No. 758,874. PATENTED MAY 3, 1904.

C. M. & O. C. TERRELL.

METHOD OF TREATING PINE NEEDLES.

APPLICATION FILED JULY 15, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

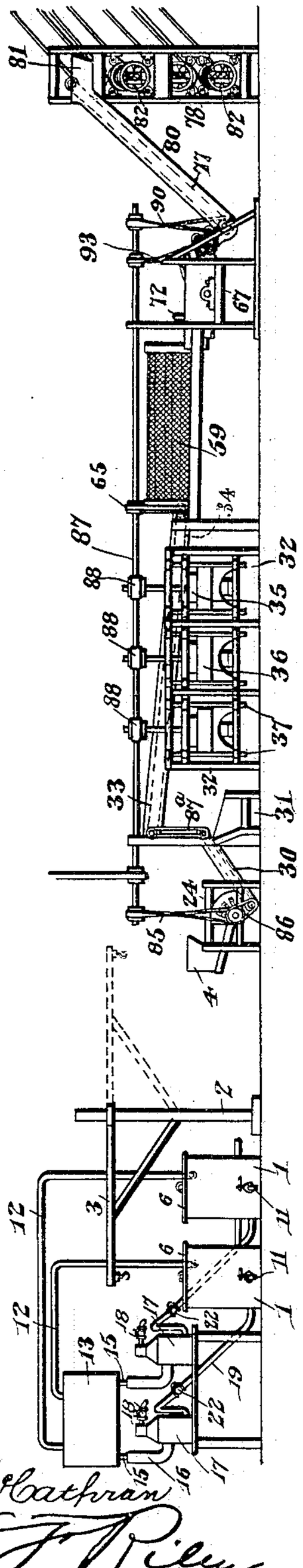

Fig. 3.

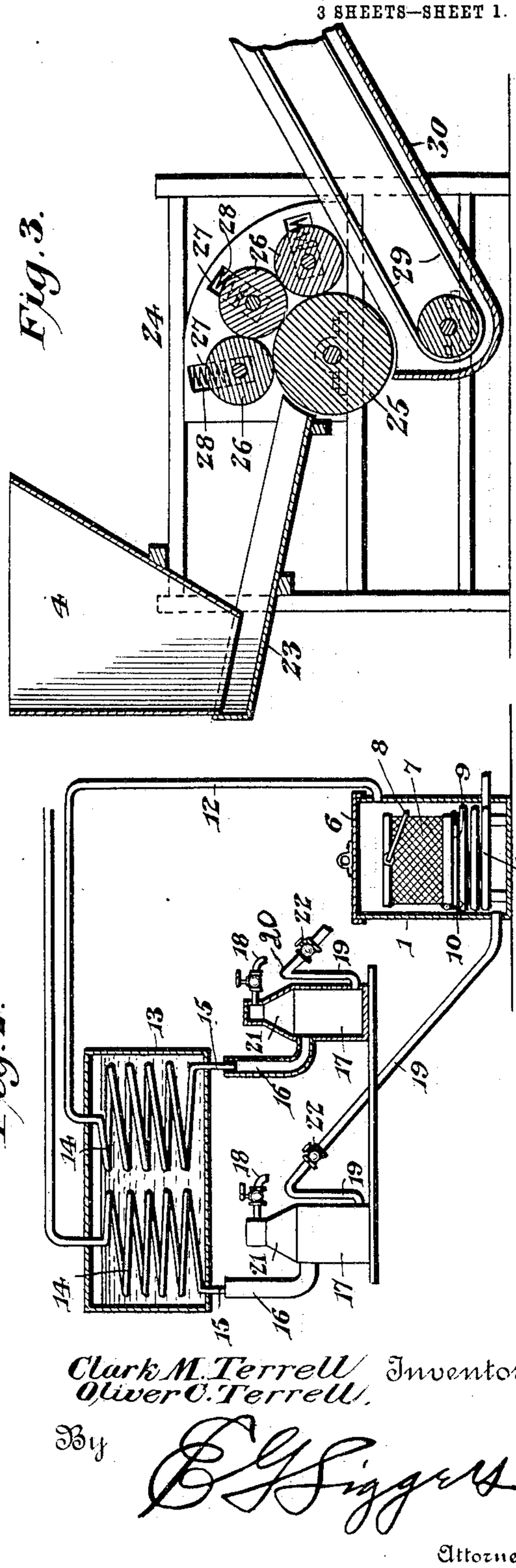

Fig. 2.

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NO MODEL. 3 SHEETS—SHEET 2.

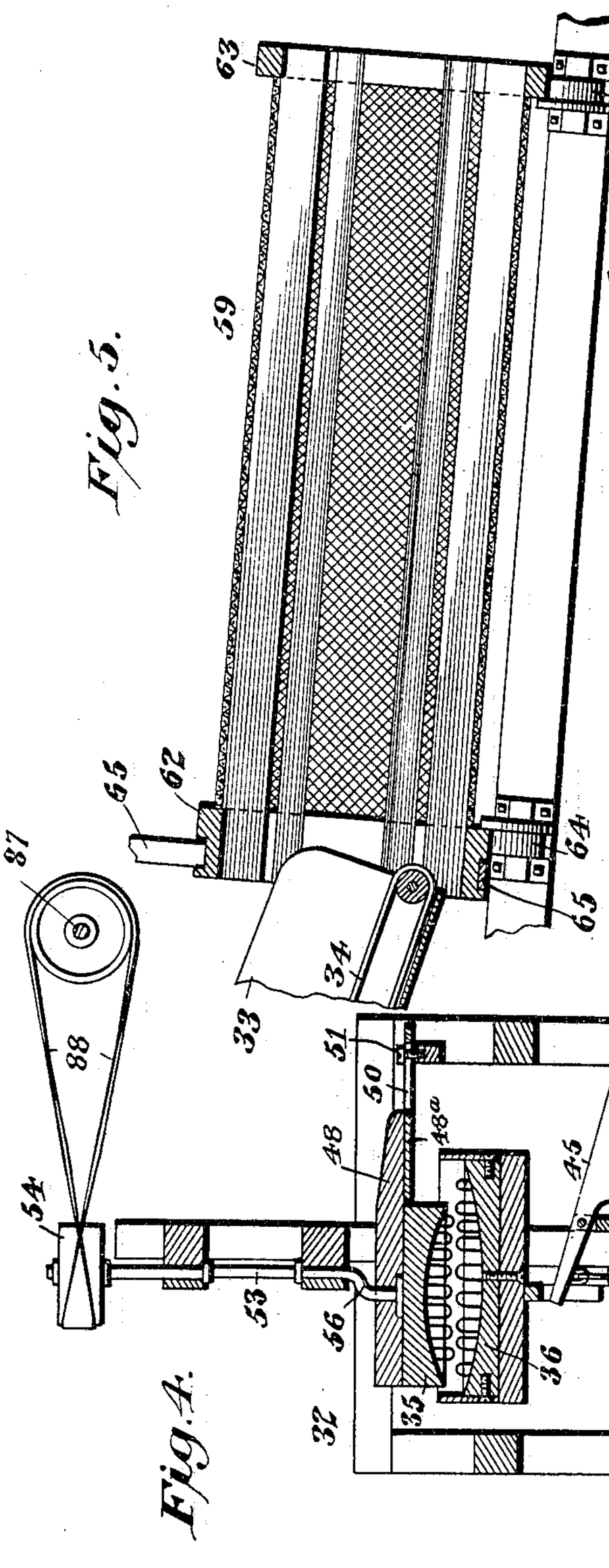

Fig. 5.

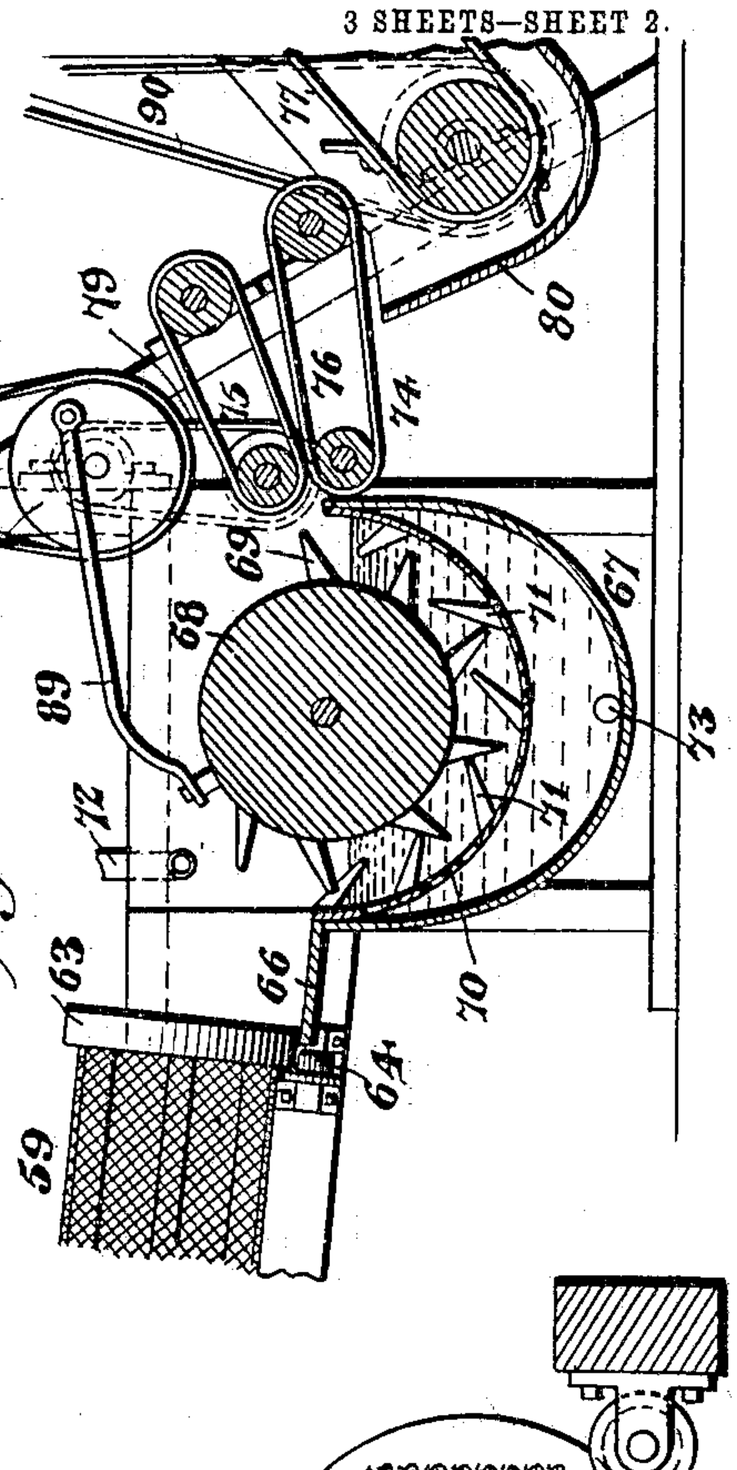

Fig. 7.

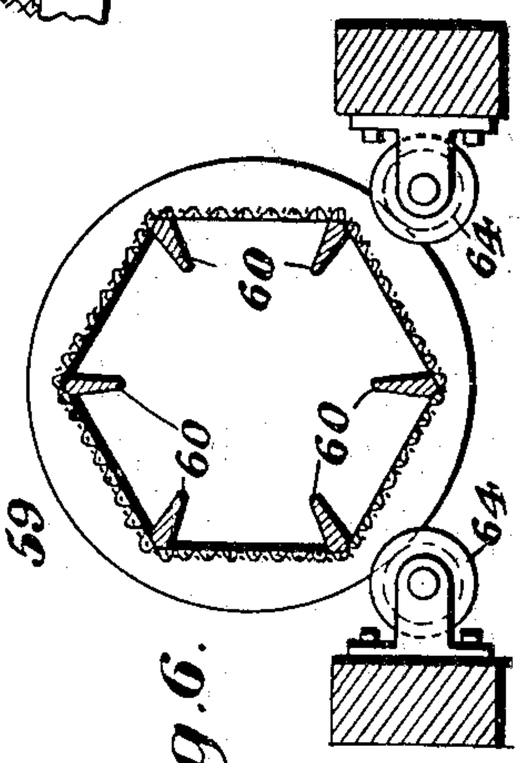

Fig. 6.

Fig. 4.

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 9.

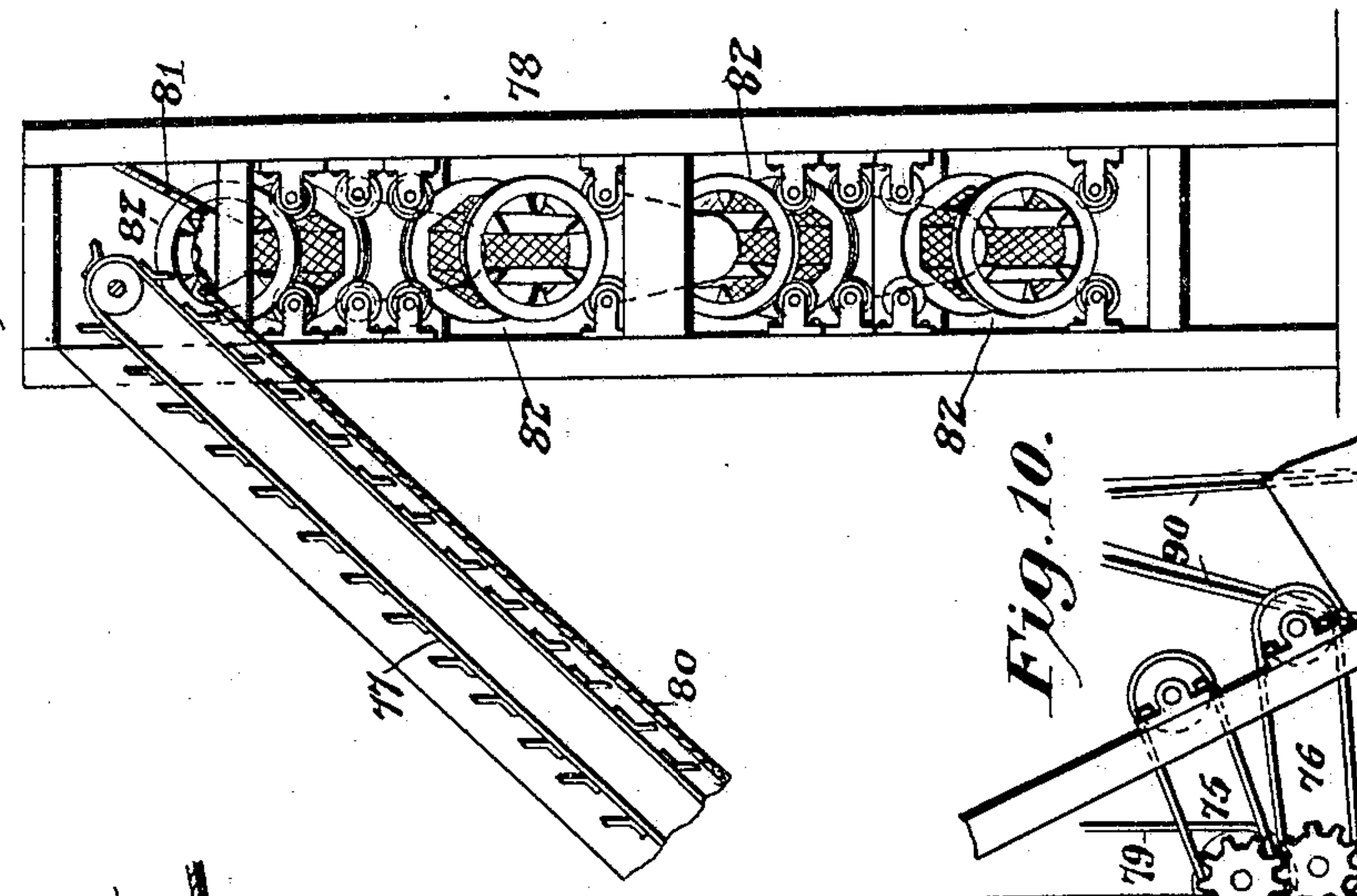
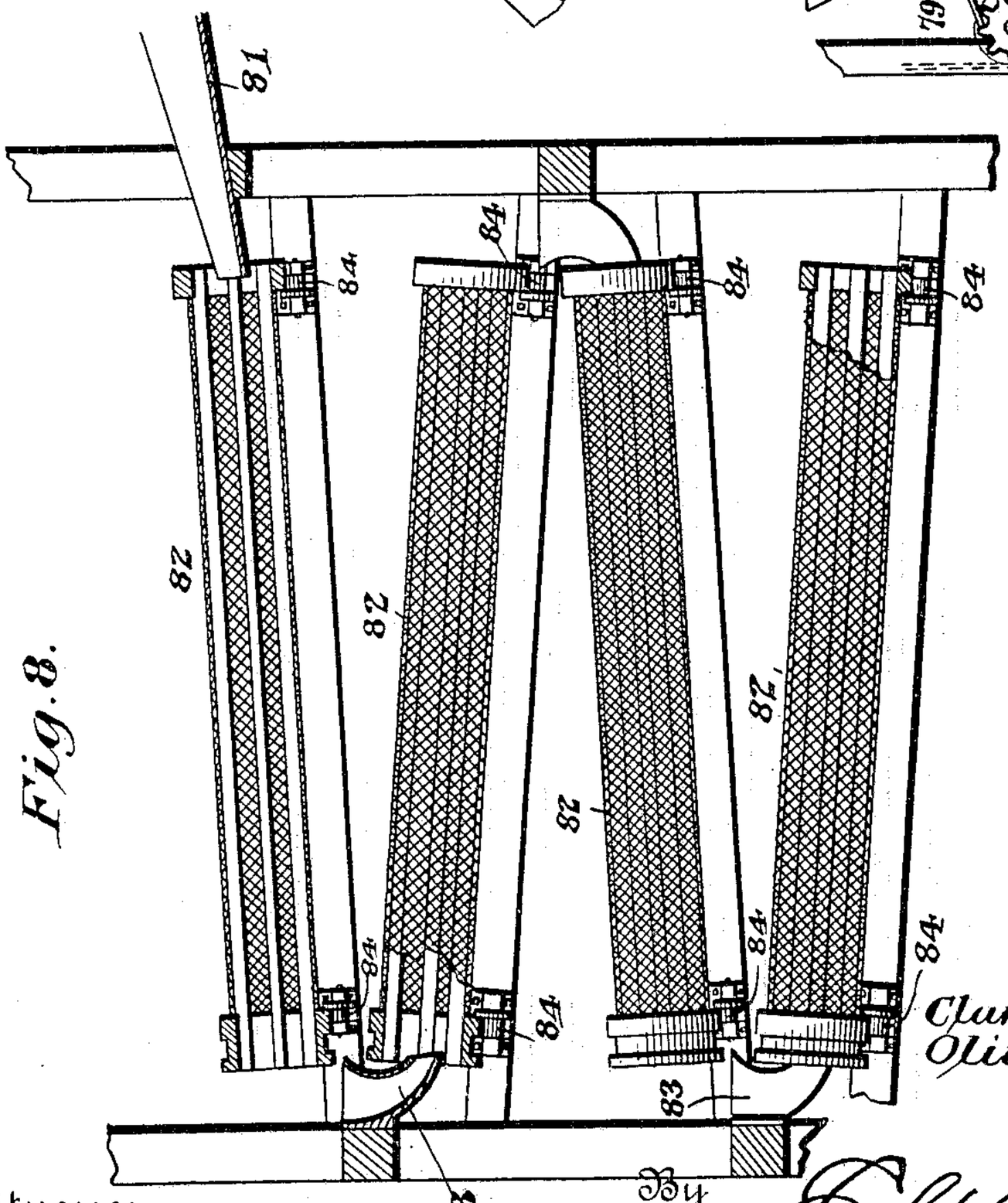


Fig. 10.

Fig. 8.



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No. 758,874. Patented May 3, 1904.

UNITED STATES PATENT OFFICE.

CLARK M. TERRELL AND OLIVER C. TERRELL, OF GRANTS PASS, OREGON.

METHOD OF TREATING PINE-NEEDLES.

SPECIFICATION forming part of Letters Patent No. 758,874, dated May 3, 1904.

Application filed July 15, 1903. Serial No. 165,612. (No specimens.)

To all whom it may concern:

Be it known that we, CLARK M. TERRELL and OLIVER C. TERRELL, citizens of the United States, residing at Grants Pass, in the county of Josephine and State of Oregon, have invented a new and useful Method of Treating Pine-Needles, of which the following is a specification.

The invention relates to a method of treating pine-needles for obtaining the fiber, the oil, and the extract.

The object of the present invention is to provide a method of treating pine-needles for obtaining fiber, pine-needle oil, and extract and to enable pine-needle fiber of a much finer character than has heretofore been possible to be rapidly produced.

A further object of the invention is to enable a larger quantity of pine-needle oil to be obtained from a given amount of pine-needles and to prevent the oil from evaporating or becoming mixed with water while it is being collected and separated from the latter, whereby pure oil of great strength is obtained and the necessity of rectifying the same obviated.

Another object of the invention is to lessen the cost of producing pine-needle fiber and oil and to provide a process adapted to be continuously and economically operated.

With these and other objects in view the invention consists in the novel method hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the claims hereto appended, it being understood that various changes within the scope of the claims may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings, Figure 1 is an elevation of an apparatus for carrying into effect the herein-described method of treating pine-needles. Fig. 2 is a sectional view of the distilling apparatus. Fig. 3 is a similar view of the crushing mechanism and the means for feeding the pine-needles to and from the same. Fig. 4 is a vertical sectional view of one of the fiber-making machines. Fig. 5 is a longitudinal sectional view of the drum or reel for removing the waste and dust from the fiber after the same has left the fiber-making machine and for loosening up the balls of fiber and rendering the same fluffy. Fig. 6 is a transverse sectional view of the same. Fig. 7 is a vertical sectional view of the washing mechanism. Fig. 8 is an elevation, partly in section, of the drier. Fig. 9 is an end elevation of the same. Fig. 10 is a detail view of the wringer and a portion of the conveyer for carrying the fiber from the wringer to the drier.

Like numerals of reference designate corresponding parts in all the figures of the drawings.

1 designates cylindrical steam-tight receptacles designed to be arranged in a curved series concentric with the standard or support 2 of a crane 3, which is adapted to oscillate to carry its hoisting mechanism from a point above any one of the cylindrical receptacles to a point above a hopper 4 for transferring the pine-needles from the cylindrical receptacles after they have been boiled or subjected to the action of steam for obtaining the extract and for liberating the volatile pine-needle oil. The receptacles 1, which may be of any desired construction and which may be heated in any desired manner for boiling the pine-needles, are each preferably provided at the bottom with a steam-coil 5 for discharging steam into the receptacle for subjecting the pine-needles to the action of the same. A removable steam-tight cover 6 is provided for the receptacle 1, and the pine-needles are held while being subjected to the action of the steam in a basket or receptacle 7, constructed of suitable open-work and provided with a bail 8 for enabling it to be readily connected with the crane. The basket, which may be constructed of wire-gauze or any other suitable material, is provided with a hinged bottom 9, normally held closed by a suitable catch 10 and adapted to be released to dump its contents into the hopper 4. The steam-tight cover is provided with a suitable eye, as shown in Fig. 2, to enable it to be engaged by a hook or other device of the hoisting mechanism of the crane to enable the cover to be readily lifted off the receptacle after the pine-needles have been subjected to the action of the steam for a sufficient length of time. Any suitable means may be provided for securing the lids

or covers to the receptacles for rendering the latter steam-tight. The receptacles are provided at the bottom with suitable cocks or faucets 11 for enabling the extract to be drawn off after the steaming operation or boiling operation has been completed. The volatile oil and steam pass upward through the tube or pipe 12 to a condenser 13, having coils 14 communicating with the pipe or tube 12 of the receptacle, as clearly illustrated in Figs. 1 and 2 of the drawings, and these pipes or coils 14 are arranged within a casing and are subjected to the action of cold water to condense the steam and the oil. Each coil has its lower or discharge end 15 piercing the bottom of the casing and depending therefrom into an upwardly-extending tubular arm 16 of a receptacle 17, into which the oil and water drip. The tube or arm 16, which is approximately L-shaped, as illustrated in Fig. 2, is of greater diameter than the depending lower discharge end 15 of the condenser-coil 14 to permit the air to escape, whereby the air is prevented from agitating the oil which collects upon the surface of the water in the receptacle 17. The receptacle 17 is provided at the top with an oil-discharge faucet 18, and it is connected at its bottom with a tube or pipe 19, adapted to carry off the water from the receptacle 17 and provided with an upwardly-extending bend 20 to cause the water to remain in the receptacle 17 to a predetermined level. The upwardly-extending bend 20 has its upper portion arranged above the plane of the lower end of the tubular arm 16, and the lower end of the water pipe or tube 19 is connected with the receptacle 17 at the bottom thereof. By this construction the tube 16 discharges beneath the surface of the water and does not disturb the oil on the surface. The upper portion 21 of the receptacle 17 is preferably tapered, as shown, and the oil collects in the upper tapered portion. As soon as a sufficient quantity of oil has collected in the receptacle a valve or cock 22 of the pipe or tube 19 is closed to prevent the escape of water from the said receptacle 17, and the water rising therein will force the oil outward through the discharge-faucet 18 into a suitable receptacle. As the upper portion 21 of the receptacle 17 is air-tight, the oil is not permitted to evaporate, and as the water is not agitated by skimming the oil from the surface pure oil unmixed or diluted with water is obtained, and the necessity of rectifying the oil is obviated. Also the loss or waste of oil is reduced to a minimum, and a much greater quantity of oil is obtained from a given amount of pine-needles than heretofore. Also the flow of the oil from the receptacle 17 is automatic, thereby enabling the oil to be more easily and conveniently obtained and reducing the cost of the same to a minimum. The oil may be permitted to collect in the air-tight upper portion of the receptacle 17 for one or more days, and any suitable means may be provided for enabling the height of oil in the receptacle to be ascertained. After the oil has been removed from the receptacle 17 by the action of the water the cock or valve of the water pipe or tube 19 is opened to permit the water in the receptacle 17 to sink back to its normal level. The cock or valve 18 is then closed, and the automatic operation of the apparatus in collecting the oil on the surface of the water continues until a sufficient quantity again accumulates.

Any number of receptacles and condensing-coils may be provided, as will be readily understood, and instead of having a separate condensing-coil for each boiler or receptacle 1 a plurality of boilers may be connected with a single condensing-coil, if desired.

The pine-needles after being discharged from the skeleton or reticulated basket into the hopper 4 are conducted by an inclined chute 23 to a crushing-machine 24, which mashes the wood off the points of needles and crushes the latter. The hopper 4 is tapered and is provided with an open lower end which is disposed directly above the upper portion of the inclined chute 23. The chute 23, which is short, is mounted on the frame of the crushing-machine, which is provided with a main crushing-roll 25, arranged at the center of the machine and at the lower end of the inclined chute 23. Any suitable means may be provided for controlling the feed of the pine-needles to the crushing-machine, and the feed may be entirely automatic, or it may be partially controlled by hand, if desired. The main crushing-roll 25 is suitably journaled in fixed bearings of the frame of the machine, and it coöperates with a series of yieldably-mounted smaller rolls 26, having their journals arranged in slots 27 and engaged by suitable coiled springs 28, located in the slots. The rolls 26 are arranged above the main crushing-roll, and the pine-needles after passing through the crushing-machine drop upon the upper flight of an inclined endless conveyer 29, arranged in a suitable frame or casing 30, which extends downward to a point directly beneath the main crushing-roll 25, as clearly illustrated in Fig. 3 of the drawings. The inclined endless conveyer carries the crushed pine-needles upward and delivers the same to a trough 31 or other suitable receptacle, where the crushed mass will be in convenient reach of an operator who feeds the material to fiber-making machines 32. The casing 30 and the endless conveyer which is arranged therein may be constructed in any desired manner.

It has been found by experience that one person can conveniently feed the material to and remove the fiber from three fiber-making machines which are constructed as shown and described in Letters Patent No. 675,206, granted to us September 4, 1900. The feed-trough, which has an inclined rear wall and

tapering sides, as indicated in Fig. 1, is located at one end of the series of machines to enable the operator to obtain the material readily, and an inclined trough 33, provided with a conveyer 34, is arranged longitudinally of the series of machines, in rear thereof, in convenient position to enable the operator to throw the fiber into it after the same has been removed from the machines.

Each machine is provided with upper and lower grinding-disks 35 and 36, and a gyratory motion is imparted to the upper disk, as set forth in the said patent. The lower disk 36 rests upon a cross-bar which is secured at its ends to vertically-reciprocating rods 37. A cross-bar 38 is secured to the rods 37 near their lower ends and is provided near its middle with an opening 42 to receive the connecting rod or bolt 43. The upper end of the connecting bar or bolt 43 is attached to a lever 45, while the lower end is attached to a lever 46, adapted to be operated by foot. The foot-lever 46 is fulcrumed near its rear end to the framework, and the rod 43 is connected to the foot-lever at a point between the ends thereof. It will be apparent that by pressing downward upon the free end of the lever 46 the lower disk 5 will be depressed, so that material can be placed upon and removed from the same. The lever 45 is provided with a weight for returning the lower disk to its initial position and for holding the same in operative relation to the upper gyratory disk 35. The upper disk 35 is provided with an arm 48, extending diametrically from the same and having a plate 48^a, which is provided with a longitudinal slot 50 for the reception of a stud or projection 51 of the framework of the machine. The stud or projection, which may consist of a fastening device, is provided with a head for holding the plate in position. Gyratory motion is imparted to the upper disk by means of a vertical shaft 53, journaled in suitable bearings of the framework of the machine and provided at its upper end with a pulley 54; but any suitable gearing may be employed for rotating it. The vertical shaft 53 is provided at its lower end with a crank 56, which is connected to the diametrical arm of the upper grinding-disk, and it will be evident that by rotating the shaft a gyratory or whirling motion will be imparted to the upper disk for the purpose of grinding the material. The lower disk is provided with a circumferential guard wall or fender extending entirely around the same and projecting above the lower face of the upper disk to prevent the escape, and consequent waste, of the material. The disks are provided at their adjacent faces with teeth, which coöperate to reduce the material between the disks to a fibrous condition. These teeth, which are arranged in circular series, preferably consist of staples, and the teeth of one disk operate in the intervals or spaces between the teeth of the other disk. The working faces of the disks are concave to prevent the fiber from spreading out between the disks when one or both of them are in motion. By means of the gyratory motion the fiber is thrown together and has a tendency to remain in the center of the disks. It is not permitted to form into a rope, but assumes the shape of balls or spheres, and each of these is thrust from side to side and rolled over and over in such a manner as to bring all the parts of the same into direct contact with the teeth of the disks, which work the fiber uniformly, and the peculiar motion brings certain actions into play—viz., a rubbing action—for when the substance is caught between the disks the pressure is brought to bear directly upon the same, and at the same time a lateral or rubbing action is applied and this compound action gathers the substance into balls and gives to them a twisting and crimping action and at the same time a crushing action so that all portions of the balls are reduced to a fibrous condition. The balls of fiber are removed from the machines by the attendant and thrown into the inclined trough upon the conveyer 34, which carries the material forward and discharges the same into a rotary drum or reel of polygonal form, preferably open at both ends, as clearly illustrated in Fig. 5 of the drawings. This rotary drum or reel, which is slightly inclined, consists of a frame covered with wire-gauze or other suitable screen material and provided with longitudinal ribs 60, extending inward from the angles or corners of the reel and arranged to engage the fiber and carry the same upward. The reel is rotated with sufficient rapidity to enable the longitudinal inwardly-projecting ribs to carry the balls of fiber nearly to the top of the reel, so that the balls will fall therefrom to the bottom of the reel to be again carried upward. By this operation the dust and waste are thoroughly removed from the fiber and pass out through the perforations of the screen material, and the balls of fiber are loosened and rendered fluffy and in suitable condition for a final washing. Owing to the inclination of the reel, the fibrous balls gradually descend to the lower end of the same and are discharged therefrom into a washing-machine 61. The polygonal reel 59 is provided at its ends with circular rims 62 and 63 and is supported by flanged wheels 64, as clearly shown in Figs. 5 and 6, and motion is communicated to the reel by means of a belt 65, as hereinafter explained. The flanged wheels are mounted in suitable brackets; but any other means may be employed for that purpose. The loose fluffy balls of fiber are discharged from the rotary sifting reel or drum upon a short inclined approximately semicircular flange or apron 66 of the washing-machine body or tank 67. Within the washing-machine body is journaled an oscillatory cylinder or agitator 68, provided with inclined

teeth or fingers 69, extending forwardly. A concave diaphragm or partition 70, forming a false bottom for the tank or washing-machine body 67, is interposed between the oscillatory agitator and the bottom of the body and is provided with fingers or projections 71, extending forwardly or in the direction in which the material is carried by the oscillatory agitator 68. The washing-machine body is pierced at its upper portion by a suitable feed-pipe 72, and it is provided near its bottom with a drain-opening 73, having a suitable cock or closure, and by these means the water necessary for washing the fiber is supplied to and removed from the washing-machine body. The fiber is positively carried forward by the fingers of the oscillatory cylinder or agitator, and it is separated and thoroughly subjected to the action of the water by the fingers of the perforated diaphragm or false bottom, so that the fiber is thoroughly cleaned by the washing-machine. The fiber is delivered by the washing-machine to a wringer 74, consisting of upper and lower rolls arranged in pairs and connected by upper and lower belts or aprons 75 and 76. The upper and lower belts, which are constructed of canvas or other suitable material, prevent the fiber from winding around the adjacent wringer-rolls, and they have rearwardly-diverging inner adjacent flights to free the material after the same has been compressed between the front wringer-rolls. The lower belt 76 operates as a short conveyer for carrying the washed fiber to an inclined endless conveyer 77, extending to a drier 78, located within a suitable dry-room, which is designed to be heated in any preferred manner. The front wringer-rolls are preferably geared together, and one of the rolls is connected by a belt 79 or other suitable means, as hereinafter explained, with the operating mechanism. The inclined conveyer 77 is arranged within a suitable casing 80, and it empties into a short inclined chute 81, which directs the material into the upper drum or reel 82 of a vertical series of the same. These drums or reels, which are reversely inclined, as clearly shown in Fig. 8 of the drawings, are constructed substantially the same as the inclined drum or reel 59. The top drum or reel 82 of the series inclines downward toward the upper end of the adjacent drum or reel, and a short end chute 83 is provided for conducting the material from the lower end of one chute into the upper end of the other drum or reel. Each drum or reel is provided with a periphery or covering of screen material and is polygonal, being provided at the corners or angles with inwardly-extending ribs or flanges for carrying the material upward in the manner heretofore described. The material is carried from the bottom to the top of the drum or reel and is permitted to fall therefrom to the bottom thereof, the material being gradually carried downward toward the lower end of the drum, owing to the inclination of the same. The drums or reels are mounted upon suitable antifriction-wheels 84, which are flanged similar to those heretofore described and which receive circular rims located at the ends of the drums or reels. One of the circular rims of each drum or reel is enlarged and preferably grooved to receive a belt for connecting it with the mechanism for imparting rotary motion to the said drums or reels. A short chute 83 is arranged at the lower end of each of the drums or reels, with the exception of the bottom one of the series, for causing the fiber to pass backward and forward through the oppositely-inclined drums or reels of the drier, whereby the fiber is thoroughly subjected to the heat of the drying-room and is thoroughly dried by the same. Any suitable means may be employed for receiving the fiber from the lowermost drum or reel of the series, and a suitable framework is employed for supporting the drums or reels, as clearly illustrated in Fig. 9 of the drawings. Also any number of rotary drying drums or reels may be employed, so that the fiber on leaving the lowermost one will be completely dried and ready for use.

The main crushing-roll is connected by a belt 85 with a line-shaft 87. The belt 85 communicates motion to the crushing-machine, and a belt 86 operates the inclined conveyer, which conducts the material from the crusher to the feed trough or receptacle which holds the crushed pine-needles until operated on by the fiber-making machines. The conveyer of the trough 43, which receives the fiber from the machines, is operated by a belt 87^a, which extends from the conveyer 29. The fiber-making machines are connected directly with the line-shaft by short belts 88, extending from the pulleys 54 to suitable pulleys on the line-shaft. The drum or reel 59 is connected directly to the line-shaft by the belt 65, and the oscillatory agitator or cylinder of the washing-machine is connected by a pitman 89 with a pulley 92, having a wrist-pin or crank to receive the pitman, whereby when the pulley 92 is rotated the cylinder or agitator will be oscillated. When the cylinder or agitator moves backward, the forwardly-extending teeth move over the material, which is fed by the forward movement of the cylinder or agitator. The pulley 92 is connected by a belt 93 with the line-shaft 87, and the belt 79 of the wringer may be either connected with the pulley 92 or the line-shaft. The belt 90 extends from the inclined conveyer 77, and it may be operated by the line-shaft directly or by indirect connection with the same. The belts 91 of the drums or reels of the drier extend from the latter, as indicated in Fig. 9 of the drawings, and any suitable means may be employed for driving these belts.

From the foregoing it will be seen that a

method of treating pine-needles is provided, adapted to extract from them a maximum amount of pure oil and capable of rapidly crushing and converting the pine-needles into fiber and of washing, wringing, and drying the same. Also it will be clear that after the balls of fiber leave the machines the material is cleaned and rendered loose and fluffy in order to enable the fiber to be quickly and effectively washed and dried. Furthermore, it will be apparent that an attendant is required only for operating the fiber-machines and for placing the baskets of pine-needles in and removing them from the cylinders, in which they are steamed, and that the oil collects within the receptacle and does not have to be drawn off until a considerable quantity has accummulated. The expense of producing pine-needle fiber and of obtaining the oil and extract is reduced to a minimum, a greater quantity of pure oil is obtained than has heretofore been possible, and a much finer quality of fiber is more rapidly obtained and is produced in large quantities.

What we claim is—

1. The herein-described method of treating pine-needles, consisting in subjecting the pine-needles to the action of steam to liberate the oil and obtain the extract, crushing the needles to remove the wood from the points thereof, converting the crushed needles into fiber, shaking the fiber and sifting the same to remove the dust and waste, and washing, wringing and drying the fiber, substantially as described.

2. That method of treating pine-needles consisting in subjecting the same to the action of heat and moisture, crushing the needles, converting the crushed material into fiber, agitating and sifting the fiber to remove the dust and waste and render the fiber fluffy, and washing the fiber, substantially as described.

3. That method of treating pine-needles consisting in subjecting the same to the action of heat and moisture, converting the same into fiber balls, agitating the balls to render the fiber fluffy, sifting the dust and waste from the fiber balls, and washing the fiber, substantially as described.

4. That method of treating pine-needles consisting in subjecting the same to the action of heat and moisture, converting the needles into fiber, agitating and sifting the fiber to render the same fluffy and to separate the dust and waste from the material, washing the fiber, and wringing the same, substantially as described.

5. That method of treating pine-needles, consisting in removing the oil and extract therefrom, converting the same into fiber balls, and agitating the balls to render the fiber fluffy, substantially as described.

6. That method of treating pine-needles, consisting in converting the same into fiber balls, and agitating the balls to render the fiber fluffy, substantially as described.

7. That method of treating pine-needles, consisting in subjecting the same to the action of heat and moisture, separating the wood from the points of the needles, and converting the latter into fiber, substantially as described.

8. That method of treating pine-needles, consisting in subjecting the same to the action of heat and moisture, crushing the needles and separating the wood from the points thereof, converting the needles into fiber balls, and agitating the latter, substantially as described.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

CLARK M. TERRELL.
OLIVER C. TERRELL.

Witnesses:
T. Y. Dean,
C. E. Maybee.