocket wheels will be subjected to a continuous driving force and the feeding chains operated continuously.

12. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, opposed endless wood feeding chains adapted to act on the mass of wood in the pocket, opposed rotary shafts, sprocket wheels rotatable with the shafts and around which the feeding chains pass, a ratchet wheel on each shaft, two pairs of segment racks oscillatable on the respective shafts, ratchet dogs carried by said segment racks and adapted to drive the ratchet wheels, two power cylinders and pistons, piston rods connected with the pistons and provided with rack teeth meshing with the segment racks, and means for controlling the operation of the pistons to cause them to apply driving impulses consecutively to the ratchet wheels.

13. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket and force the same against the grinder, two cylinder and piston mechanisms operative on the feeding means to apply driving impulses to the same in succession, controlling valves for the respective cylinders, valve actuating devices associated with each cylinder and operative on its valve, and connections between the valve actuating devices of each mechanism and the piston of the other mechanism.

14. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket and force the same against the grinder, two cylinder and piston mechanisms operative on the feeding means, controlling valves for the respective cylinders movable from neutral position to active position to admit pressure respectively to the opposite ends of the cylinders, and movable from said active position to neutral position to cut off the pressure, connections between each of said valves and the piston of the opposite mechanism operative to move the valves from neutral to active position, and

connections between each of said valves and its own piston operative to move the valves to neutral position.

15. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket and force the same against the grinder, two cylinder and piston mechanisms operative on the feeding means, controlling valves for the respective cylinders movable to active position to admit pressure to the cylinders and to neutral position to cut off pressure, means controlled by the piston of each mechanism for moving the valve of the other mechanism to active position, and means controlled by each piston for moving its associated valve to inactive position.

16. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, wood feeding means adapted to engage the mass of wood in the pocket and force the same against the grinder, two cylinder and piston mechanisms operative on the feeding means, controlling valves for the respective cylinders movable to active positions to admit pressure to the cylinders and to neutral position to cut off pressure, cross heads carried by the respective pistons, valve actuating devices operated by the respective cross heads for moving the associated valves to neutral position, valve actuating devices associated with the respective cylinders for moving their valves to active positions, and connections between each of the last mentioned valve actuating devices and the piston of the other mechanism.

17. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, endless wood feeding chains mounted in spaced relation in the pocket and adapted to act on the mass of wood therein, means for driving said chains, and supports for the wood disposed in the spaces between the feeding chains, said supports being movable with the wood in its advance.

18. In a wood grinding machine, the combination of a grinder, a pocket for holding the wood to be ground, endless wood feeding chains mounted in the pocket in spaced relation to each other and adapted to engage the mass of wood in the pocket, means for driving said chains, and endless guard chains mounted in the pocket in the spaces between the feeding chains and free to travel with the advancing wood.

19. In a wood grinding machine the combination of a grinder, a pocket for holding the wood to be ground, endless wood feeding chains mounted in the pocket in spaced relation to each other and adapted to engage the mass of wood to be ground, means for driving said chains, endless supporting chains mounted in the pocket in the spaces between the feeding chains, and endless guard chains traveling on the supporting chains.

In testimony whereof, I have affixed my signature hereto.

ROBERT E. READ.