H. Voelter.

Paper Making Mach.

No. 21,161. Patented Aug. 10, 1858.

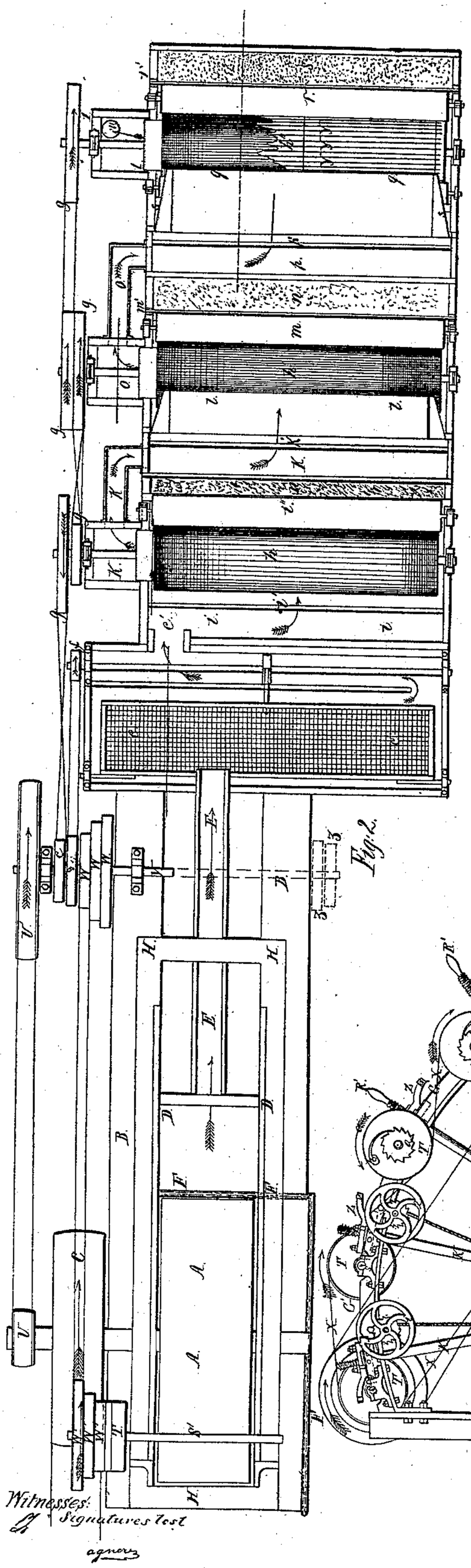

Fig. 2.

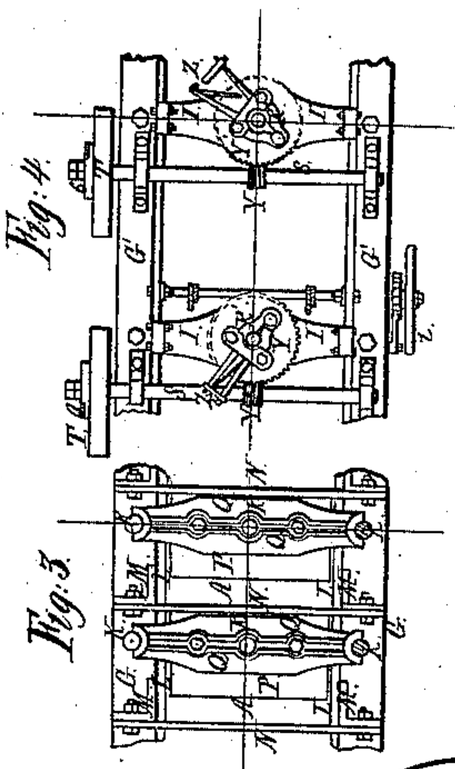

Fig. 4.

Fig. 3.

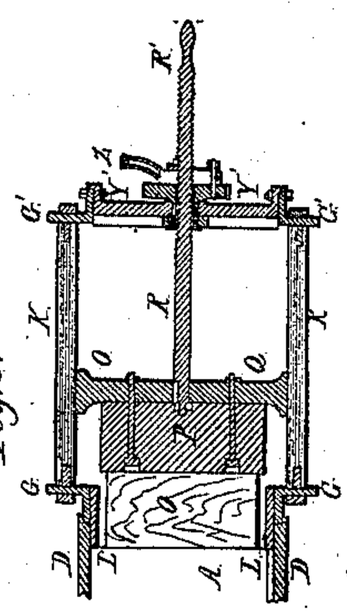

Fig. 5.

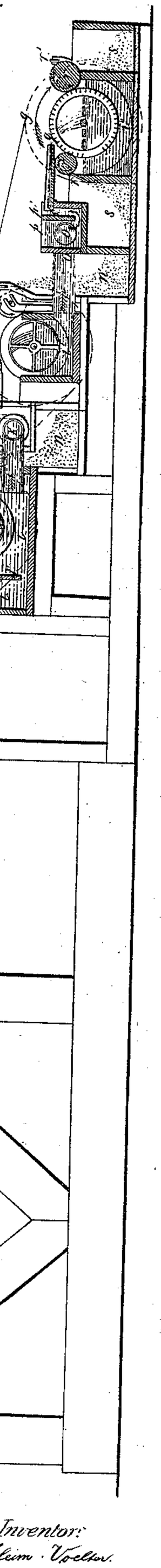

Fig. 1.

Witnesses:
Signatures lost
agnew

Inventor:
Heim Voelter.

UNITED STATES PATENT OFFICE.

HEINR. VOELTER, OF FEIDENHEIM, GERMANY.

IMPROVEMENT IN REDUCING WOOD FIBERS TO PAPER-PULP.

Specification forming part of Letters Patent No. **21,161**, dated August 10, 1858.

To all whom it may concern:

Be it known that I, HEINR. VOELTER, of the firm of Henry Voelter's Sons, of the city of Feidenheim, in the Kingdom of Würtemberg, Germany, have invented a new and most useful machine for producing and assorting pulp from wood or woody fibers for the purpose of making it into paper, pasteboard, papier-maché, and similar paper-like fabrics, a patent having been granted to me therefor in the Kingdom of Würtemberg, Germany, a sworn and certified copy of which being annexed to this application; and I do hereby declare that the following is a full, clear, and exact description of the invention and of the operation and construction of the same, with a due reference to the accompanying model and duplicate drawings.

The principle and the elements of my invention as will be hereinafter exhibited have nothing in common with any known or used machinery or apparatus for preparing and assorting wood pulp except the employment of a circular and rotating mill or grindstone as a reducing agent, and even this method of obtaining the fiber of wood by employing such a stone caused to revolve and made to act upon said material, and by directing at the same time a current of water to the stone before its contact with the material to be reduced, belongs to the invention and has been patented by my brother, Christian Voelter, of the firm Henry Voelter's Sons, in various countries of Europe; in France as early as 1847, patent dated April 11, and published in the 10th volume of the official patent reports of France for the year 1852. I am further aware that for this very same or essentially the same invention a patent has been taken out in Great Britain by R. A. Brooman, of London, England, 1853, (see Repertory of Patent Inventions, May, 1856, page 110, and Mechanic's Magazine, 1856, No. 1613,) for a process of reducing blocks of wood to pulp, and for the purpose of making it into paper by means of mechanical agents consisting of a millstone or cylinder acting upon pieces of wood held in a frame always in the direction of the length or grain of the fibers and parallel thereto. In connection with this he claims the particular arrangement of the machine employed for reducing the wood, and also describes the method of assorting or separating the pulp after leaving the stone by employing a current of water and a series of shaking frames or boards covered with sieves of different gages.

It may here be proper to state that at the time a patent was applied for in France for the reducing machinery by my brother Christian this last-mentioned separating apparatus had already been in use in our establishment. Owing to its imperfect operations, however, and the constant manual assistance it required, I did not deem it worth patenting.

Brooman, in his patent for the reducing process, distinctly describes and claims that the wood to be reduced be placed on the stone with its fibers running in the same direction as that in which the stone revolves, and considers this arrangement absolutely essential. Now experiments and experience have shown that in order to carry out this plan not only an enormous amount of power is consumed by keeping up the proper speed of the revolving stone, since the blocks to be reduced, and when so located, gradually become so in any regular brakes by partaking more and more of the circular grinding-surface, but, what is still worse and most objectionable, the grinding by degrees takes place in a cross-grained direction, thereby destroying the length of the fibers and grinding up the filaments completely. On the other side a most important and decidedly novel feature is introduced by constructing and arranging the reducing apparatus in such a manner as to admit, first, of a portion of the block with its fibers parallel to the axis of the revolving stone, and, second, owing to this very position to be able to locate a number of them behind each other, so as to cause the fibers when separated from the first block of wood to pass again under the grinding-surface of the second block and along with the fibers of the latter to and under the third, fourth, fifth, and sixth one, and so on. The greatest part of the fibers having thus been several times in contact with the grinding-stone leave it as pulp of a better and much more uniform quality. The separation may be carried on to any extent, and the better and very best sorts of paper can be produced.

The nature of my invention for making and

assorting wood pulp, generally speaking, therefore consists, first, in the particular mode of applying or locating blocks of wood upon the grinding-surface of a circular and rotating millstone for the purpose of separating the fibers from the wood and reducing them to pulp—that is to say, in placing a number of such blocks in or above the upper right or left hand quarter of the said stone, as it may revolve, behind each other and with their fibers running parallel to the axis of the stone, the blocks to be confined within stationary boxes and held in their respective position during the grinding process by a strong and suitable framing, all of which, in combination with the employment of a self-acting feeding apparatus, arranged to be operated by a positive mechanism and by the revolving stone itself, said feed to be so constructed that in case of need its action is automatically intercepted at any moment or diminished to any degree when the momentary condition of the grinding-surfaces of the blocks should demand it, rendering thereby the reducing machinery more perfect and susceptible of yielding and adapting itself to the condition of the material and to retain the filaments of the wood after the reducing process; second, in the novel manner of assorting or separating the pulp by employing for this purpose and in close connection with the reducing device a series of hollow and rotating cylinders or reels covered with sieves of various gages, together with a number of rollers or receivers made to bear upon the circumference of said cylinders and revolving therefore in opposite directions, in combination with a steady and subtile flow of water caused to spread evenly over their surfaces, said cylinders to be placed within channels or troughs and located beside or behind each other, yet descending gradually and sufficiently to make the watery pulp pass by its own gravity from the first one upon the second, from thence to flow over the third, fourth, and so on, whereby I am enabled to assort and separate this pulp in different ways, by directing it either to flow immediately upon the first rotating cylinder and to spread over its outside surface, the finer particles then passing with the entering water through the sieves and the interior of the cylinder and into the conducting-channels upon the surface of the following finer one, while the coarser fibers, adhering to the outer surface, are taken off by the receiving-rollers. The separated and finer particles may also be received and carried away at once and separately through an extra channel placed at a slope within the first rotating cylinder; or the pulp may not be caused to flow directly upon the cylinder, but merely in its channel or trough. The mass will there be constantly agitated by the rotation of the cylinder, the tendency of the water to pass through the sieves carrying again the finer particles along, while adhesion will cause the coarser ones to collect upon the outside, ready to be taken up by the rollers and thrown into a separate partition, the assorting apparatus fulfilling thereby the second condition—viz., producing paper from wood economically and without manual assistance.

To enable the Office fully to understand the precise operation of the machine, as well as others skilled in the art to make and use my invention, I will now proceed to describe its detailed construction and operation, reference being had to the annexed drawings, making a part of this specification.

Figure 1 represents an elevation with partial sections and with a portion of the outer casings removed so as to fully exhibit the various processes of grinding and assorting. Fig. 2 gives a ground view of the machine with the feed-motion detached therefrom and the water-channels, conducting-pipes, and receiving-boxes cut open. Figs. 3, 4, and 5 represent details of the iron frame-work encircling the upper part of the stone, as seen in Fig. 1. They also give top views of the working parts of the feed-motion and showing the manner of feeding up itself.

A A in Figs. 1, 2, and 5 indicate the circular mill or grind stone, of any suitable width and diameter, employed for reducing the blocks. It is fixed in a vertical position on a shaft turning in suitable bearings and mounted upon or between the strong wooden framing B B, the sides of said framing being tightly planked up to form a water-proof casing D D for the stone to revolve in. It receives a rotary motion at the rate of one hundred and twenty to two hundred and fifty revolutions per minute, according to size and diameter, from the main pulley C, Fig. 2, and a driving-belt connecting with the line-shaft or engine. The under part of casing or box D D is provided with an outlet E for the ground pulp and water introduced by the pipe F for the purpose of wetting the stone and mixing with the pulp during grinding.

G G and G′ G′ in Fig. 1 are strong iron arches or side frames, of suitable dimensions to receive the feeding apparatus and the auxiliary machinery connected therewith. They are strongly combined and firmly bolted to the main framing B by means of the iron bed-plate and standard H H, while their vertical and parallel position is maintained by iron braces or traverses I I, in Fig. 6, the latter forming in the same time the support of the driving machinery actuating the feed of the blocks. Additional connection between the arches G G and the outer segments G′ G′ are established by the employment of wrought-iron columns or rods K K K, bolted at proper distances firmly between them, keeping the arches in a proper relation to each other and rendering the whole a stiff and substantial structure. The inner arches G G, encircling the stone on each side, form a water-tight joint with the casing D, while their inside

faces are lined with the wooden segments L L, Fig. 5, slightly lapping over the edges of the stone, so as to prevent the fibers when separated, or any other foreign substance, from passing between the casing and the stone and causing friction or accident.

M M M are brackets, cast at suitable divisions upon the outer rims of the two arches G G. They are made to receive the plates N N, the latter fitting closely between G G and forming thereby the bottom and top or the partitions of regular and separate boxes, which, being located behind each other, serve as recipients for the blocks to be reduced. It is obvious that any number of such boxes may be applied—larger or smaller ones—to suit the dimensions of the stone. It is, however, essential that they should not reach any higher over its circumferential surface than indicated in Fig. 1—that is to say, not much over the right or left hand upper quarter of the stone, according to the direction of its rotation. It is also most important that it should always revolve against the boxes containing the wood and in the direction indicated by the arrow in Fig. 1.

O O in Figs. 1 and 5 represent the blocks of wood when in contact with the stone for the purpose of being reduced. The wood of course is first cut and split into pieces of suitable length and then prepared for use by freeing it from bark, knots, and adhering foreign matters. That most any kind of wood can be made use of, according to quality and color of the paper to be produced, need hardly be said.

It now remains to explain the automatic and self-intercepting action of the feed-motion. From a view at Figs. 1 and 5 will be perceived that the blocks are acted or pressed upon by the pieces P P, so as to distribute a regular pressure on the whole surface of the blocks. These pieces P P are bolted firmly to the iron press-platens Q Q, and the latter terminate in the spindles or feed-screws R R R, extending outward and passing through the centers of the traverses I I. Thus by pulling or pushing the spindles R R R out and in, or by raising and lowering the same, the platens Q Q, with their soles P P, are brought to act upon the blocks O O, the supporting-columns K K K by doing so serving in the same time as guide-rods to keep the said platens Q Q and spindles R R in a rectilinear direction and at right angles with the blocks, as shown in Fig. 3. Now, around the circumference of the outer framing G′ G′ are located a number of cross-shafts S′ S S, having their stationary bearings firmly secured upon the rims of said framing and carrying on their extremities the driving-pulleys T T T, a positive and rotary motion being transmitted to them in the following manner, viz: A small driving-pulley U is keyed upon the outer end of the grindstone-shaft to convey a suitable motion to the counter-shaft V by means of the larger pulley U′. This shaft V may be set somewhere upon the main framing B B, or attached thereto in any position fit to again convey motion, by a band to the uppermost and first cross-shaft S′ by aid of the cone-pulleys W W W and W′ W′ W′, whereby the speed of S′ and subsequently of shafts S S S can be varied at pleasure by conjoining these shafts with the first one S′, in the manner shown at Fig. 1—viz., by running the endless band X from pulley T′ alternately above or below the rims of the pulleys T T T of shafts S S S, motion being so conveyed to the same by the reducing-agent itself, it is evident that the shafts will at any moment partake of the least changes of its velocity, and if they are made to actuate the feed control the same accordingly. To accomplish this a worm Y is placed and secured upon each of the shafts S S S, Fig. 4, to gear with and give a slow motion to the worm-wheels Y′ Y′. The traverses I I I, as already said, form the support and the stationary bearings for the wheels by letting their hubs pass through the center of the traverses in such a manner as to admit the wheels to turn freely upon them. To keep the wheels in their proper position to the worms and within their bearings a strong collar is shrunk on or otherwise fastened to the projecting ends of the hubs, forming a solid shoulder to bear against and preventing thereby the wheels from rising when power is applied. The hubs of wheels Y′ Y′ Y′ are bored out sufficiently large to receive the feed-screws or spindles R R R, and to allow them to slide freely through and over the threads of the spindles, and to admit of raising or lowering by taking hold of their handles R′ R′.

Z and Z Z Z in Figs. 1 and 5 exhibit a pair of iron tongs provided with spring and catch to readily open and close when required. One of these tongs is firmly secured and bolted to the upper face of each wheel Y′ Y′, partaking thereby of their rotary motion. The inner portions of the semicircular jaws of the tongs contain screw-threads matching with those of the feed-screws and the jaws by encircling the screws while passing through the traverses and the hubs of wheels Y′ Y′ form thus the two halves of a nut. It is clear that by closing the tongs and giving motion to wheels Y′ Y′ they—that is to say, the nut itself—will revolve, and being kept within its bearing will necessarily act upon and urge down the feed-screws together with the platens Q Q, and this in proportion to the velocity given to the worm-shafts S S. By simply opening the tongs the screw is readily disengaged. It may then be pulled back and made ready again to descend. To facilitate this drawing back or rather raising of the uppermost screws, being not within the reach of the attending workman, little band-wheels 1 and 2, Figs. 1 and 6, mounted on small cross-shafts, have been provided for hoisting up

the spindles by aid of a rope and drum, or a similar lifting device.

An arrangement of the foregoing description, when combined and constructed as proposed, would constitute an automatic feeding apparatus possessed with a reliable motion. Now, in order to render it at the same time self-intercepting, for the purposes already stated, the following arrangement has been resorted to: The pulleys T T are not keyed fast upon the worm-shafts S S S, but are made to run loosely upon them. They are facing, however, the disks or ratchet-wheels *a a*, which are fixed upon the shafts, as shown in Fig. 1, where, for the sake of a better understanding, two of these shafts are represented turned over, thereby showing the ratchets and pulleys in front. The pulleys carry the steel springs *b b*, pressing vigorously upon the ratchet-wheels, and with a tension so adjusted as to move along the shafts S S S and consequently to operate the feed when the machinery is in an ordinary and regular state of working, but letting loose instantly, intercepting the action of the feed, when an undue friction takes place or a diminished pressure upon the blocks is momentarily required. Should one or the other of the blocks be reduced or ground up sooner than the attending workman might expect it, this same contrivance will indicate the fact by a noise sufficiently distinct to call his immediate attention and prevent the machinery from serious breakage which inevitably would occur by working up the spindles and platens against the framing G G and farther than the guide-rods K K will permit.

The machinery, so as described, is fully self-acting. It requires no further assistance but to supply the boxes with fresh material when one or the other of the blocks is done. Nor does this manipulation demand a minute's delay or the stopping of the machine, as it simply consists in the opening of the nut or tongs Z, the pulling back of screws R R for the introduction of the material, and the reclosing of Z, when feeding up is resumed and continued without further assistance.

Having now minutely described the reducing machinery, I will proceed to explain the second part of my invention so integrally combined with the first one, viz., the novel device proposed for assorting the fibers when separated from the wood.

E E E, in Fig. 1, as already stated, is an outlet and channel of the casing D D for the purpose of leading or carrying the watery pulp to the cylinders. It first passes from E E E into the shaking frame *c c*, covered with sieves of the coarsest gages and constructed on what is termed "Donkin's plan." This is an old and well-known contrivance. The shaking or rolling motion naturally pertaining to its construction as well as the rotary motion of the succeeding and separating cylinders is conveyed by one and the same counter-shaft V, by aid of the pulleys *d* and *e* and the pulleys *f g g g* in Fig. 2.

The shaking frame *c c* in my invention serves only to throw out and separate extraneous substances and such fibers as are unfit for paper-making. In most cases, however, I would suggest the employment of a large cylinder in its stead of a construction similar to that of the assorting-cylinders hereinafter described. The mode of assorting the pulp after leaving the frame *c c* is very simple and has in its nature already been described. I will therefore merely refer to the details of the apparatus as represented in the drawings and in Figs. 1 and 2.

$h h' h^2$ indicate the rotating cylinders. Their entire surfaces are covered with sieves of gradually-increasing fineness, say from sixteen up to two thousand meshes per square inch. It is very essential for the good working order of the cylinders that the sieves should be very carefully and accurately put on. To facilitate this their circumferences should be provided with a sufficient number of strips *y y y* running throughout the length of the cylinders, as shown at *h''*, Fig. 2, for the sieves to fasten or screw to, as the penetrability of the sieves is thereby greatly enhanced. Rollers instead of strips turning in stationary bearings may also be employed to support the sieves. The same might then revolve or rotate upon them and independently from the shafts of the cylinders. The last cylinder h^2 is covered with sieves of the finest gage. It is called the "pulp-catcher," in as far as it terminates the operating process by taking up or catching within itself the finest particles of the pulp. The waste water is then allowed to flow off entirely through the channel *t t* and the pipe *w*. As the nature of my assorting process principally consists in the employment of revolving cylinders for the purpose of dividing the finer particles by causing them to pass through these cylinders—that is, to enter through their perforated surfaces and into the interior portion of the same, while the coarser ones are scraped off from without—it is evident that the only communication existing between the cylinders succeeding each other in the separation is established by the meshes of the sieves they are covered with, and that the water and watery pulp contained, for instance, in the trough and around the exterior of the first cylinder can only reach the following finer one by passing through the sifting envelopment of the former. The cylinders $h\ h'\ h^2$ are therefore tightly closed up on one end, while the other and open one of cylinder *h* communicates with the conducting-pipe and distributing-trough of the following one *h'*, and so on. A glance at the elevation, Fig. 1, and the ground view, Fig. 2, will illustrate this.

i i i is the first receiving-trough in which the cylinder *h* revolves. The pulp and water

are carried into it after leaving the frame *c c* and after having passed through the channel *c' c'* in the direction of the arrow at Fig. 2. To prevent sand or particles of stone from getting into the trough *i i* and upon the cylinders, the passage through the partition *c'* is somewhat raised—say one inch or so. This forms a sort of a weir for the mass to flow over and to cause the heavy and hard substances to settle there. It is most essential that the flow of water and pulp be as uniform as possible and that the sheet of the liquid touching the cylinders and when spreading over their surfaces be kept in the most perfect state of tranquility. To achieve this, partitions *i'* K' *p'* are inserted in the troughs and reservoirs *i*, K, and *p*, so as to separate the body of water at the surface and allow it to communicate, but underneath the partitions and at the lowest point of the sheet.

The mode of operating by letting the pulp flow into the surrounding trough instead of leading it directly upon the rotating cylinder, is illustrated in Fig. 1 of the drawings at the first cylinder *h* and its trough *i i*. The mass there is slightly agitated by the rotation of the former and the coarser fibers adhering without are taken up by the touching roller and separated, while the water and the finer particles are entering the sieves. This finer pulp with the water next reaches the receiving box or reservoir R R by aid of the conducting-pipes communicating with the interior of cylinder *h*. It is then caused, owing to the lower position of box R, to flow by its own gravity evenly and gently over the horizontal board *l l* and upon the surface of cylinder *h'*. The separation here is continued in the other way set forth—viz., by letting the pulp spread directly over and upon the sieves of *h'*, the coarser fibers being again taken up and separated by the rollers touching upon the cylinders. i^2 *m r* in Figs. 1 and 2 show these rollers. They are made of wood carefully clothed with flannel, rubber, or similar soft substance. There may also be employed one, two, or more of such rollers in contact with each cylinder, according to its size and working capacity.

Straight bars running closely along the surface of the rollers, as seen at *m'* and *r'* in Figs. 1 and 2, serve to scrape off and deliver from the rollers the separated fibers received from the cylinders and to deposit them according to their respective fineness in the different boxes *n n' s s'* provided therefor. The still finer pulp having penetrated the meshes of cylinder *h'*, again passes through it and into the conducting-channel *o o*, from thence to the next receiving-box *p p*, and for the reasons set forth it is once more compelled to descend or flow over the plane *q q* upon the cylinder or pulp-catcher h^2, which, in the drawings, terminates the separating process. The entrance into this cylinder by the finest and very best portion of the pulp takes place precisely the same way, as before stated, and the outside separation is again effected by the rollers *r r* and the bars *r' r'*. To more readily collect the finest pulp in the cylinder h^2, a series of small buckets may be placed and secured within in such a manner as to allow the waste water to escape freely through the channel *t t*. The trough *i'' i''* of cylinder *h''* is of a semicircular shape, to prevent the fibers from collecting or settling at the bottom or in the sharp corners, insuring thereby the constant "taking up" of the mass by the rotation of the cylinder. It is hardly necessary to remark that the pulp before reaching this last cylinder may pass one or two more intermediate sieves or cylinders of increasing minuteness. It will then only be necessary to give them and their surrounding troughs *i i' i''* the proper degree of declivity to secure an easy and gentle descent of the pulp. By a careful perusal of this specification, drawings, and model it will certainly be admitted that the problem of utilizing wood for paper-making extensively has been practically solved by my invention, and that the use and assistance of my self-acting machinery will make it an object to employ wood or woody fibers as a substitute for rags. It may, lastly, be proper to add that in order to conform as far as possible in the present case to the rule of the Office as to size of models the rotating cylinders here had to be placed alongside of the grindstone-frame, while they are put ahead and in a more natural position in the accompanying drawings.

z z indicate the cone-pulleys in Fig. 2 to transmit motion to the cylinders when they are placed as shown in the model.

Having now fully explained my invention in all its parts, I wish it to be understood that I make no claim in this application as to the originality of invention of using wood-pulp for paper-making, although it might be shown that this even emanated from me; nor do I claim, broadly, the employment of mechanical agents in combination with water or other suitable liquids for the purpose of separating and obtaining the fibers of wood. I also disclaim the various parts and mechanical devices constituting my machine when separately considered and when not combined as herein set forth; but

What I do claim as new in manufacturing paper from wood, and desire to have secured to me by Letters Patent of the United States, is—

1. The particular arrangement, construction, and combination of the machinery or the mechanical expedients employed, as herein specified, for reducing blocks of wood or producing wood-pulp by feeding them up automatically to a rotating grind or mill stone, in connection with the peculiar manner of applying or locating said blocks upon the circumference of the stone or on a portion of its

circumference by holding them behind each other in a position and direction essentially the same as described and herein set forth.

2. The employment and the combination of a series of perforated and rotating cylinders with the reducing expedient when constructed and connected between themselves in the manner herein specified by surrounding troughs and communicating channels or reservoirs, all made to operate as set forth, and for the purpose of assorting the fibers when separated from the wood in the modes herein described, rendering the pulp fit to be formed into paper of different qualities.

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Witnesses:

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