J. KINGSLAND.

MACHINE FOR PREPARING PAPER STOCK.

No. 16,239. Patented Dec. 16, 1856.

Fig. 1.

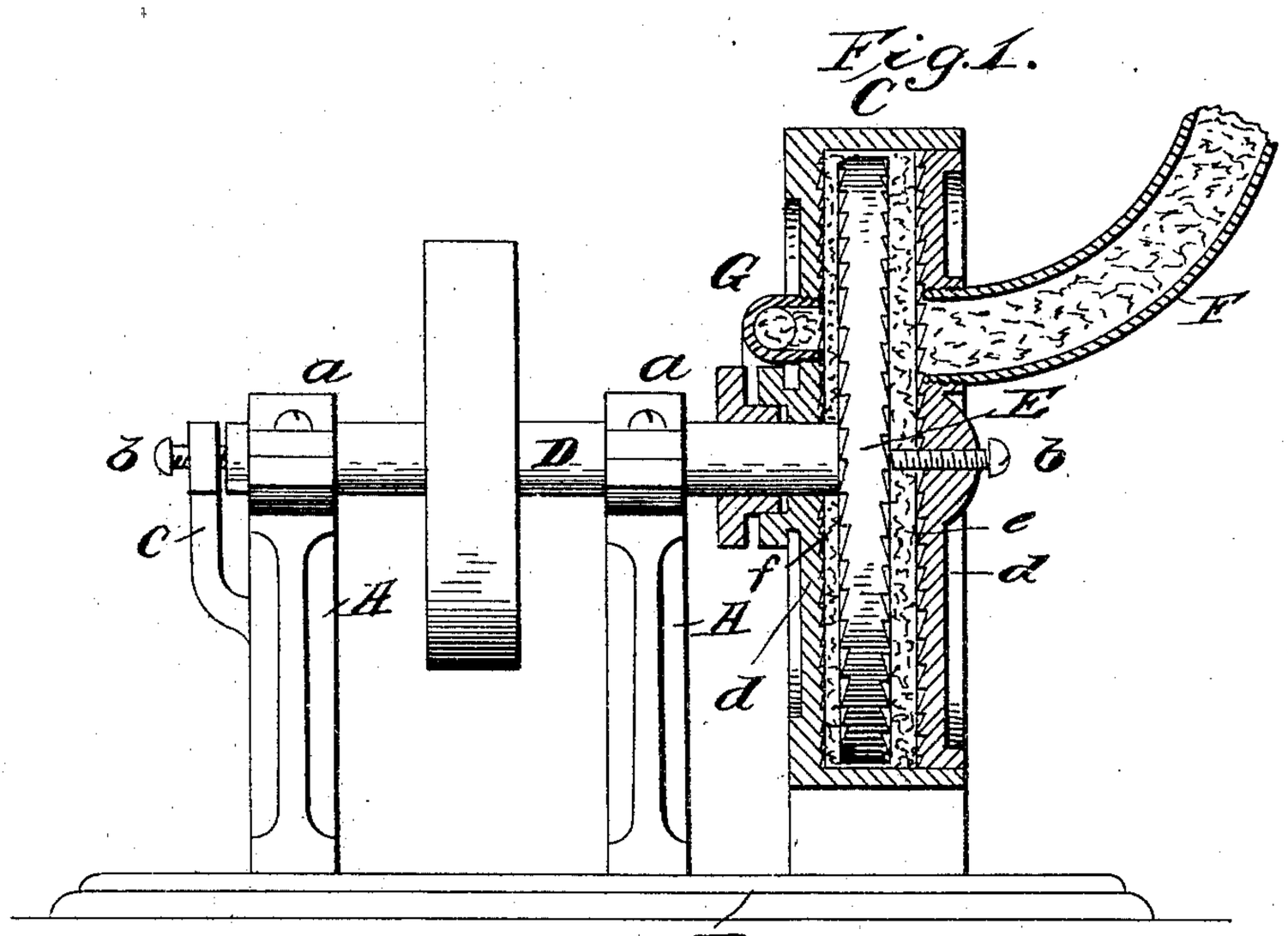
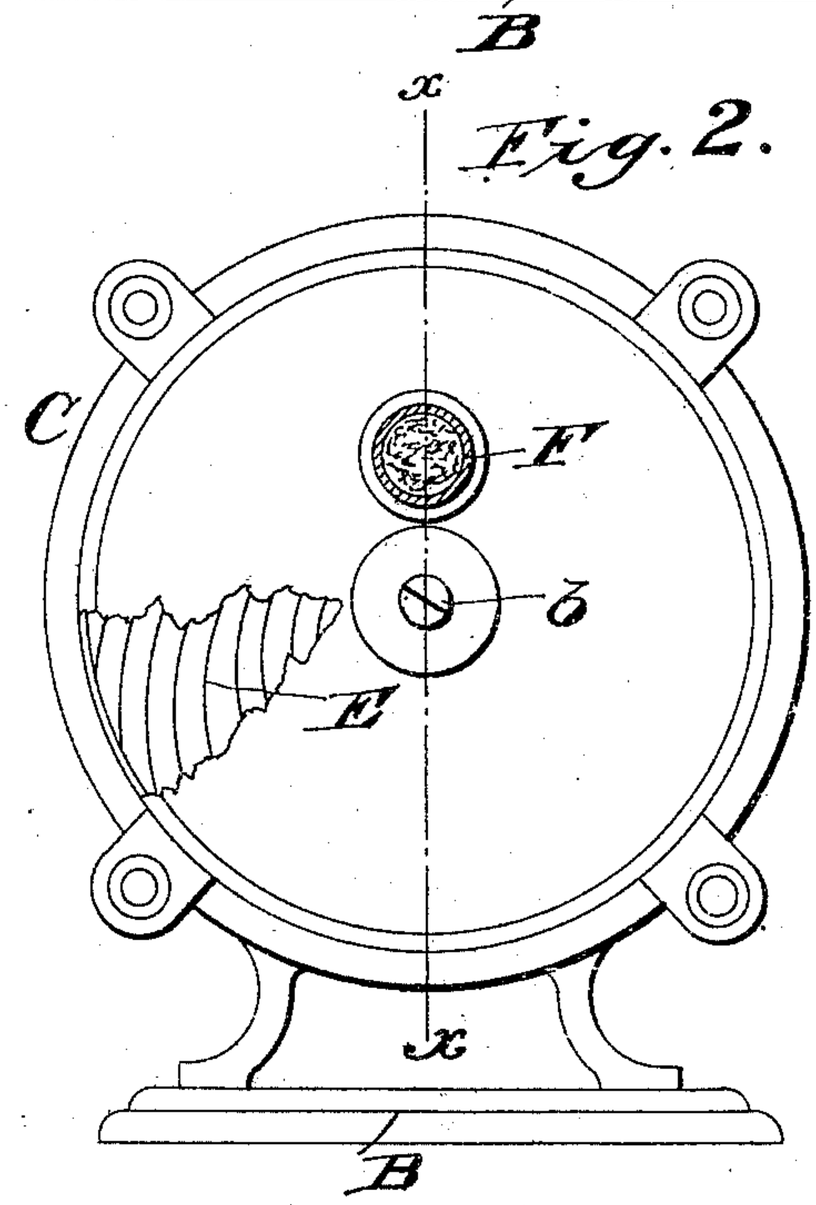


Fig. 2.



UNITED STATES PATENT OFFICE.

JOSEPH KINGSLAND, JR., OF FRANKLIN, NEW JERSEY.

MACHINERY FOR GRINDING PAPER-PULP.

Specification forming part of Letters Patent No. 16,239, dated December 16, 1856; Reissued June 28, 1859, No. 745.

To all whom it may concern:

Be it known that I, JOSEPH KINGSLAND, Jr., of Franklin, in the county of Essex and State of New Jersey, have invented a new and useful improvement in what is termed the "beating" or "stuff engine" for grinding fibrous vegetable matter in water to pulp in the manufacture of paper, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which make part of this specification, and in which—

Figure 1, represents a vertical section of a stuff-engine upon my improved plan, and Fig. 2, represents an elevation of the end of the same.

The material or stock from which paper is made consists of vegetable fibers, and, for papers of the finer qualities, is usually obtained in the form of rags, old cordage, and other worn out manufactures of fiber. These substances are reduced to a pulp by grinding in water, preparatory to being made into sheets of paper, by means of what are termed the "washing-engine" and the "stuff-engine." The "washing-engine" rough-grinding the stock, and thereby converting it into what is termed "half-stuff," and the stuff-engine reducing the half-stuff to fine pulp. In the process of grinding paper-stock by means of these engines it is found that different kinds of fiber require the grinding surfaces of the engine to be set at different distances, and almost all stock is so heterogeneous in quality that the distance beween the grinding surfaces requires almost constant variation to insure the proper reduction of the fiber and to prevent the choking of the engine. To adjust the grinder by hand with such frequency and nicety, although highly desirable, is obviously impracticable.

I have, however, invented a grinder which adjusts itself as required, and my invention consists in placing a revolving grinder between two stationary grinders, the revolving grinder having free play on its axis to enable it to vibrate back and forth between the stationary grinders, to approach toward either as required; the fiber to be ground being caused to pass in a current through the space between one stationary grinder and one side of the revolving grinder; thence around the periphery of the revolving grinder and through the space between the opposite side of the revolving grinder and the other stationary grinder, to the orifice of discharge.

I have not only rendered the revolving grinder self-adjusting, but I also propose to take advantage of its rotary motion to facilitate the feeding of the fiber to be reduced into it, and the retention of the fiber within its action until sufficiently reduced. This I accomplish by causing the fiber to be fed into the grinder at an orifice near its axis on one side, and discharged by a similar orifice on the opposite side, after passing between the grinders from the center to the circumference on one side, and thence back again to the center on the opposite side, the centrifugal action tending to carry the fiber from the center to the circumference on the feeding side, and to retard its passage from the circumference to the center on the discharging side of the grinder, thus operating to keep the fiber longest near the circumference, where the motion is greatest, and the grinding action consequently, the most energetic.

By reference to the accompanying drawings the construction and operation of my improved stuff-engine will more fully appear.

It consists of a bed-plate (B) which supports two standards (A, A,) and a hollow cylinder (C) whose diameter is equal to about four times its length. In a line with the axes of this cylinder, a shaft (D) is mounted in bearings in the heads of the standards (A, A). In a bracket (*c*) on the outer standard (A) and in a boss at the middle of the outer head (*d*) of the cylinder (C), set screws (*b*) are placed in a line with the axis of the shaft (D); the object of these set screws is to permit the shaft (D) to have a regulated amount of end-play in its bearings, for a purpose which will presently be described. This shaft passes through a stuffing-box (*s*) on the inner head (*d'*) of the cylinder (C), and projects about two-thirds of the way across the space within the cylinder toward the outer head (*d*). On this projecting end of the shaft, a disk (E) is secured at right angles to the shaft and concentric with it and the cylinder. This disk is somewhat less in diameter than, and in thickness about half the length of the interior of the cylinder, so as to leave between it and the heads

and periphery of the cylinder, a free space for a current of water and rags, half-stuff, or paper pulp to flow through.

The inner surface of the heads of the cylinder and the sides of the disk, are grooved in the usual manner of metallic grinders, or they may be armed with teeth, or knives of any suitable kind. An orifice is made in each head of the cylinder as near the center as possible. The orifice in the outer head is connected by a pipe (F) with a tank above, containing half stuff mingled with water, and ready to be ground to pulp. With the orifice in the inner head, a pipe (G) is connected, which conducts off to a proper receptacle, the pulp discharged from the machine.

The operation of the engine is as follows. Rotary motion is communicated to the shaft (D) through the pulley near its middle, and the set-screws (*b*) are in general so adjusted as to allow the shaft to play enough to permit the disk (E) to run freely from end to end of the cylinder (C), to grind close at either end or open at both as may be required. The mixed half-stuff and water, may now be let into the feed-pipe (F) from the tank above, and the hydraulic pressure will force it into the cylinder through the space (*e*) between the disk and the outer head (*d*), around the periphery of the disk and through the space (*f*) to the orifice of the discharge pipe (G) where it will leave the cylinder, and entering the discharge pipe, will pass through the same, in to any suitable receptacle.

The centrifugal motion of the disk will coöperate with the hydraulic pressure to pass the half stuff from the feed orifice near the center, where the motion of the disk is slow and but little grinding takes place toward the periphery, where the motion is greater and the grinding more energetic, but, when the current of water and fiber turns the periphery of the disk and enters the space (*f*) on the opposite side, its passage to the discharge orifice is retarded by the centrifugal action of the disk. This retarding force acts with the greatest effect upon the largest fibers, their specific gravity being greater than that of any equal measure of any other portion of the flowing mass. Moreover the current carries the fibres through the grinder at a speed inversely proportioned to their size, the more reduced fibers having an area of surface for the current to act upon, relatively far greater than that of the larger fibres. In this way the reduced fibres are withdrawn from the action of the grinder, while the coarser fibers are left for further reduction. This separation of the finer from the coarser fibers during the process of grinding, is facilitated by the increased mobility which they acquire by reduction. By augmenting the speed with which the disk revolves, relative to the floor of the pulp through the grinder, the pulp will be ground fine, it will also be ground finer if the feed is diminished while the speed of the disk remains the same, but, in the latter case, less of the pulp will be ground in a given time. In case a knot or lump of fiber should be fed into the grinder, the disk would yield moving toward the side opposite the knot, to allow the knot to pass freely toward the periphery, where it would be quickly reduced by the energetic action of that part of the grinder. While this reduction of the knot or lump is going on, at the feed side of the grinder both the feeding and the discharge are diminished by the crowding over, by the knot, of the revolving disk toward the discharge aperture; by this yielding of the disk all danger of clogging is avoided, and, at the same time, the flow of unground fiber through the grinder is prevented. As this knot or lump of fiber is reduced the temporary increase of lateral pressure on the side of the revolving disk next the feeding aperture, is abated and the pulp carried in by the current between the side of the revolving disk next the discharge aperture and the stationary disk on that side, will crowd the disk back again toward the feeding aperture, until it reaches a position where the lateral forces acting against the two sides of the revolving disk are brought to an equilibrium, at which position the disk will remain until this equilibrium is disturbed, when the disk will seek another position that will restore the equilibrium of lateral pressures. In this way the disk will oscillate so long as the pulp is lumpy, but if the pulp were perfectly homogeneous and the feed regular, the revolving disk when once properly adjusted, would maintain its position. Further, if the fiber is tender and easily reduced it will flow freely through the grinder, and occupy but little more space on the feeding than on the discharge side of the disk, but if the fiber is tough and grinds slowly, it will accumulate on the feed side, and crowd the disk over to the discharge side, retarding the discharge; the strong fiber being in this way subjected to, as it requires, more grinding action than the weaker fiber.

This machine is one I have devised for carrying my process into effect, but it will be obvious to those skilled in the art of manufacturing paper, that the modifications of machinery which may be constructed to operate upon this principle would be very numerous indeed, and it would be impossible even to enumerate them within the proper limits of a specification.

What I claim as my invention and desire to secure by Letters Patent is—

1. The combination of the revolving grinding disk, having play in the direction

of its axis, with the fixed grinding disks on either side of it, whereby the revolving disk is free to adjust itself at such varying relative distances from the fixed disks as may be required to prevent the grinder from clogging, and to adapt it to working properly upon different qualities of fiber and under different rates of feeding, substantially as herein set forth.

2. I also claim the arrangement of the feeding and discharging orifices of the grinder, and its grinding surfaces as herein described so that the motion of the revolving disk will facilitate the entrance of the fiber into the grinder, tend to retard its discharge therefrom until properly reduced, and to keep it while in at those places where the grinding action is most energetic, substantially as herein set forth.

JOSEPH KINGSLAND, JR.

Witnesses:
WM. TUSCH,
J. F. BUCKLEY.

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