(No Model.) 3 Sheets—Sheet 1.

E. R. MARSHALL.

MACHINE FOR GRINDING WOOD TO PULP.

No. 438,633. Patented Oct. 21, 1890.

Fig. 1

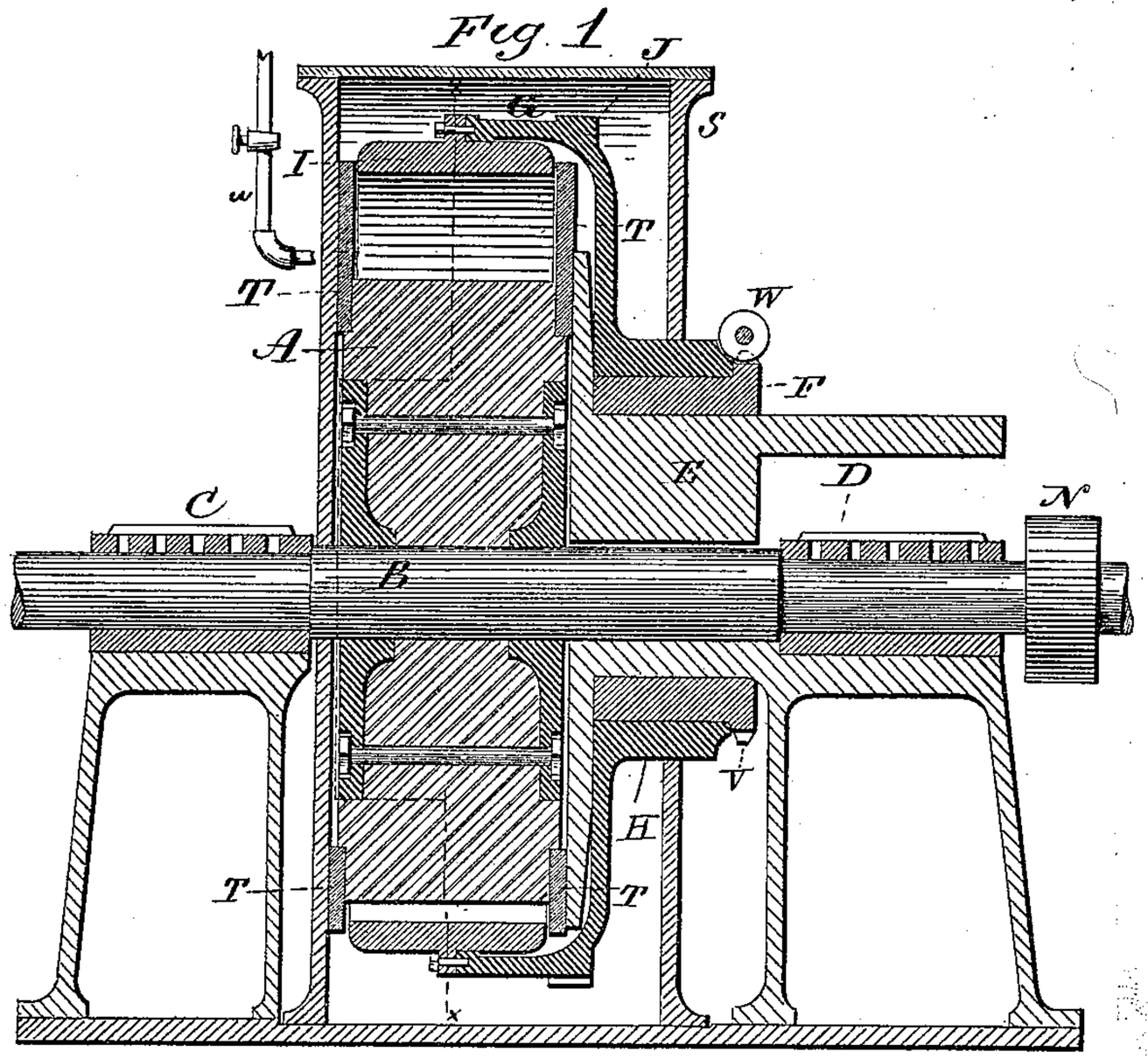
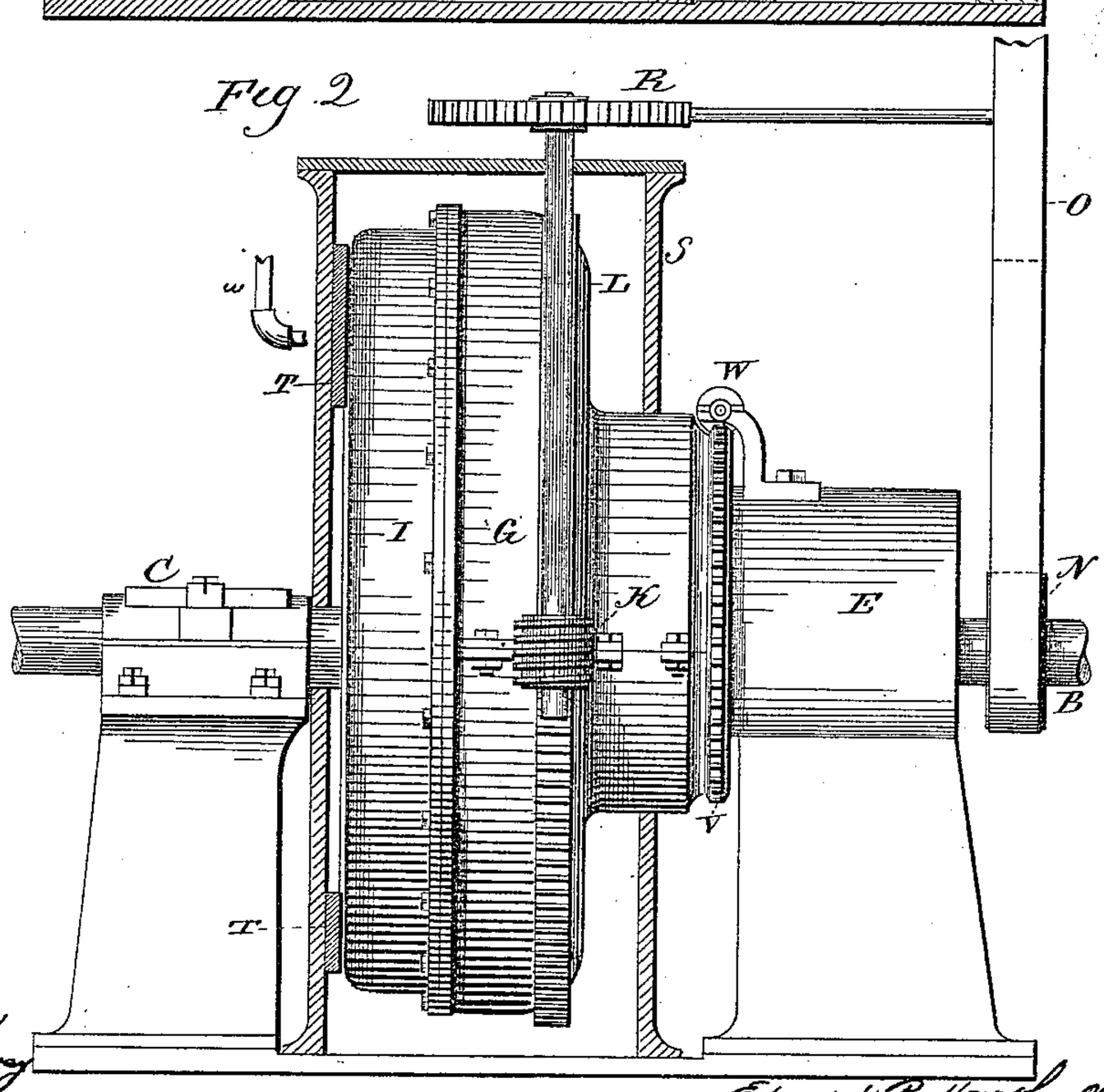


Fig. 2



Witnesses
J. H. Shumway
F. C. Earle

Inventor
Edward R. Marshall
By Atty.
Thos. G. Ewle

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E. R. MARSHALL.

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Fig. 3

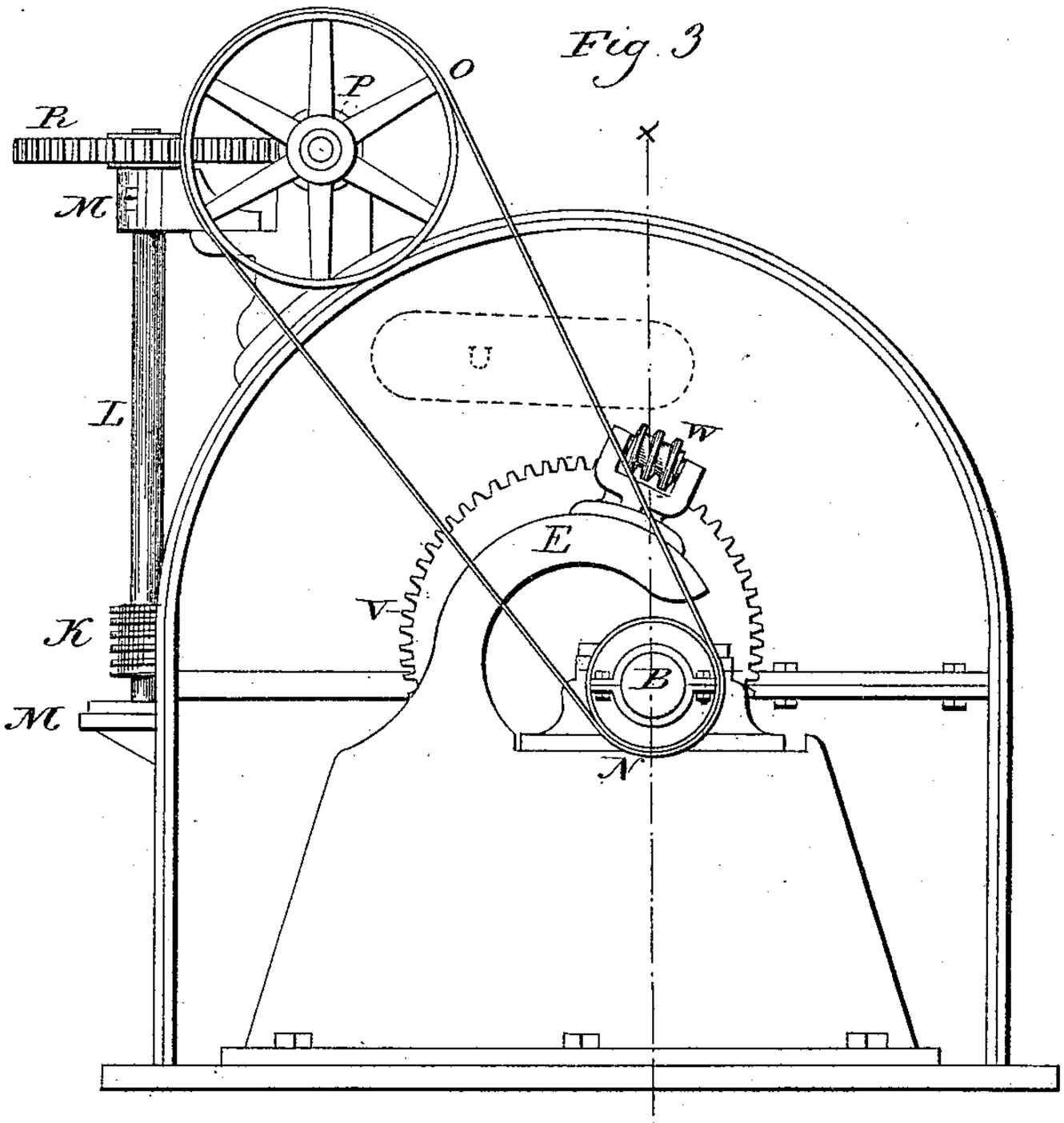


Fig. 4

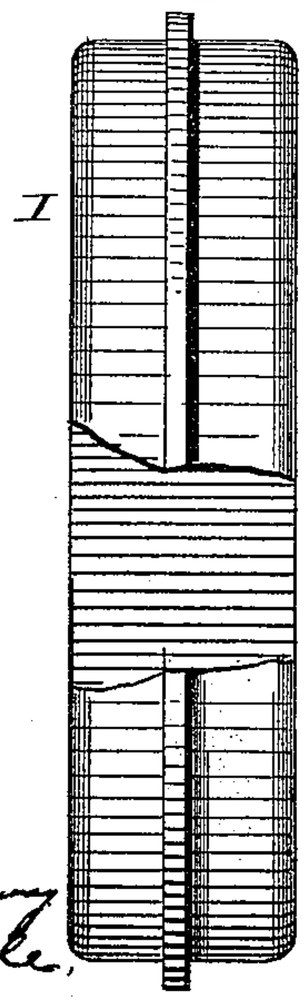
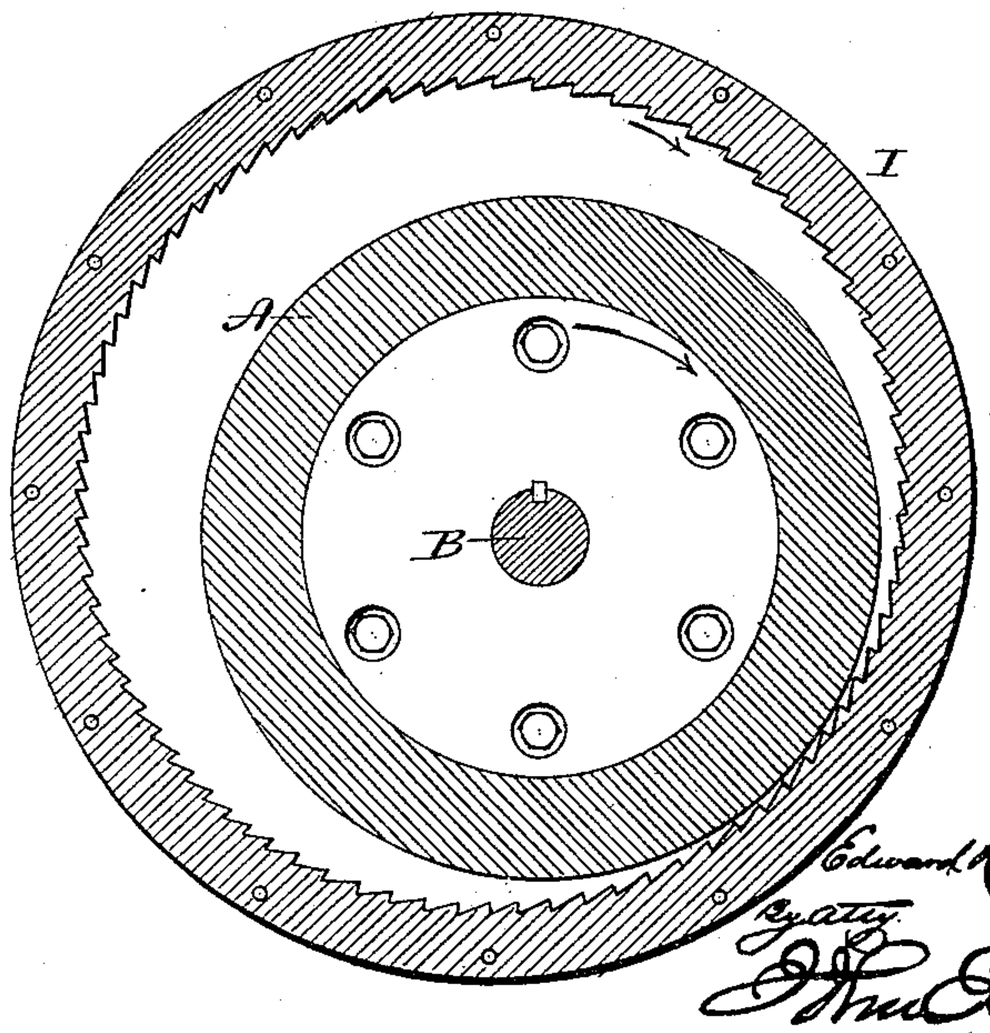


Fig. 5



Witnesses
J. V. Shumway
F. C. Earle.

Edward R. Marshall,
Inventor.
By atty.
F. C. Earle

(No Model.) 3 Sheets—Sheet 3.

E. R. MARSHALL.

MACHINE FOR GRINDING WOOD TO PULP.

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Fig. 6

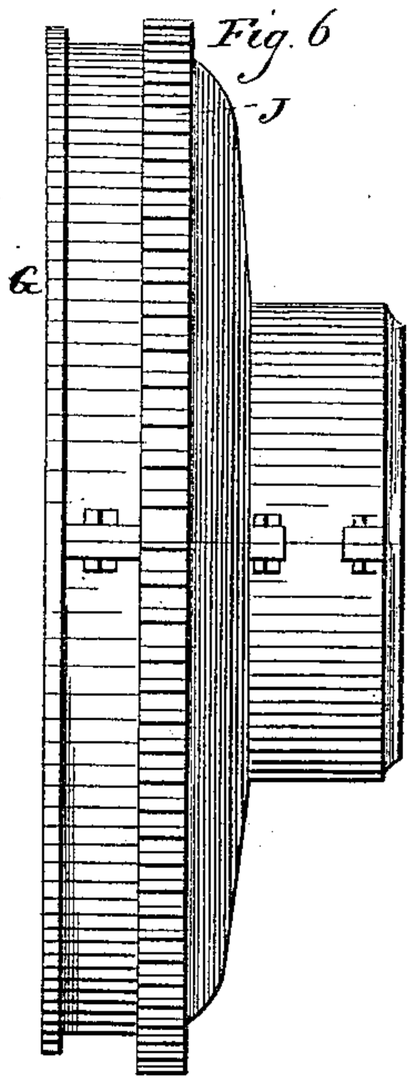


Fig. 7

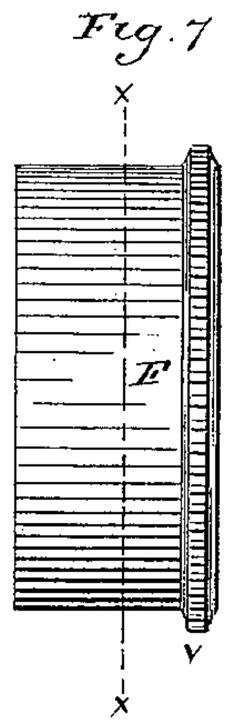


Fig. 8

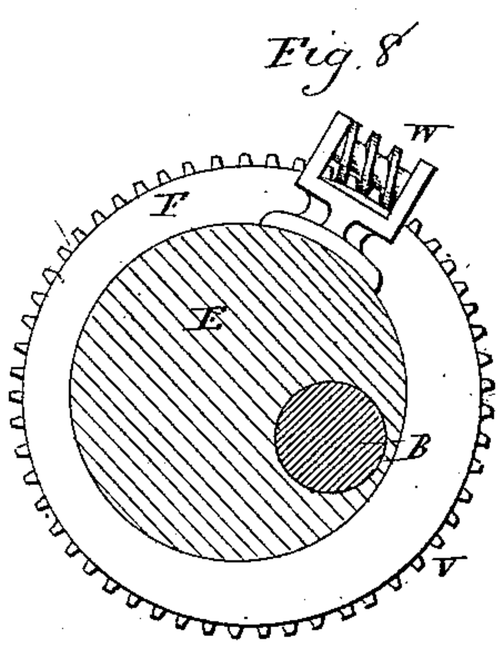


Fig. 9

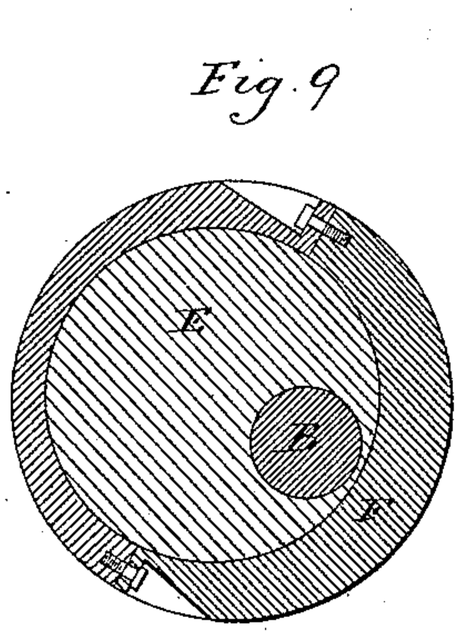


Fig. 10

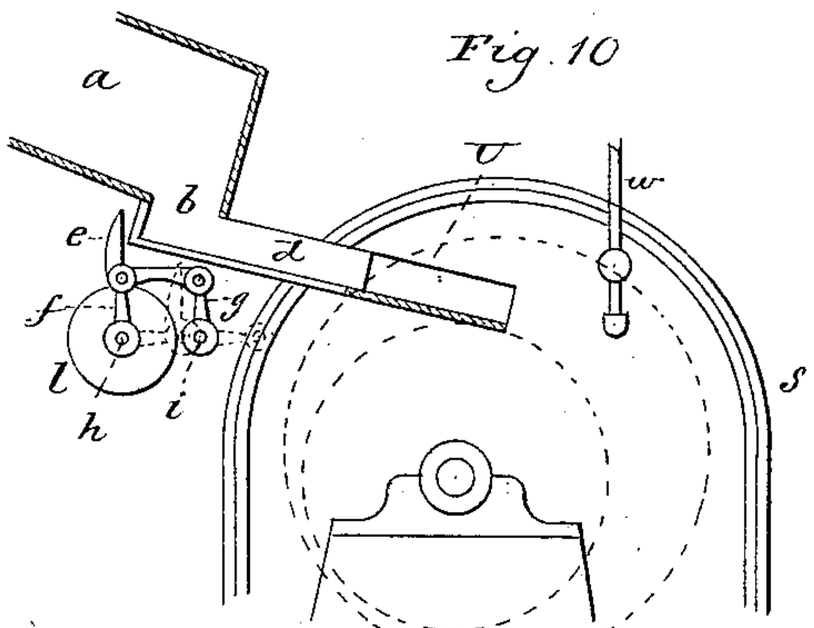


Fig. 13

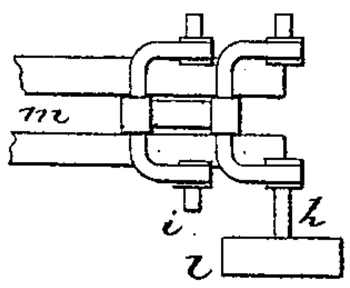


Fig. 12

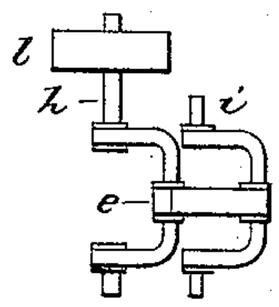


Fig. 11

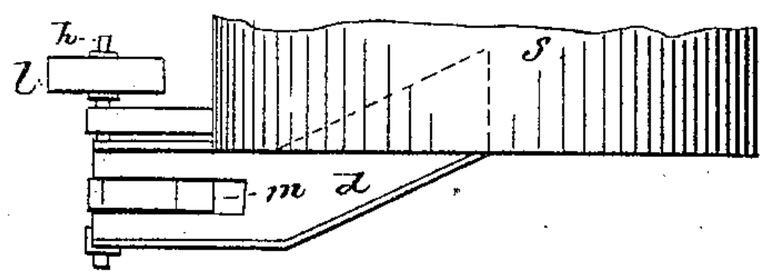
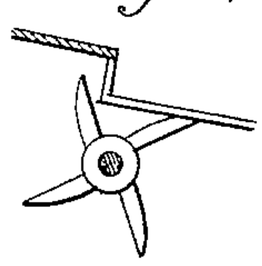


Fig. 14



Witnesses.
H. T. Sherman.
Fred C. Earle.

Edward R. Marshall
Inventor.
By atty.
Thos. C. Earle

UNITED STATES PATENT OFFICE.

EDWARD R. MARSHALL, OF TURNER'S FALLS, MASSACHUSETTS.

MACHINE FOR GRINDING WOOD TO PULP.

SPECIFICATION forming part of Letters Patent No. 438,633, dated October 21, 1890.

Application filed May 24, 1889. Serial No. 311,964. (No model.)

To all whom it may concern:

Be it known that I, EDWARD R. MARSHALL, of Turner's Falls, in the county of Franklin and State of Massachusetts, have invented new Improvements in Machines for Grinding Wood to Pulp; and I do hereby declare the following, when taken in connection with accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a longitudinal vertical section of the grinding-machine without the feed devices, cutting on line *x x* of Fig. 3; Fig. 2, a side view of the same, part of the casing being removed; Fig. 3, an end view of the same; Fig. 4, a side view of the ring detached, a portion being broken away to expose the internal saw-teeth serrations, the shoulder of the serrations being opposite to the direction of revolution; Fig. 5, a transverse section cutting on line *x x*, Fig. 1; Fig. 6, a side view of the disk detached; Fig. 7, a side view of the sleeve detached; Fig. 8, an end view of the sleeve, showing section of the collar; Fig. 9, a section of sleeve, collar, and arbor on line *x x*, Fig. 7; Fig. 10, an end view of grinding-machine, showing the hopper and chute in section, and side view of automatic feed devices; Fig. 11, a top view of same; Fig. 12, a detached top view of cranks and follower; Fig. 13, an under side view of the rear part of the chute and feed devices; Fig. 14, a modification in feed devices, Figs. 10 to 14, inclusive, on a reduced scale.

This invention relates to improvements in machines for grinding wood to pulp for the manufacture of paper; and the invention consists in the construction as hereinafter described, and particularly recited in the claims.

A represents the grindstone, such as usually employed for grinding wood. It is supported upon an arbor B, resting in suitable bearings C D, power being applied to the arbor in the usual manner to cause the stone to revolve. Between the bearing D and that side of the stone a stationary cylindrical collar E is arranged around the arbor B. As here represented, this collar E is made as a part of the bearing-stand. (See Figs. 1 and 3.) The collar E is eccentric to the arbor, as seen in Figs. 8 and 9, the arbor working freely through the collar. The cylindrical collar E forms a bearing for a cylindrical sleeve F, arranged to rotate thereon. The opening through the sleeve F for its bearing upon the collar E is eccentric to the periphery of the sleeve, as seen in Figs. 8 and 9.

The sleeve F has arranged upon it a cup-shaped flanged disk G, the hub H of the said disk being supported on the said eccentric sleeve F as a bearing upon which the disk may be rotated, as seen in Fig. 1, the rotating of the disk and sleeve being independent each of the other. The internal diameter of the flange of the disk is considerably greater than the diameter of the stone, and so that, notwithstanding its eccentricity to the stone, the flange surrounds the stone, as seen in Figs. 1 and 5.

To the inside of the flange of the disk a circular ring I is secured, the width of the ring being about the same as the thickness of the stone, as seen in Fig. 1, and presents an internal face opposed to the grinding-surface of the stone. The eccentricity of the ring I to the stone forms a corresponding eccentric space between the stone and ring, as seen in Fig. 5, the ring coming near the surface of the stone on the shortest radius from the axis of the stone. The interior surface of the ring is serrated, forming saw-like teeth, as seen in Figs. 4 and 5.

A slow rotative movement is imparted to the ring, here represented as by a worm-gear J on the periphery of the ring-carrying flange G, into which a worm K on a shaft L works, said shaft supported in bearings M M, (see Figs. 2 and 3,) and said shaft L is driven from a pulley N on the arbor B through a recessed pulley O and worm P, working into a worm-gear R on said shaft L, as represented in Figs. 2 and 3. The proportion of the revolution of the ring to the stone is as about three revolutions per hour for the ring to about two hundred and forty revolutions per minute for the stone, the velocity of the ring being varied as circumstances may require.

The stone and ring should be inclosed by a casing S. (See Figs. 1, 2, and 3.) Stationary cheeks T (see Fig. 1) are provided at each side the space between the stone and ring. The said space thus inclosed forms the pocket

to receive the wood to be ground. The wood is delivered into the pocket through an opening U in the case.

The eccentric sleeve F is provided to adjust the eccentricity of the ring with relation to the stone, and to conveniently impart such rotation to the sleeve F it is constructed with a worm-gear V on its periphery, (see Figs. 2 and 6,) into which a worm W, mounted on the collar E, works, and so that by applying a suitable instrument to the arbor of the worm W and rotating it the sleeve F will be correspondingly rotated, and so vary the eccentricity of the ring I in its relation to the stone.

In operation the stone and ring revolve in the same direction, as indicated by the arrows, Fig. 5, with the differential velocities before described. The blocks of wood are supplied to the pocket through the opening U in the case, which is near the broadest part of the space between the ring and stone. The wood so introduced is forced forward and toward the narrower part of the pocket, it being gradually ground away by the action of the stone upon it, the ground wood passing out through an opening provided for the purpose. (Not shown.) The ring, revolving, as it does, with but a fraction of the velocity of the grindstone, acts as a feed upon the wood to be ground simply to hold the wood in contact with the stone and to cause it to advance no faster than it is ground away. Thus it will be seen that there is no crushing or grinding action between the stone and ring. The stone gradually grinds away the surface of the wood bearing upon it, while the ring produces no other effect upon the wood than to hold it upon the stone and permit its advance no faster than it is ground away. It is to produce this result that the very slow advance or feed of the ring can be permitted. The serrations, having their shoulders opposite to the direction of revolution of the ring and stone, serve to hold the wood against the tendency of the stone to draw the wood into the narrowing space between the stone and the ring, so that the wood can advance no faster than it is ground away, the velocity of the feed-ring being adjusted accordingly. I therefore term this ring a "feed-ring."

The supply of wood to the machine being continuous, the operation of the machine may be continuous and all necessity for stopping the machine avoided. Its work will be uniform. Consequently no variable effect upon the power will be produced.

I provide a feeding device to automatically supply the wood to the machine, and thereby greatly reduce the attendance upon the machine. This feeding device I illustrate in Figs. 10, 11, 12, and 13. A receiver or hopper *a* is supported and elevated somewhat above the opening into the case, the hopper being of a width corresponding to the length of the blocks of wood. Through the bottom of the hopper *a* is an opening *b*, through which the blocks may pass into a chute or conductor *d*, which leads to the feed-opening U in the case, as seen in Fig. 11, so that the blocks passing through the conductor will lie parallel as they come from the hopper, and in this parallel condition will pass into the machine, as represented in Fig. 11.

To automatically force the blocks through the conductor or chute I provide a reciprocating follower arranged to work against the column of blocks in the chute, so as to press the column of blocks forward toward the grinder and prevent the clogging of the blocks at the delivery-mouth of the hopper. This follower is adapted to advance and force the column, and then retreat and take a new hold upon the column, and thus advance the blocks as they may be required by the machine.

The feeding device is illustrated in Figs. 10, 12, and 13. The follower *e* is hung upon a pair of cranks *f g*, these cranks extending from shafts *h i*, supported in suitable bearings below the end of the chute at right angles to the path of movement required for the blocks. A friction-pulley *l* is arranged upon one of the shafts, as *h*, and so that power applied to the said pulley will cause it to revolve in such frictional engagement with the shaft that when the resistance to the revolution of the shaft is greater than such friction the pulley will revolve on the shaft; but if such resistance be less than the friction then the shaft will revolve with the pulley. The follower *e* is of L shape, and so that one leg forms a connection between the two cranks, the other leg projecting upward, as seen in Fig. 10. The movement of the follower will be in a circle in a vertical plane corresponding to the path of the crank with which it is connected, and so that as it advances from the position in Fig. 10 it will press against and force the column of blocks in the chute, and gradually working downward will escape from the blocks, as indicated in broken lines, Fig. 10. Then, there being no resistance to the follower, the pulley *l* will quickly bring it around to take a new hold upon the column of blocks to continue the advance of that column.

The chute is constructed with an opening *m* in its bottom and rear end, as seen in Fig. 13, through which the vertical leg of the follower may work.

The hopper and automatic feed devices may be omitted, the chute serving to contain a supply of blocks, which may be from time time replenished by hand.

Instead of making the automatic forcer reciprocating, it may be rotative, as represented in Fig. 14, and accomplish the same result.

I prefer to employ the eccentric sleeve F as a means for varying the eccentricity of the revolving ring I; but in case such adjustment is not required the sleeve may be omitted and the ring arranged to revolve directly upon the eccentric-collar E. This modification is too apparent to require illustration.

I do not confine myself to the specific con-

struction of the various parts of the machine as described, reserving to myself the right to modify the same so long as I do not depart from the general description and illustration herein contained.

It will be understood that the usual supply of water is provided between the stone and the wood. In Fig. 10, *w* represents this water-supply pipe, being preferably provided with a cock by which the flow may be regulated.

I claim—

1. In a machine for grinding wood to pulp, the combination of a rapidly-revolving grinding-stone, a feed-ring arranged around said stone upon an axis eccentric to the axis of the stone, the interior of the said ring presenting a surface adjacent to and eccentric with the periphery of said grinding-stone, the said feed-ring revolving upon its axis in the same direction as the stone, but at a very much less velocity than that of the stone, the said feed-ring forming an eccentric pocket around the stone to receive the wood to be ground and also operating to hold the wood upon the stone, with mechanism, substantially such as described, to impart said rapid revolution to said grinding-stone and the very slow revolution to said ring, each independent of the other, substantially as described.

2. In a machine for grinding wood to pulp, the combination of a revolving grinding-stone, a stationary eccentric collar around the arbor of the grindstone, a rotating eccentric sleeve around said collar, a disk arranged to rotate on said eccentric sleeve, and a ring attached to said disk and surrounding said stone, the said ring concentric with the axis upon which it rotates, but eccentric to the stone which it surrounds, and so as to form an eccentric wood-receiving pocket around said stone, substantially as described.

3. In a machine for grinding wood to pulp, the combination of a rapidly-revolving grindstone, a feed-ring arranged around said stone and upon an axis eccentric to the axis of said stone, the said feed-ring revolving upon its own axis in the same direction as the stone, but at a very much less velocity, the said ring forming an eccentric pocket around the stone to receive the wood to be ground, the inner surface of the said ring constructed with saw-teeth like serrations, the shoulders of the said serrations being in the direction opposite to the revolution of the stone and feed-ring, with mechanism, substantially such as described, to impart said rapid revolution to said grinding-stone and the very slow revolution to said ring, each independent of the other, substantially as described.

4. In a machine for grinding wood to pulp, the combination of a rapidly-revolving grindstone, a feed-ring surrounding said stone and revolving in the same direction upon an axis eccentric to the axis of the said grindstone, and the ring concentric with its own axis, so as to form an eccentric pocket between the said stone and ring to receive the wood to be ground, the said ring revolving very slowly, so as to serve as a feed to present and hold the wood upon the stone, a hopper to contain the blocks of wood, and a chute or conductor into which said hopper opens, said chute leading into the said pocket between the said stone and feed-ring, with mechanism, substantially such as described, to impart said rapid revolution to said grinding-stone and the very slow revolution to said ring, each independent of the other, substantially as described.

5. In a machine for grinding wood to pulp, the combination of a rapidly-revolving grinding-stone, a feed-ring surrounding said stone and arranged upon an axis eccentric to the axis of said stone, but revolving very slowly in the same direction as the stone, said ring forming an eccentric pocket around said stone to receive the wood and adapted by its slow velocity and eccentric position to feed and hold the wood upon the stone, a hopper to contain the blocks of wood, a chute or conductor into which said hopper opens, the said chute leading into said pocket around the stone, and an automatic feed arranged to work against the column of blocks in the chute in the path of movement of the blocks and across the delivery-mouth of the hopper, with mechanism, substantially such as described, to impart said rapid revolution to the said grindstone and very slow revolution to said feed-ring, substantially as described.

6. In a machine for grinding wood pulp, the combination of a revolving grinding-stone, an eccentric ring surrounding said stone and revolving in the same direction as the stone, but at a greatly-reduced velocity, said ring forming an eccentric pocket around said stone to receive the wood to be ground, a hopper to contain the blocks of wood, a chute or conductor into which said hopper opens, the said chute leading into the said pocket around the stone, and an automatic reciprocating feed composed of a pair of parallel cranks *f g*, arranged at the receiving end of the chute and so as to revolve in paths parallel with the path of movement of the blocks in the chute, an L-shaped follower *e*, connecting said cranks and so that the vertical leg of the L may work against the column of blocks in the chute, and a driven pulley in frictional engagement with the shaft of one of the cranks, substantially as described.

EDWARD R. MARSHALL.

Witnesses:
FRED E. ALLEN,
F. J. MARSHALL.