

No. 806,253.

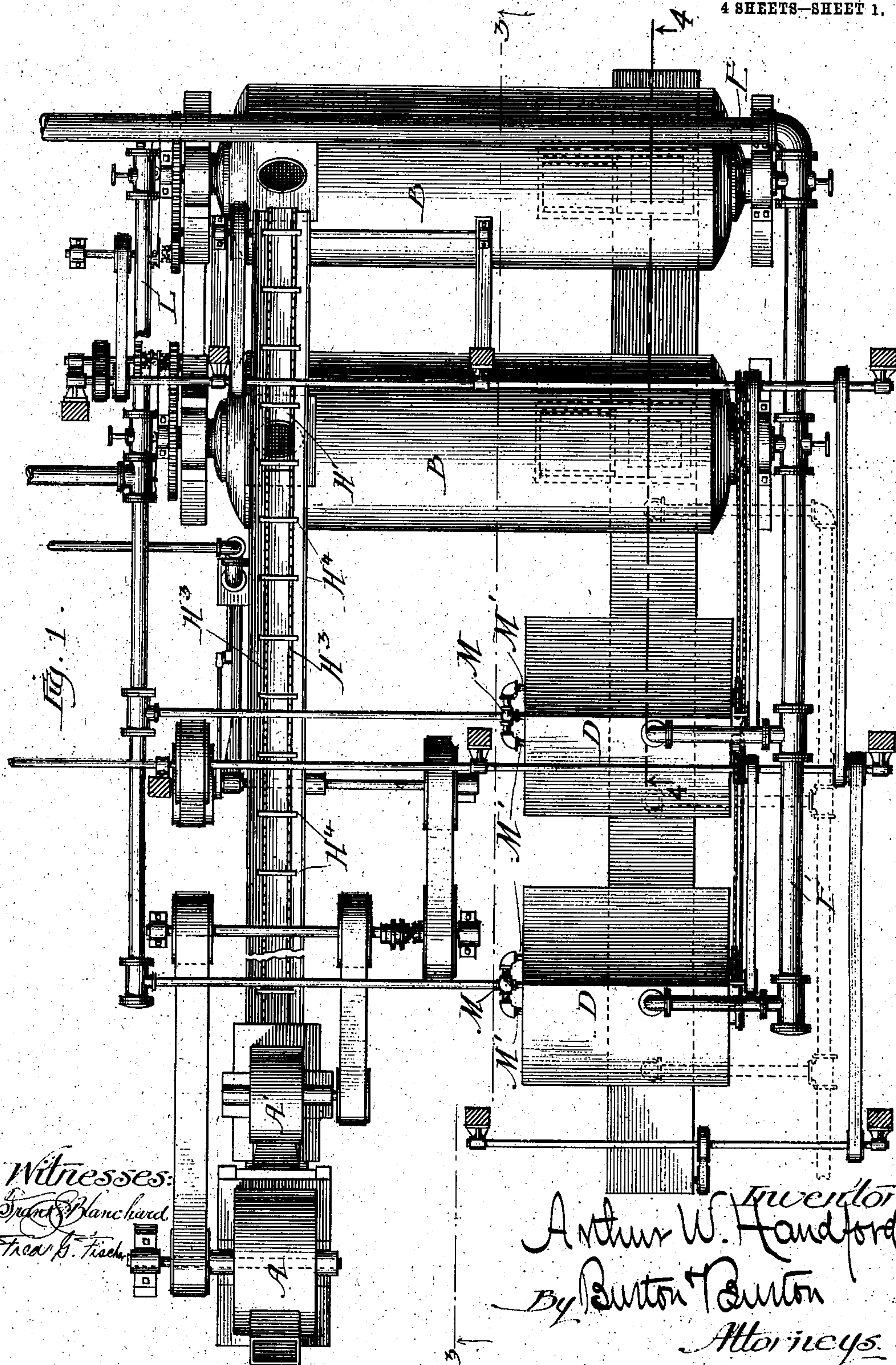
PATENTED DEC. 5, 1905.

A. W. HANDFORD.

APPARATUS FOR FIBERIZING AND DERIVING OTHER PRODUCTS FROM WOOD.

APPLICATION FILED DEC. 27, 1904.

4 SHEETS—SHEET 1.



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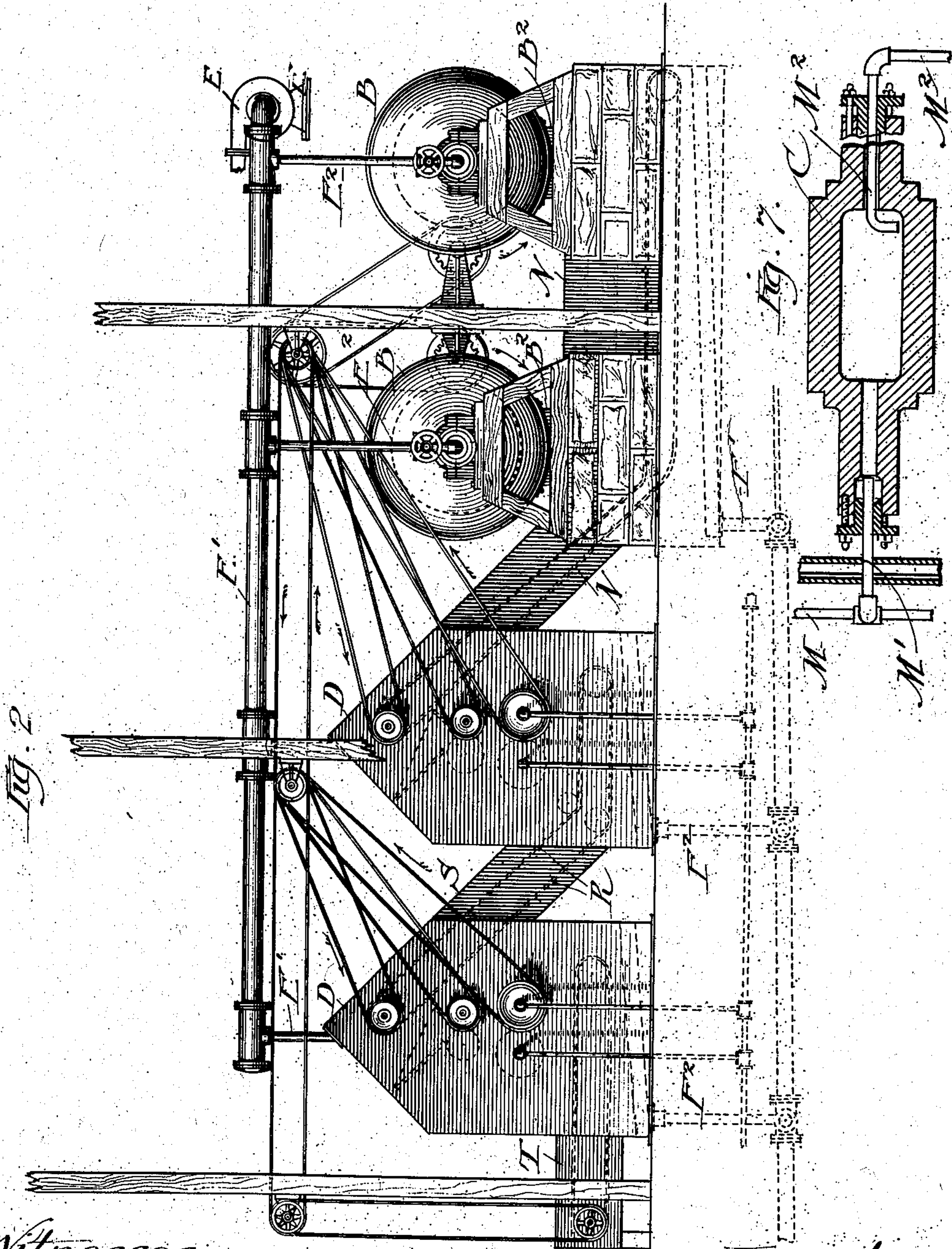
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Inventor:
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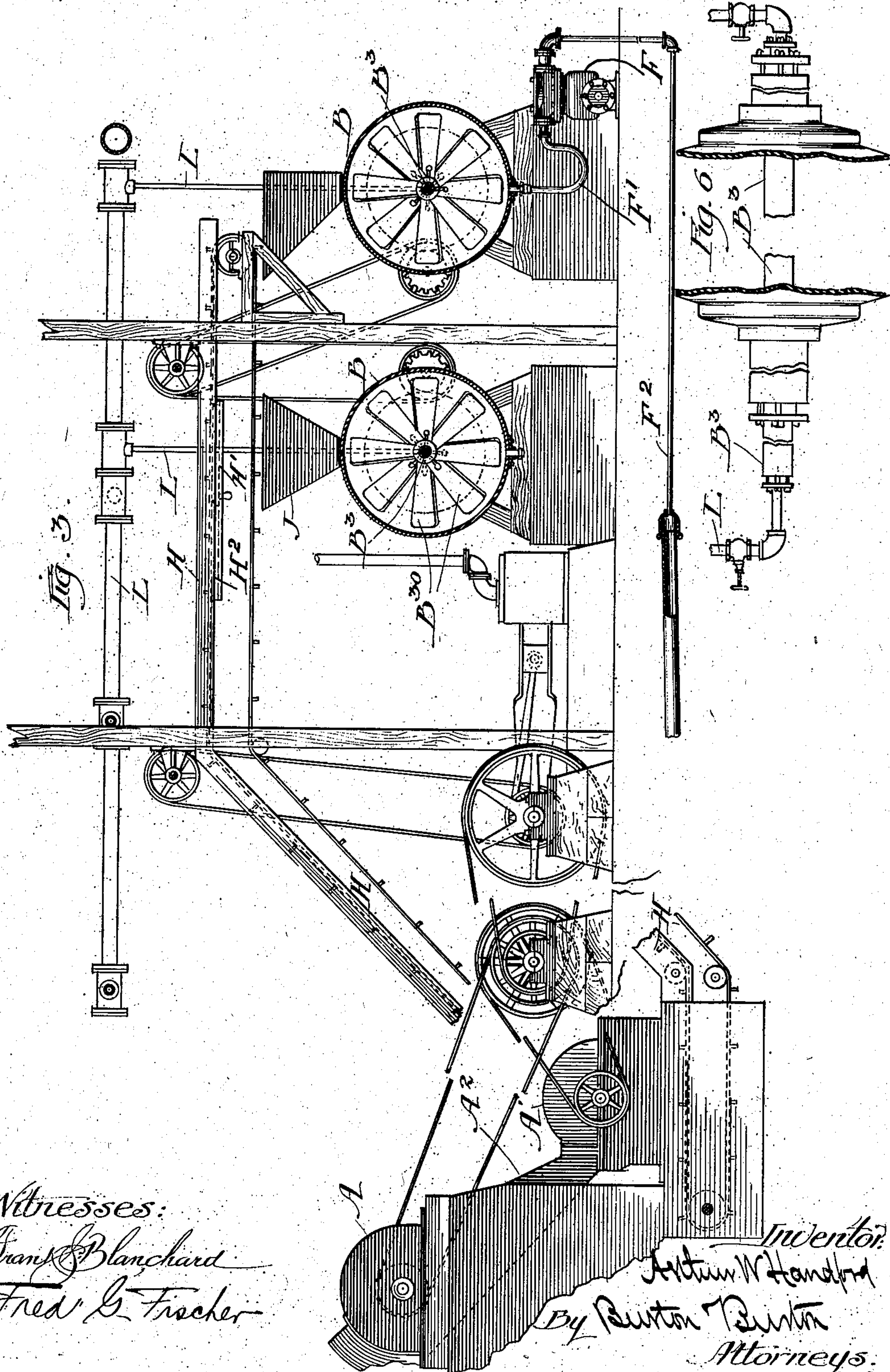
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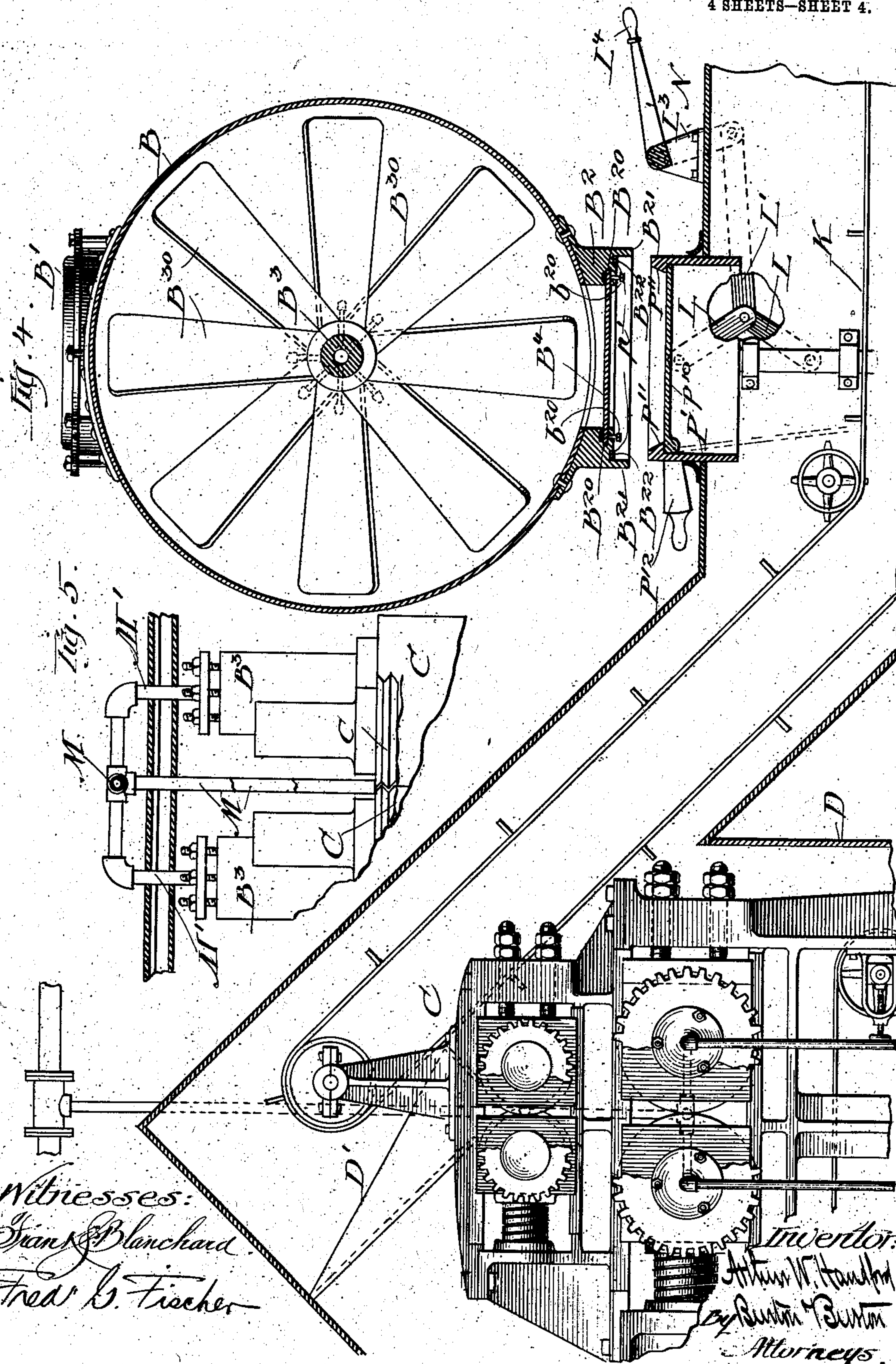
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

ARTHUR W. HANDFORD, OF EVANSTON, ILLINOIS, ASSIGNOR TO WOOD DISTILLATES AND FIBRE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

APPARATUS FOR FIBERIZING AND DERIVING OTHER PRODUCTS FROM WOOD.

No. 806,253.

Specification of Letters Patent.

Patented Dec. 5, 1905.

Application filed December 27, 1904. Serial No. 238,308.

To all whom it may concern:

Be it known that I, ARTHUR W. HANDFORD, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented new and useful Improvements in Apparatus for Fiberizing and Deriving other Products from Wood, of which the following is a specification, reference being made to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide an improved apparatus or system of cooperating structures and devices for treating wood to reduce it to fiber and obtain therefrom valuable liquid products to avoid the necessity of handling the wood at any step in the process after it is delivered to the first machine for crushing it until it is delivered from the final device in the form of wood fiber or wood-pulp and in which the various liquid and vaporous products shall in like manner be taken off at proper stages in the operation automatically or without necessity of manipulation other than the opening and closing of proper valves and gates; and as a part of this general purpose one specific purpose of the invention is to avoid exposure of the material which is being treated to the atmosphere after it has been subjected to the action of heat and moisture for liquefying and vaporizing its elements which are subject to such action, and thereby to prevent not only the waste of these valuable products by their escape in vapor form, but also to reduce and as nearly as possible remove the danger arising from the inflammability of these vapors.

The invention consists of the features of construction and organization of the entire apparatus shown and described as set out in the claims.

In the drawings, Figure 1 is a plan view of a plant embodying the apparatus constituting this invention. Fig. 2 is a front elevation of the same, parts below ground being shown in dotted line. Fig. 3 is a vertical section at the line 3 3 on Fig. 1. Fig. 4 is a section at the line 4 4 on Fig. 1 through the digester, roll-housing, and connecting-conduit. Fig. 5 is a detail section showing the steam-pipes entering the roll-housing. Fig. 6 is a detail axial section of the digester-shaft at the end portions and of the adjacent portions of the

digester-heads for showing the steam-entrance and vapor-exit. Fig. 7 is an axial section of the end portions of one of the rolls, showing the steam-entrance and waste-water exit.

The entire apparatus shown in the drawings comprises, first, a "hog" or grinder A, adapted to receive the wood in chunks or fragments (the purpose being to utilize the refuse slabs and fragments of pine and other resinous woods) and reduce the same by maceration to comparatively fine fragments, so that it can be handled in mass very much as short-fibered wool or chopped straw might be handled; second, a shredder A', for further reducing the wood mechanically to shreds, splinters, or filamentary fragments; third, a digester B, which is a horizontal cylinder into which the product of the shredder is delivered and wherein it is subjected to the action of steam for digesting it by heat and moisture to liquefy and vaporize the portions which may be thus reduced; fourth, a system of wringing or pressing rolls C, contained in a housing D, the fiber product of the digester after draining therefrom the liquids which may be thus separated and exhausting the vapor products from the digester being delivered to the rolls therein, and thereby pressed and ground to express from the fibrous mass the remaining liquid which they contain and at the same time reduce the mass to the condition more strictly denominated "fiber," for which reason this step of the process is called "fiberizing." The resultant fiber is conducted away from the discharge side of the rolls as the final step in the process. The vapor products separated from the mass by the action of the steam in the digester and the further vapors which are given off in the step of the process which is performed by the rolls are withdrawn from the digester and from the roll-housing, respectively, by an exhaustor E through suitable conduits or exhaust-pipes E' and E'', leading from the digester and roll-housing, respectively. The liquids drawn from the mass in the digester and expressed therefrom by the rolls are pumped away from the digester and drained from the roll-housing, respectively, by a pump F through conduits F' and F'', by which they are delivered to a distilling apparatus. (Not shown.) To avoid

the handling of the wood after it is delivered to the hog, the shredder A' is depressed, so that the product passes by gravity through the inclined chute A² to the shredder, and an
 5 endless conveyer and elevator H is provided for conducting the shredded mass of wood from the shredder to a hopper J for delivering it into the digester B, which has a man-
 10 hole with a removable cover B' for that purpose, and it is especially important that the shredded mass exposed to the steam (through means hereinafter described) in the digester, and thereby heated and moistened, should
 15 not thereafter be exposed to the outer air until the process is completed, both because such exposure would involve waste of the heat, which is necessary to maintain the valuable products of the wood in liquefied condition until the treatment is complete, and also
 20 because such exposure would permit the escape of considerable quantities of the hydrocarbon vapors which it is the purpose of the process to preserve and condense and which being highly inflammable would render the process dangerous if their free escape
 25 at any stage was permitted. There is therefore provided a closed conduit N, leading from the hopper-mouthpiece P', which is adapted to register with a discharge-manhole
 30 B² of the digester into the housing D of the roll system C, and in this closed conduit an endless conveyer K operates to conduct the fiber mass which is discharged onto it from the digester and deliver the same to the hop-
 35 per D' for directing its discharge to the upper side of the first pair of rolls of the system C.

Inasmuch as each item of this apparatus is necessarily very heavy and not suitable to be mounted on upper floors of a building,
 40 but, on the contrary, should be supported directly upon firm foundations, it is necessary for the continuous handling of the material in the manner indicated that the conveyer for conducting it from step to step or
 45 from element to element of the apparatus should be elevators, so that the material delivered from the bottom of the shredder is carried up for delivery into the top of the digester and when delivered from the bottom
 50 of the digester is carried up for delivery into the upper part of the roll-housing, as seen in the drawings. Inasmuch as the extraction of the elements of the wood which can be liquefied by heat and moisture requires that
 55 such heat and moisture should be continuously applied throughout all stages of the process of extracting such elements, not only the digester B, but also the roll-housing D and rolls C therein, are kept supplied with
 60 steam for the purpose of both heat and moisture. The digester receives its supply of steam by a pipe L through the center of the shaft B³, which carries within the digester arms B³⁰ for feeding the fibrous material
 65 longitudinally therethrough for filling and

emptying it. The roll-housing and the rolls are supplied with steam by the pipes M M' M', the former being branched for delivering the steam through the housing-wall at the
 70 lines of tangency of the two systems of rolls therein, so that it may be directed onto the material as it passes between the rolls, while the pipes M' M' deliver the steam through the shafts of the rolls of the second set into
 75 said rolls, which are hollow, for heating them directly and more completely than it is necessary to heat the first set. The water of condensation from these rolls is taken off by pipes M² M².

For the same reason for which it is impor-
 80 tant that the shredded wood fiber should be conducted from the digester to the fibering apparatus without exposure it is desirable that the means of connecting the digester and the hopper leading to the conduit N
 85 should be one which can be operated so that no substantial opening shall occur by means of which vapors might escape in the transfer of said material from the digester to the conduit. For this purpose the cover B' of the
 90 discharge-manhole B² of the digester is mounted in slideways B²⁰ on the manhole-fitting, so that it slides longitudinally with respect to the cylinder for covering and uncovering the manhole. The manhole-
 95 fitting has a flange B²¹ extending around the manhole-opening, which projects beyond the plane of the slide-cover B³, and the conduit P has a telescoping mouthpiece or hopper P', which is adapted to telescope also within the
 100 flange B²¹ up to the shoulder or seat B²² of the latter, and said seat B²² may be provided with a packing p' for making a tight seat for the upper edge of the mouthpiece. The mouthpiece P' is also fitted with a valve or
 105 gate P¹⁰, adapted to be swung up against the under side of a stop-shoulder P¹¹ for closing the mouthpiece and to be dropped to vertical position, as shown in dotted line in Fig. 4, for opening the same. The rock-shaft or
 110 hinge-pintle of this gate or valve P¹⁰ extends to the exterior, where it may be provided with suitable handle for rocking the valve to open and close it, and said handle may be weighted, as shown at P¹², to hold the gate
 115 normally closed up against the shoulder P¹¹. Any convenient means may be provided for raising and lowering the telescoping mouthpiece—such as, for example, a pair of links L L at the two opposite sides of the conduit and
 120 mouthpiece, one link of each pair pivoted to the conduit and the other to the mouthpiece, the two links of the pair being pivoted together and the pivot of one of the pairs being connected by a link L', extending at one side
 125 of the conduit to one of the arms of a bell-crank lever L³, fulcrumed on the conduit, and having another arm or handle L⁴, which may be operated to push the links L L into line, upholding the mouthpiece or to fold them, as
 130

seen in Fig. 4, to allow the mouthpiece to descend.

By keeping the exhauster in operation during the period of discharge of the shredded material from the digester into the conduit there will be caused an intake of air through any crevices that may exist, and thus the leakage of inflammable vapors will be prevented; but it is still necessary to make the connection between the digester and conduit as close as practicable, because any considerable entrance of air would cool the product and diminish the efficiency of the apparatus. It will be understood that upon bringing the digester to rest in position for discharge through the discharge-manhole the mouthpiece B' will be first thrust upward to the shoulder B²². The valve P¹⁰ will then be opened and the manhole-cover withdrawn in its slideways. The contents of the digester having been discharged into the conduit, the valve P¹⁰ will be closed and the mouthpiece lowered, leaving the digester free for another charge, which it will receive after the discharge-manhole has been closed. The manhole-cover may be bound tightly in closed position by bolts b²⁰ b²⁰, which can be slacked before the mouthpiece P' is thrust up, so that the manhole-cover can be withdrawn, as above described.

In order to maintain the continuous operation of this entire apparatus, it is necessary to employ two digesters, one of which shall be operated while the other is being emptied and filled, and the above description of the digester and its relation to the remainder of the apparatus may apply to either of the digesters at any moment in use; but in order to turn the delivery of the shredded wood into either digester at will the trough of the conveyer H, which at the end delivers into the more remote digester has, at a point above the hopper of the conveyer first reached a trap-door H' in its bottom, which may be opened by sliding it back in its slide-bearings H², as shown in dotted line in Fig. 3, to cause the shredded material to be delivered into said first conveyer. The conveying apparatus, as seen in Fig. 1, consists of the two parallel chains H³ H³ and connecting cross-bars or pushers for pushing the shredded material along the floor of the trough, so that when the bottom of the trough is opened by dropping the trap-doors H' the material will pass through into the hopper between the cross-bars H⁴ of the lower ply of the chain.

The two roll-housings and the inclosed mechanism are shown. The foregoing description may be taken as applied to either one of them, so far as the general operation is concerned; but when two are employed it is only for the purpose of repeating the process of fiberizing the material delivered to them, and in this case the fiber delivered from the rolls of the first housing is carried

by an endless conveyer (represented conventionally at R) and carried up through a closed conduit S, which-connects the two housings, and delivered to the roll of the second housing in the same manner as the conveyer of the conduit N delivers the shredded fiber to the rolls of the first housing, and from the final rolls of the second housing the fiber is delivered by an endless conveyer T, by which it may be understood that it is conducted to any suitable receptacle.

I claim—

1. In an apparatus for the purpose indicated, means for comminuting the wood; a digester for steaming the resultant mass; a system of rolls for expressing the liquids from the mass and fiberizing the remainder, in combination with conveyers leading respectively from the comminuting means to the digester and from the digester to the fiberizing-rolls and from the rolls for final discharge of the fiber.

2. In an apparatus for the purpose indicated, means for comminuting the wood; a digester for steaming the comminuted product; rolls for expressing the fluids from the product of the digester and a housing inclosing such rolls; conveyers leading respectively from the comminuting means to the digester and from the digester to the rolls and from the rolls for final discharge of the fiber; an exhauster and conduits thereto leading from the digester and from the roll-housing for gathering the vapors from both.

3. In an apparatus for the purpose indicated, means for comminuting the wood; a digester for steaming the comminuted product; rolls for expressing the fluids from the product of the digester and a housing inclosing such rolls; conveyers leading respectively from the comminuting means to the digester and from the digester to the rolls and from the rolls for final discharge of the fiber; a pump and conduits thereto from the digester and roll-housing respectively for gathering the liquid from both to a common receptacle.

4. In an apparatus for the purpose indicated, means for comminuting the wood; a digester for steaming the comminuted product; rolls for expressing the fluids from the product of the digester and a housing inclosing such rolls; conveyers leading respectively from the comminuting means to the digester and from the digester to the rolls and from the rolls for final discharge of the fiber; an exhauster and conduits thereto leading from the digester and from the roll-housing for gathering the vapors from both, and a pump and conduits thereto from the digester and roll-housing respectively for gathering the liquids from both to a common receptacle.

5. An apparatus for the purpose indicated comprising, in combination with the digester, means for delivering thereto a fibrous

mass to be treated therein; a system of pressing-rolls and means for delivering thereto from the digester the fibrous product of the latter; a housing in which said rolls are contained; means for supplying steam to the digester and to the roll-housing; a conveyer for taking the product of the digester to the rolls and housing for such conveyer continuous with the roll-housing whereby the fiber mass is kept inclosed from its first exposure to the steam until its final delivery.

6. An apparatus for the purpose indicated comprising, in combination with the digester, means for delivering thereto a fibrous mass to be treated therein; a system of pressing-rolls and means for delivering thereto from the digester the fibrous product of the latter; a housing in which said rolls are contained; means for supplying steam to the digester and to the roll-housing; a conveyer for taking the product of the digester to the rolls, and housing for such conveyer continuous with the roll-housing; an exhaustor and connections thereto from the roll-housing, for maintaining inflow of gases and preventing their escape through all the apertures, inlets or crevices of said housing and the connected cavity of the conveyer-housing.

7. An apparatus for the purpose indicated comprising a device for mechanically reducing the wood; an endless elevating-conveyer leading from the device for carrying away and simultaneously elevating the product from the latter; an elevated hopper into which the elevating-conveyer discharges; a digester into which the hopper leads; an elevating-conveyer to which the digester delivers its fiber product for conducting said product away from the digester and simultaneously elevating it, and a series of wringing-rolls located one above another, the last-mentioned elevator being adapted to deliver to the upper of said rolls, and said rolls being adapted to deliver successively from a pair above to a pair below, and a conveyer to which the lowest pair of rolls of the series delivers the fiber product.

8. In an apparatus for the purpose indicated, a continuously-inclosed path for the wood - fiber product during treatment and means in such path for treating it comprising a digester and means for supplying it with steam for steaming the mass; a series of rolls for wringing the product of the digester and fiberizing it, and a housing for such rolls; a conveyer for taking the product of the digester to the rolls and a housing for such conveyer, the last-mentioned housing being continuous with the housing of the rolls, and at its receiving end making junction with the discharge-aperture of the digester.

9. In an apparatus for the purpose indicated, the combination of a rotatable digester and a conduit into which it discharges, the digester having a discharge-manhole provided with a sliding cover and the conduit having an adjustable mouthpiece adapted to be thrust radially with respect to the digester for registration with the discharge-manhole.

10. In an apparatus for the purpose indicated, the combination of a digester rotatable about a horizontal axis and a conduit below the same into which it discharges, the digester having its discharge-manhole provided with a fitting having longitudinal slideways and a flat manhole-cover operating in said slideways, the conduit having a mouthpiece movable radially with respect to the digester and adapted to register under the digester discharge-manhole and to seat upon the manhole-fitting outside the manhole-cover slideways of the latter.

11. In an apparatus for the purpose indicated, the combination of a rotatable digester and a conduit into which it discharges, the digester having a discharge-manhole provided with a manhole-fitting having a flange encompassing the manhole-opening projecting off from the body of the digester and the conduit having a mouthpiece movable radially with respect to the digester adapted to telescope with said manhole-encompassing flange, and a valve in said mouthpiece.

12. In an apparatus for the purpose indicated, the combination of a rotatable digester and a conduit into which it discharges, the digester having a discharge-manhole and a manhole-fitting about the same, the conduit having a mouthpiece adapted to be thrust radially toward the digester and to register with the manhole-fitting; means for operating such movable mouthpiece consisting of similar pairs of links at two opposite sides, one link of each pair being pivoted to the mouthpiece and the other to the conduit and adapted when in line to hold the mouthpiece projected; operating-links connected to the pivots of said pairs of links respectively, said operating-links being connected at their ends remote from said pivots, and a bell-crank lever fulcrumed on the conduit and connections therefrom for actuating the operating-links to fold and straighten the pairs of links.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 29th day of November, 1904.

ARTHUR W. HANDFORD.

In presence of—

FREDK. G. FISCHER,
M. GERTRUDE ADY.