

W. RIDDELL'S.

Apparatus and process for treating Vegetable Fibres.

3 Sheets Sheet 1

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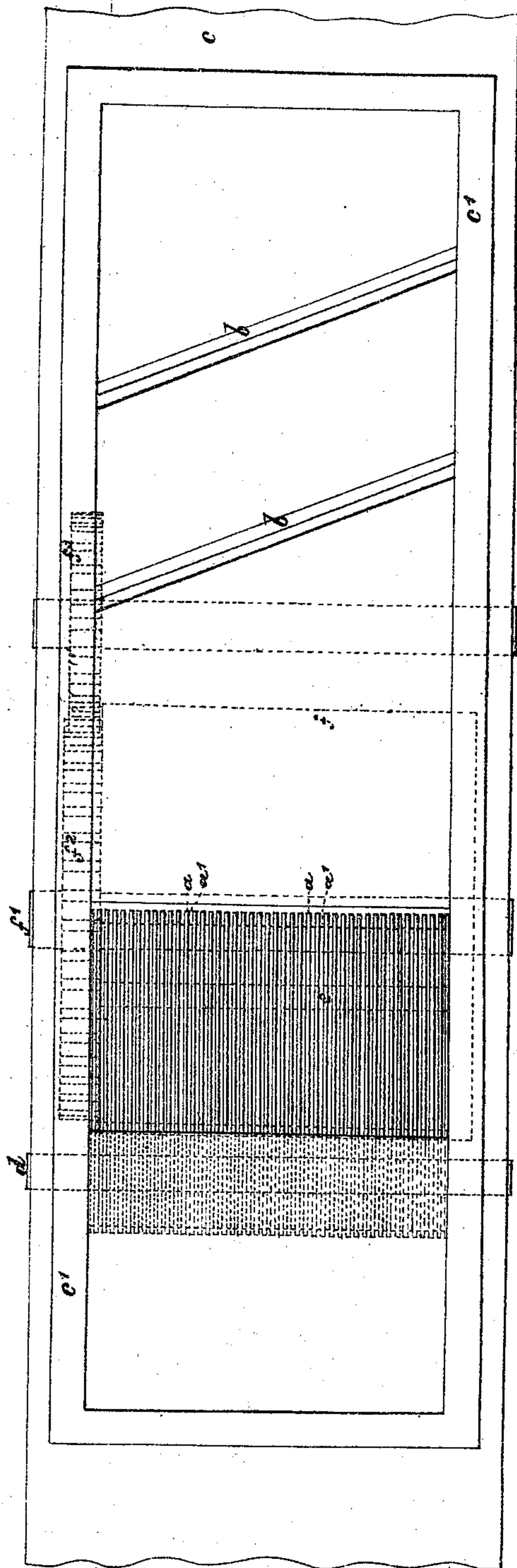


FIG. 1.

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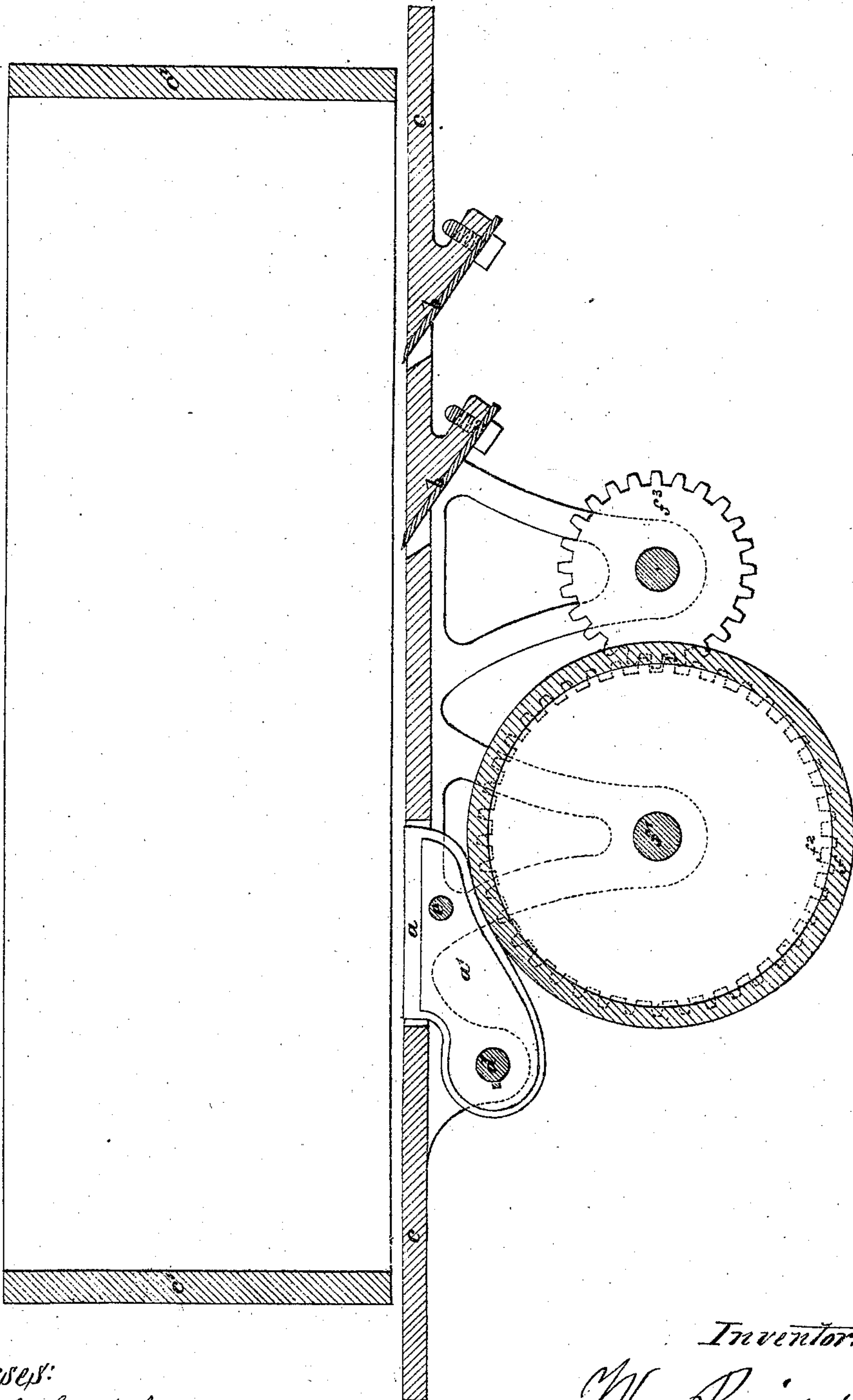
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FIG. 2.



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FIG. 3.

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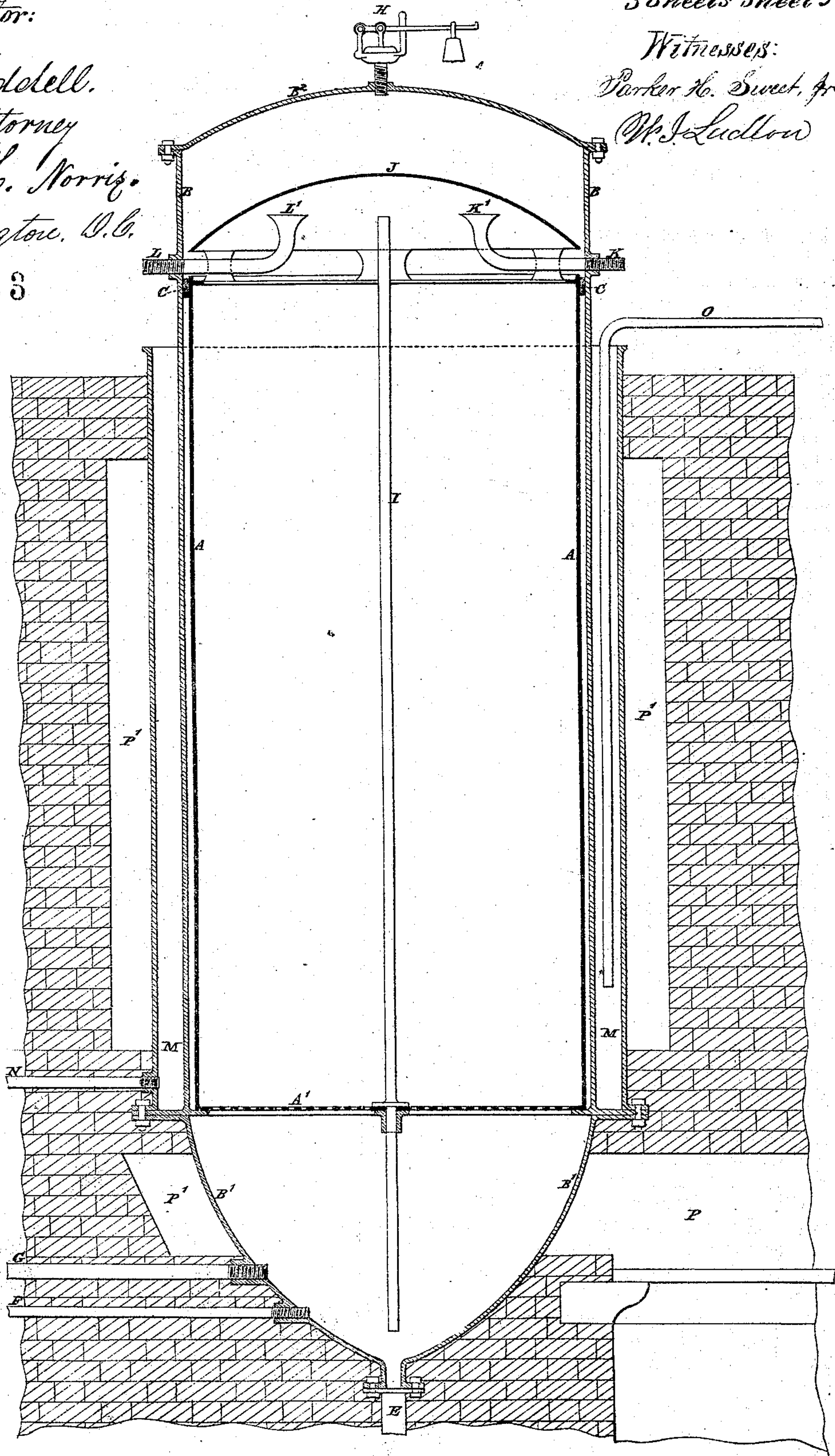
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UNITED STATES PATENT OFFICE.

WILLIAM RIDDELL, OF LONDON, ENGLAND.

IMPROVEMENT IN DISINTEGRATING VEGETABLE FIBERS FOR PAPER-PULPS, &c.

Specification forming part of Letters Patent No. 117,683, dated August 1, 1871.

To all whom it may concern:

Be it known that I, WILLIAM RIDDELL, of London, England, civil engineer, have invented certain improved processes and apparatus for disintegrating, softening, washing, and bleaching wood, straw, esparto grass, and other vegetable fibers, and for extracting resin, silica, or other substances therefrom, which invention is chiefly designed for manufacturing such fibers into paper-pulp, of which the following is a specification:

My invention is chiefly designed for the production of paper-pulp or half-stuff from wood and various other vegetable fibers; but the said invention also supplies the means for advantageously retting flax, developing and cleaning rhea grass and ramme, and for preparing for bleaching and bleaching wood straw, esparto grass, palm grass, New Zealand flax, aloes, maize, rice-straw, stringy bark, Manila, jute, Adamsonia, gunny, and various other vegetable fibers; and during and by the same processes I extract from these various materials resin, silica, dextrine, wax, various acids and alkalies, and other substances found combined with these different fibers in various proportions, which substances may be afterward employed for many commercial purposes not forming a part of this invention.

Figure 1 is a plan of an apparatus which I use for reducing wood to filaments. Fig. 2 is a longitudinal vertical section on the line *x x*, Fig. 1. Fig. 3 is a vertical central section of the vessels used in my process for extracting the resin, silica, and other matters contained in the fibers.

In the manufacture of wood into paper-pulp, according to my invention, the first operation is the reduction of the wood into thin filaments, shavings, or chips. I accomplish this operation by the apparatus shown in Figs. 1 and 2. This apparatus has a series of vertical marking-blades, *a*, and horizontal plane-irons *b*. The blades *a* are separated by division-plates *a'*. These blades and planes are fixed on a reciprocating table, *c*; the wood to be cut is placed in the stationary bottomless box *c'* and is pressed down by a weight or lever. The blades *a* cut incisions in the wood to any required depth, which depth is regulated by raising or lowering the blades. To enable this to be done the said blades are fixed, by means of a feather, on the bar or spindle *d*, and they are secured together by the rod *e*. Underneath this series of blades is a drum, *f*, placed eccentrically

on the shaft *f*¹, on which is keyed a toothed wheel, *f*², controlled by a pinion, *f*³, or other suitable device, by turning which the blades are adjusted to the proper height above the level of the table. These blades project through the reciprocating table *c* in front of the plane-irons *b*, which are set to any required depth, and which, as the table moves under the box, shave off filaments from the wood in the box, the said filaments being received in a proper receptacle under the table; or the said apparatus may have a series of cutting revolving disks instead of the adjustable blades *a*; or the cutting-blades or disks and plane-irons may be fixed in a stationary table or frame, the balks, deals, or other pieces of timber being moved over them by rollers, drums, or other suitable means. The said apparatus, besides its use for cutting the wood into filaments or shavings to be afterward treated as herein set forth, may be advantageously employed in the manufacture of match-splints. The filaments of wood or other fibers to be operated upon are then placed in the cage A, Fig. 3. This cage is made of sheet or plate-iron or other suitable metal. It is open at the top, and is fitted with a bottom piece, A', of perforated metal or wood, or of wire-gauze. This cage is formed to fit a strong cylindrical vessel, B, made of boiler-plate or other suitable metal. At the top of the cage A, between the same and the outer cylindrical vessel B, is a packing, C, of India rubber or other suitable material, which prevents the passage of the steam or liquor between the cage and the outer vessel. Rings or other suitable contrivances are fixed at the top of the cage A to enable it to be lifted to place it in or remove it from the outer vessel, for which purpose I may use any suitable apparatus. The cylindrical vessel B has a conical or egg-shaped bottom, B¹, and a rounded or domed top, B². In the bottom is fixed a discharge-pipe, E, fitted with a tap or valve. A waste-pipe, F, provided with a tap, is also fitted in this bottom at such a height as to leave about six inches of liquor in the vessel B. Another pipe, G, also provided with a stop-cock, is fitted in the bottom B¹, and this pipe is attached to an air pump of any suitable construction. The top B² of this vessel is fitted with a safety-valve, H. A vertical tube, I, open at both ends, is passed through the center of the cage A. The top of this tube must be a few inches above the top of the cage and the bot-

tom must be at least two inches below the waste-pipe F. Over the tube I, and from four to six inches above the same, is a domed iron plate, J, which is suspended over or supported on the cage, and is of the same diameter as the said cage. Steam of any required pressure is admitted into the vessel B by a pipe, K, which is turned a little upward at the end K' under the dome J in order to spread the steam over the top surface of the contents of the cage. A pipe, L, serves to admit water or liquor for washing or preparing the material. The end L' of this pipe is also turned upward under the dome J for the purpose of distributing the water or liquor equally over the contents of the cage. Around the cylindrical portion of the vessel B is an annular jacket or casing, M, for containing water. This casing is open at the top, and has a waste-pipe, N, and tap. A pipe, O, serves for blowing steam into this casing, or may be connected with a worm for boiling or heating the water contained therein to any desired temperature. The vessel B is fixed in brick-work over a fire-place or furnace, P. Flues P' from this fire-place, after passing around the egg-shaped or conical bottom B', extend around the annular casing M nearly to the top, and thence to the chimney or shaft. The pipe L is connected with a cistern for containing water or any liquor or solution required in preparing or washing the materials operated upon in the cage, which water or liquor can be boiled or heated by steam or otherwise.

The operations are conducted as follows: The cage A is filled with the wood or other fibers, which are pressed down as evenly as possible, without making them too hard or close. The cage is then lowered into the cylindrical vessel B. The packing C is properly arranged and the domed spreader J fixed over the cage. The top cover B² is then screwed down and made steam-tight. The taps and valves must be closed and the vessel made steam-tight in all parts. After this has been done steam of any desired pressure is admitted by the pipe K. The waste-pipe F is then opened to permit the exit of the condensed water and a slight escape of steam, which will regulate the pressure during the operation. This condensed liquor will be found to contain the greater portion of the coloring matter, resin, silica, or other substances extracted from the wood or other fibers or materials operated upon, and this liquid is collected in a vessel, to be afterward evaporated or otherwise treated as may be required. These condensed liquors may be used for various useful purposes. That obtained from wood may be used in the manufacture of soap, resin, size, and other articles of commerce. The condensed liquor from straw, esparto grass, flax, and other fibers which contain a considerable quantity of starch, dextrine, silica, wax, and gummy matters may be advantageously used for feeding cattle. That liquor which contains the largest proportion of silica may be used also in the manufacture of soap and for mixing with clay and other materials, for the purpose of giving hardness to bricks for building purposes.

When, by the condition of the water of condensation it is found that the materials have been sufficiently operated upon, the steam is shut off, the waste-pipe closed, and the steam in the vessel B allowed to condense; or it may be condensed by artificial means, or drawn off with the air by the air-pump which is attached to the pipe G. By this means a vacuum or partial vacuum is obtained in the vessel B. At this stage of the operation hot or cold water (or any suitable solution) is admitted to the vessel B through the pipe L from the aforesaid cistern, and is forced through the mass of fibers by atmospheric pressure. The pipes from the cistern and to the air-pump are then closed, the annular vessel is filled with water and heated, and a fire is lighted in the furnace P to boil the water or liquor in the inner vessel under any desired pressure, which is to be regulated by the safety-valve H. When the liquor boils a circulation is established and maintained in the vessel, the liquor flowing up the pipe I against the domed spreader J, being thereby distributed over the entire surface of the materials and percolating between them. When the material has been sufficiently boiled the fire is withdrawn, the annular vessel M emptied, and the liquor drawn off from the inner vessel B, (preferably by an air-pump.) When all the liquor is drawn off, and a partial or complete vacuum is formed in the interior of the said vessel, a fresh supply of water is admitted through the pipe L for washing the fibers, and is also drawn off, these operations being repeated until the material is sufficiently washed. The cover B² of the vessel B is then removed. The cage A containing the material is taken out or emptied in any suitable manner, and the operations on a fresh quantity of fiber or other material can then be recommenced.

If the material thus treated is required for the manufacture of paper-pulp it can be prepared in the usual manner, and may be further operated upon in a beating-engine to bring it into a proper condition for bleaching. The bleaching can be effected by the ordinary processes; but I prefer, during the time this operation is carried on, to pass a stream of carbonic-acid gas and atmospheric air through the material and bleaching liquor. I thereby greatly accelerate the action of the bleach and diminish the quantity required. In some cases, and for particular fibers, I use the chlorine gas, chlorine water, or chlorite and chlorate salts as bleaching agents. After being washed the bleached pulp is ready for the subsequent ordinary operations employed in the manufacture of paper. When the fibers or materials operated upon in the vessel B are not to be used for the manufacture of paper, but are required for other purposes, such materials, after being removed from the cage A, are ready for scutching, cleaning, washing, bleaching, or other treatment, as may be required, which operations may be conducted in the ordinary manner. For the manufacture of paper pulp for sale, the material, before or after being bleached, may be made into boards, which are pressed, dried, and packed in bales or cases.

Other materials not required for paper manufacture can either be finished in the ordinary manner, or pressed, dried, and baled for shipment.

I wish it understood that I do not limit myself to the precise form or construction of the apparatus or details of operation herein described, but may make such variations therein as will facilitate the accomplishment under any circumstances of the object of my invention; and I am aware that a stationary concentric case or cage has been before used in a cylinder; such I do not claim.

I claim—

1. The apparatus for reducing the wood to small filaments, shavings, or pieces, constructed and operating substantially as set forth.

2. The extraction of coloring matter and other substances from filaments of wood and vegetable fiber by subjecting the same to the action of steam in a removable cage, A, having a perforated bottom fitted within the closed cylinder B, with packing *c* interposed between the cage A and cylinder B, arranged and operating as herein shown and set forth.

3. The steam-pipe K with its bent arm K', in combination with the dome J, removable cage

A, and cylinder B, substantially as and for the purpose set forth.

4. The water-pipe L provided with the arm L', in combination with the dome J, removable cage A, and cylinder B, substantially as and for the purpose set forth.

5. The intermediate spaces between the casing M B and removable cage A, in combination with the pipes L K, dome J, and open central permeating-pipe I, arranged and operating in relation to the inlet and exit-pipes, substantially as and for the purpose set forth.

6. The process of bleaching fiber, by subjecting and passing through the mass a stream of carbonic-acid gas and atmospheric air combined, substantially as and for the purpose set forth.

7. The process of bleaching fiber, by subjecting the same to the action of chlorine gas or salts, in combination with carbonic-acid gas and atmospheric air, substantially as and for the purpose set forth.

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Witnesses:

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