(No Model.) 4 Sheets—Sheet 1.

# F. PHILIP.

## FEED MILL.

No. 565,690. Patented Aug. 11, 1896.

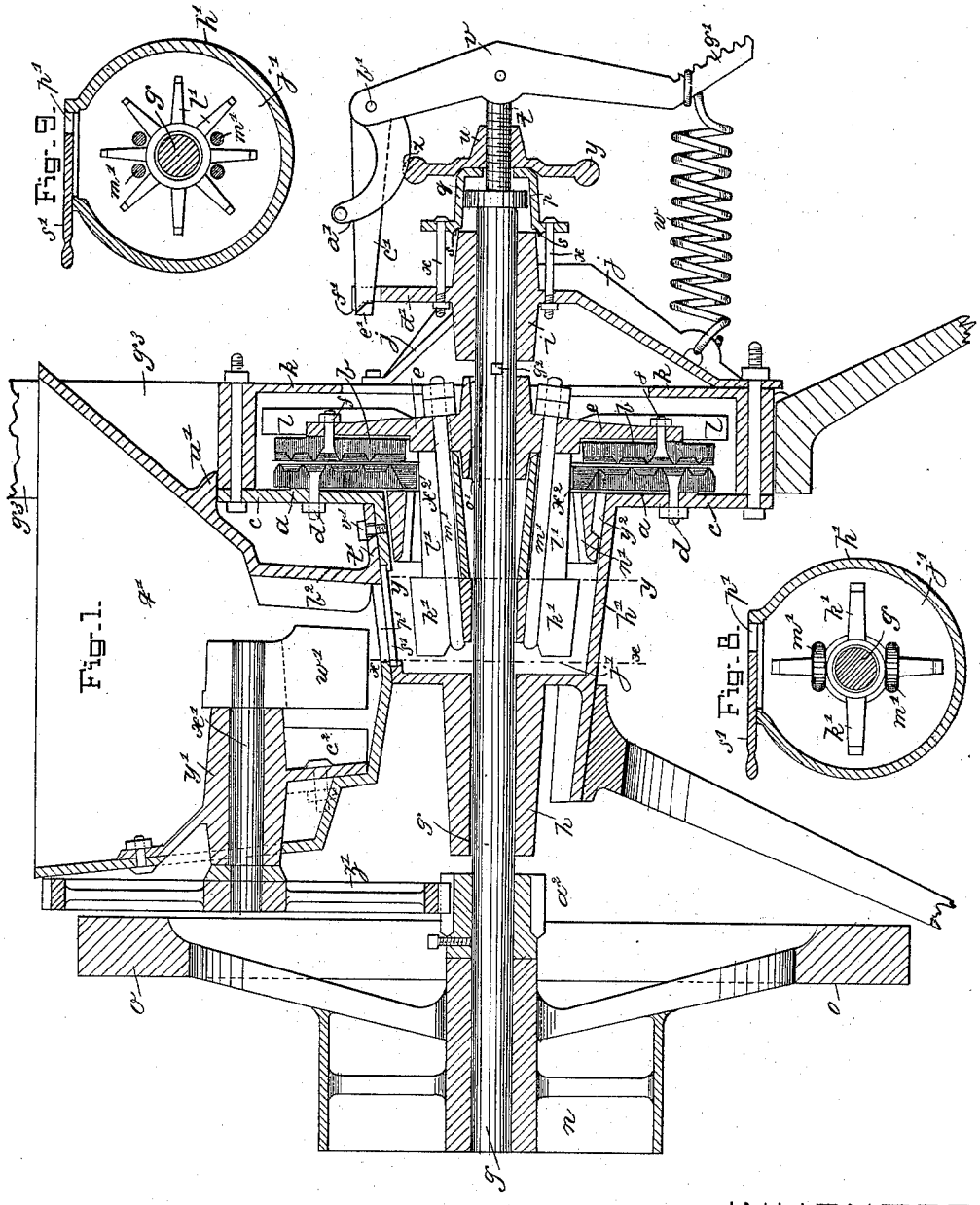

Fig-1.

Fig-2.

Fig-3.

INVENTOR.

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WITNESSES.

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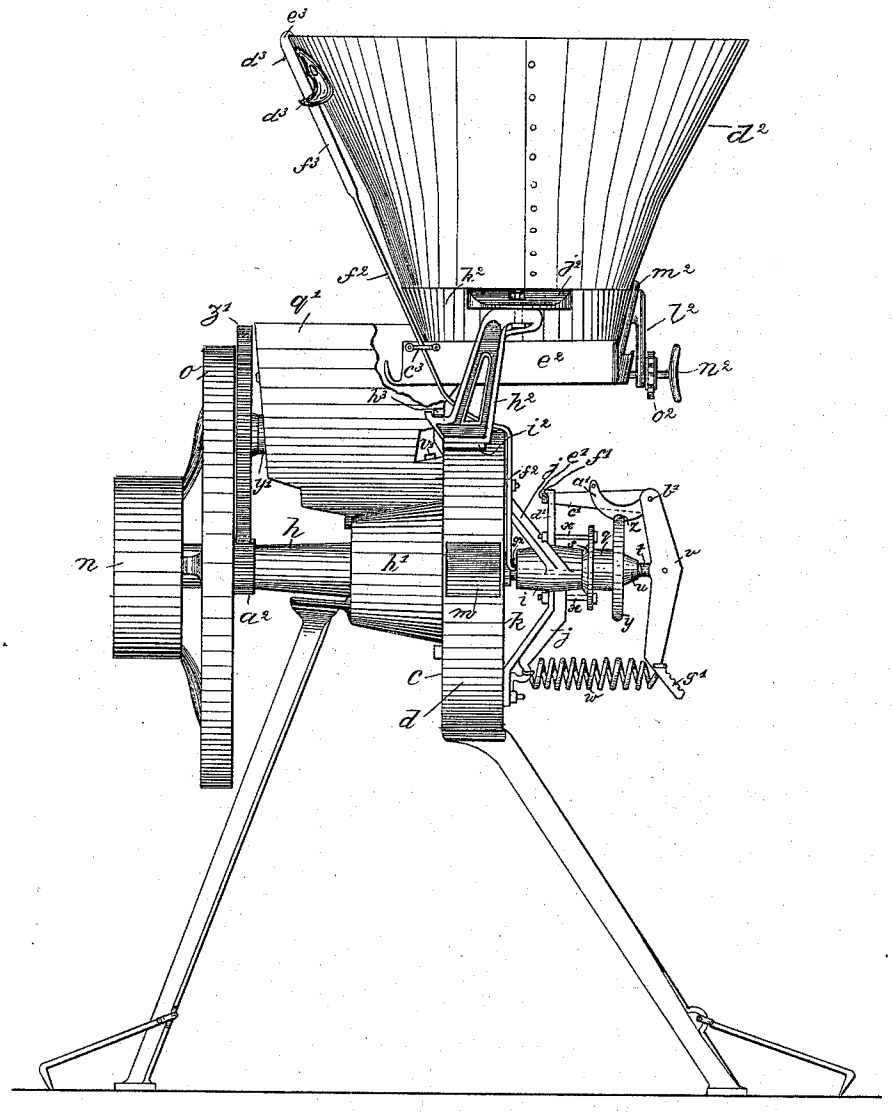
(No Model.) 4 Sheets—Sheet 2.

# F. PHILIP.

## FEED MILL.

No. 565,690. Patented Aug. 11, 1896.

Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

# F. PHILIP.

## FEED MILL.

No. 565,690. Patented Aug. 11, 1896.

Fig. 3.

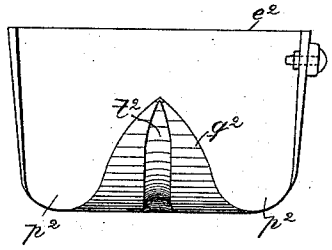



Fig. 4.

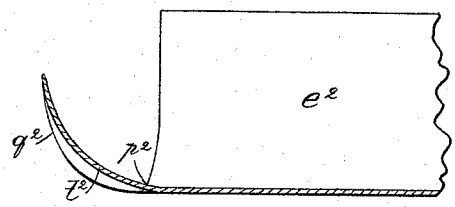



Fig. 5.

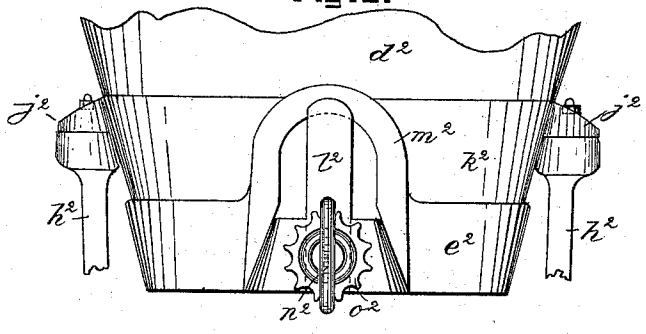



Fig. 6.

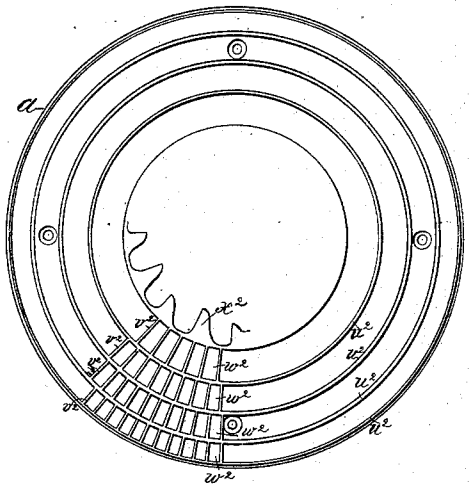
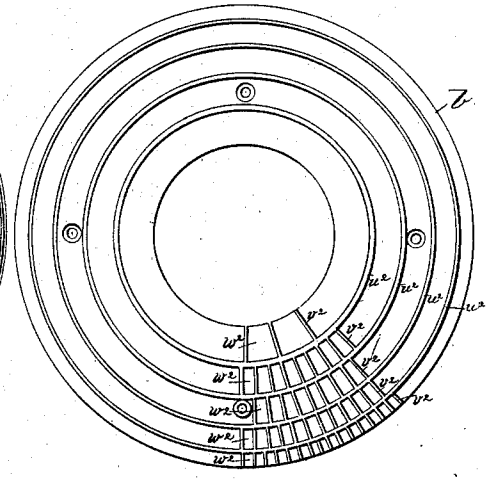



Fig. 7.

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(No Model.)

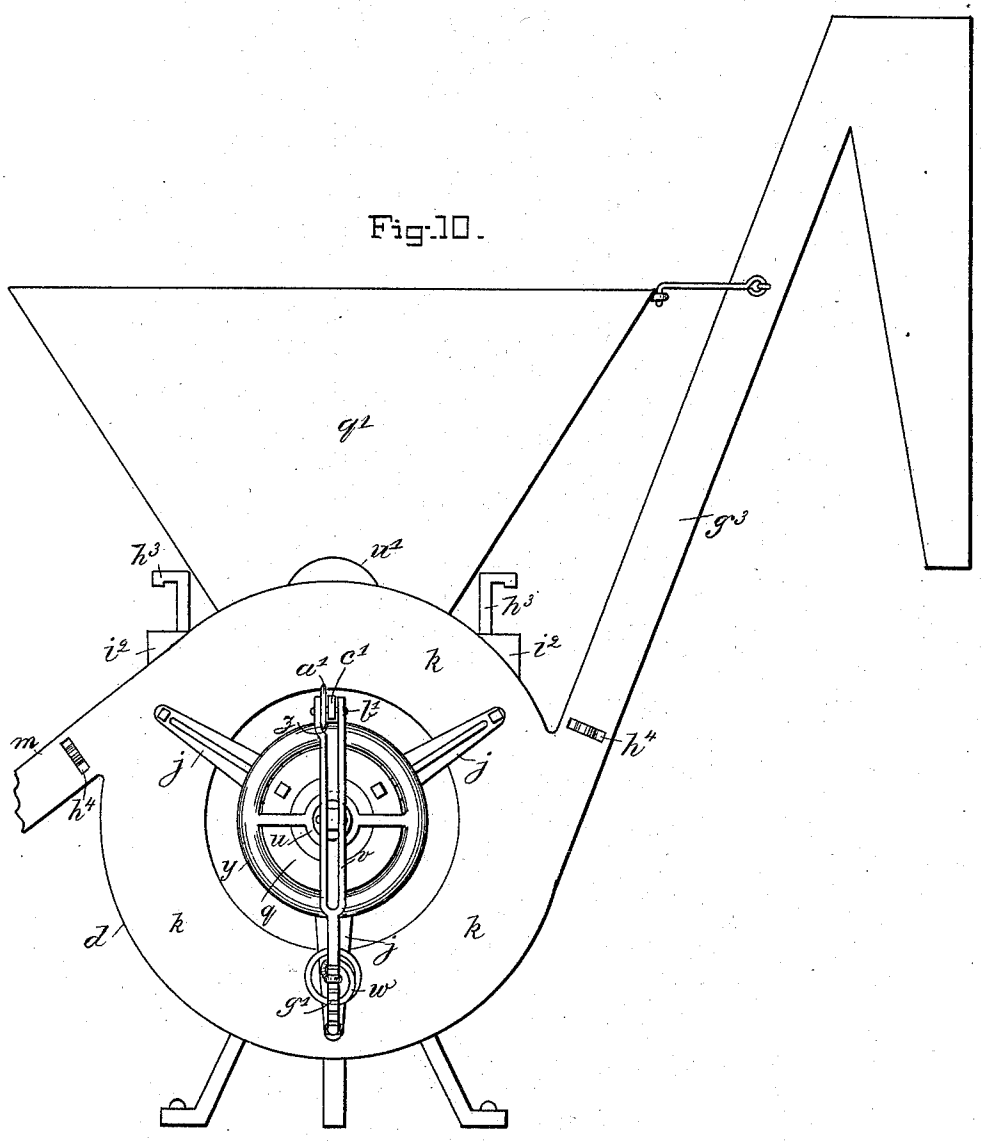
4 Sheets—Sheet 4.

# F. PHILIP.

## FEED MILL.

No. 565,690. Patented Aug. 11, 1896.

Fig. 10.




WITNESSES.

Ernst Maurice Lundgren

D. Gillongan

INVENTOR.

Frank Philip

By A. P. Thayer.

his Attorney

# UNITED STATES PATENT OFFICE.

FRANK PHILIP, OF STOCKPORT, NEW YORK.

## FEED-MILL.

SPECIFICATION forming part of Letters Patent No. 565,690, dated August 11, 1896.

Application filed March 15, 1890. Serial No. 344,068. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK PHILIP, a citizen of the United States, and a resident of Stockport, in the county of Columbia and State of New York, have invented new and useful Improvements in Feed-Mills, of which the following is a specification.

My invention consists of improvements in the feeding, crushing, and grinding devices; also in a cob-breaking attachment; also in the regulating apparatus for governing the degree of reduction, and also in the contrivances of the various parts of the apparatus for economy of construction, all as hereinafter fully described, reference being made to the accompanying drawings, in which—

Figure 1 is a vertical section of my improved mill as used for grinding corn in the ear and other coarse materials, the section being in the plane of the shaft. Fig. 2 is a front elevation of the mill with the hopper and feed apparatus used for regulating the feed. Fig. 3 is a front elevation of the feed-shoe. Fig. 4 is a longitudinal section of part of the feed-shoe. Fig. 5 is a rear elevation of the feed-shoe and part of the feed-hopper and its supports. Figs. 6 and 7 are face views of the grinding-plates, respectively. Figs. 8 and 9 are details of feeding and crushing devices, on lines $x\,x$ and $y\,y$, respectively, Fig. 1. Fig. 10 is a side elevation of the mill, showing an elevating-discharge for delivering the ground material into bags.

I employ vertical grinding-disks, as $a$, which is stationary, and $b$, which revolves and being in this example made of chilled iron or steel and in a special form of construction, which is part of my invention and will be described farther on, but so far as the rest of my invention is concerned I may use disks of any approved material or form of construction.

The disk $a$ is bolted to the inside of the vertical side $c$ of the inclosing case at $d$. The disk $b$ is similarly bolted to the rotating disk $e$ at $f$, which is keyed fast to the shaft $g$, having one of its bearings in the hub $h$ of the side $c$ of the case and the other bearing in the hub $i$ of the spider $j$, which is bolted at the extremities of the arms of the spider to the side $k$ of the case. The disk $e$ has radial arms $l$, reaching beyond the periphery of the grinding-disks a short distance to serve like the wings of a fan for discharging the ground material through the elevating-spout $g^3$, which it is sometimes desirable to use for delivering it directly into bags; otherwise it may be delivered downward through the spout $m$, according as the gates $h^4$ are adjusted. The side $k$ of the case has a large central opening to admit air for promoting a current through the discharge-spout, facilitating the discharge of the ground material, said current being generated by the rotating disks and the arms $l$.

The shaft carrying the rotating disk is driven by a pulley $n$ on the end projecting from the side of the case to which the stationary grinding-disk $a$ is attached, and it carries a fly-wheel $o$ next to said pulley for steadying the motion. At the other extremity of the shaft it bears against a thrust step-plate $p$, located in and adjustable along the box $q$, bolted to the outer end of bearing-hub $i$, and having its bearing-support in opposition to the shaft on the end of the regulating-screw $t$, which is controlled for adjusting the rotating grinding-disk, and also for allowing said disk to "give way" for relief in case of need by the nut $u$, lever $v$, and spring $w$, said nut being adjustable and holding the screw, and bearing against the end of box $q$, but not connected to it, and the lever and spring pressing the screw and nut against the end of the box, the spring having the requisite power to hold the rotating grinding-disk up to its work, but adapted to yield and allow the necessary relief to prevent breaking the grinding-disks or other parts in case a stone, piece of iron, or other like substance too hard for being ground happens to get into the mill, said spring-lever and nut then allowing the rotating disk to be forced apart from the other disk as necessary while such object is between the disks and restoring it to the normal position at once when relieved of said object. The box $q$ is centered on the end of hub $i$ by the circular recess $s$ in the inner end of said box, and is detachably fastened thereto by the bolts $x$, inserted through its flange and the arms of the hub. The screw $l$ is fitted to shift lengthwise freely through the outer end of box $q$, and the nut $u$ has bearing contact only with the box. The nut has a hand-wheel $y$ for turning it readily to regulate the grind-

ing-disks by shifting the screw outward or allowing the screw to be forced farther in by the lever and spring, and said wheel is notched at $z$, and a gravity-latch $a'$ is fixed on the lever-pivot $b'$ suitably for engaging the notch and preventing the nut from working by the jar of the mill, as it might otherwise do at times when there is not much pressure on it, owing to the counteracting pressure of the material being ground on the spring $w$.

The lever $v$ is pivoted at the upper end to the link $c'$, which is detachably connected to the standard $d'$ of hub $i$ by its T-head $e'$, inserted in the bifurcated upper end of the standard under the projecting ribs $f'$ on the back of the standard, where it is securely retained by the stress of the spring $w$ on the lever, but from which the link can be instantly detached by pulling the lower end of the lever forward and thrusting the T-head backward the width of the ribs $f$ or a little more.

The T-head $e'$ and ribs $f'$ are beveled, as shown in Fig. 1, to facilitate the ready connection and disconnection of the link. This device provides a simple means of effecting the said detachable connection without fitting. Such a detachable connection is very useful, because it facilitates the adjustment of the spring $w$ along the notched section $g'$ of the lever for varying the power of the spring, which is frequently required, the operation being, first, pulling the lower end of the lever outward and disconnecting the link, then slackening the spring free of tension, then shifting the coil embracing the notched end of the lever along the same from one notch to another, and then again pulling out the notched end and stretching the spring so as to pass the T-head $e'$ back over the retaining-ribs $f'$ of the standard.

The side $c$ of the case has a central hollow conical extension $h'$, on the outer end of which is the other bearing-hub $h$ of the shaft and within which is a feeding and crushing space $j'$, containing the feeding and crushing wing-cones $k'$ and $l'$, both mounted on the shaft $g$ and clamped to the rotating disk $e$ by the yokes $m'$, and also containing the stationary internally-fluted ring-crusher $n'$, between which and the wings or flanges of cone $l'$ any large grains or particles are reduced preparatory to entering between the grinding-disks. This ring $n'$ is also cone-shaped and fits in the conical extension $h'$ and abuts against the back of disk $a$ next to the eye and is held by a key-lug $y^2$, so as not to be turned by the thrust of the material being ground. The disk $e$ is suitably keyed to the shaft at $o'$, and these cones $k'$ and $l'$ are so yoked to it by the yokes placed around some of their wings or flanges that no fitting is required other than the holes in the disk for the yokes and the fitting of the nuts on the yokes. The wing-cone $l'$ has a conical central hole, which at one end centers it on the shaft and at the other end on the hub of disk $e$.

The material to be ground enters space $j'$ through an opening $p'$ at the outer upper extremity of extension $h'$ from the hopper $q'$, the quantity being regulated by a slide $s'$, which graduates the opening in such cases when required.

The hopper has a bottom plate $t'$ bearing on the top of the part $h'$ of the case and bolted thereto at $v'$, said part $h'$ having a suitable flat top for seating said bottom of the hopper. The hopper also has a flange $u'$ bearing on the top of the case. Within the hopper is a rotary stirring and cob-breaking arm $w'$, carried by the short shaft $x'$, located in the bearing-hub $y'$, and geared by the wheel $z'$ and pinion $a^2$ with the shaft $g$. The hopper also has the cob-breaking vertical inwardly-projecting flanges $b^2$ and $c^2$, between which the rotary breaker $w'$ works so as to break the cobs suitably for feeding through passage $p'$ to the feeders and crushers in space $j'$, effecting further reduction therein preparatory to entering between the disks for final reduction. The hopper may be attached in any approved way, and I do not go into details respecting it, but it is to be observed that it is detachably secured so that it may be removed when desired, and the ears of corn may be fed into space $j'$ by hand to be broken by the wing-cones.

For shelled corn or other fine grain that will feed regularly another hopper $d^2$ is used, with a vibrating feed-shoe $e^2$ under it, and a shaking-rod $f^2$ for working it by a tappet $g^2$ on the shaft $g$, said hopper being bolted on the brackets $h^2$, seated on the top of the case at $i^2$ and detachably secured by hooking under the brackets $h^3$, so that said hopper can be put on and taken off readily so as to feed into hopper $q'$ from the shoe $e^2$. In this example I have represented the elevation of this hopper such that part of one side of hopper $q'$ has to be displaced, and with such part broken out in Fig. 2 to receive the shoe suitably for discharging into it, but the elevation of said hopper $d^2$ may, of course, be sufficient for the shoe to reach over the top of the hopper $q'$, as may be preferred; but this hopper may be seated lower, so as to feed directly into space $j$ through opening $p'$ without using the cob-breaking hopper, if desired.

The hopper $d^2$ has a cast-metal bottom section $k^2$, on which the flanges $j^2$ are cast; also a hanger $l^2$, from the upper shoulder of which the shoe $e^2$ is suspended by a yoke $m^2$, resting in a notch of said shoulder, as represented in Fig. 5, and through the lower end of which hanger the shoe-adjusting screw $n^2$ works to hold the shoe in its proper position and vary the height of the opposite end for regulating the feed, the end of said screw bearing against the heel of the shoe, so as to raise or lower the other end according as the screw is screwed forward or backward through the hanger $l^2$. The check-nut $o^2$ prevents the screw from working slack. Instead of the usual single feed groove or channel for dis-

charging a single stream out of the mouth of the shoe, I provide two such discharge-passages $p^2$ by making the upturned toe $q^2$ in the middle of the mouth and thus dividing said mouth. It is a means of retaining a surplus in the shoe, which, when driving by the irregular motion of a tread-power, will on undue acceleration of the motion give out an excess of feed and check the motion.

The shoe is made thin in the main portion for lightness, and the tongue $q^2$ is stiffened by the inset rib $f^2$. The shaking-rod $f^2$ has a spring-section $f^3$ and a hook-head $e^3$ on the upper end. It is sprung between two prongs $d^3$, projecting from the side of the hopper and retaining the rod in position by its tension for a simple detachable connection. Said rod is connected with the shoe by the eye-loop $c^3$ and extends down where the tappet $g^2$ takes effect to thrust it forward, and its spring-section $f^2$ retracts it.

The grinding-disks are made with a series of annular flanges $w^2$ and intersecting radial flanges $v^2$, on the confronting faces between which are recesses $w^2$, the annular flanges of the disks being disposed so that the circumferential flanges of one disk are intermediate to those of the other disk radially, and the stationary disk has internally-projecting teeth $x^2$ in its eye or central opening confronting the wing-flanges of cone-crusher $l'$, which extends through said eye to and abuts against the face of the disk $e$, carrying the rotating grinding-disk $b$. It will be seen that the course of the material is over both the radial and circumferential flanges from the recesses of one disk into those of the other, alternately and continually crossing the cutting-edge forward and backward from the recesses of one disk to those of the other, so as to be subject to the cuts of the passing flanges in vast numbers, calculated to effect exceedingly rapid reduction and to invest the mill with great capacity.

I claim as my invention—

1. A pair of grinding-disks having the concentric circular and intersecting radial flanges with intermediate recesses and so arranged that the concentric circular flanges of one disk are intermediate to those of the other substantially as described.

2. The combination with a pair of vertical grinding-disks, of the laterally-extended hollow cone-receptacle for the material to be ground, the separate detachably-arranged internally-toothed crushing-ring located therein, said ring removably connected with its base abutting the back of the stationary disk, by the taper cone-receptacle and the rotating feeding and crushing wing-cone extending through the said ring substantially as described.

3. The combination with the shaft and the rotating disk, of the wing-cones centered on the shaft and clamped against the face of said disk by the yokes embracing the wings the yokes coupling the cones to the disk by the wings substantially as described.

4. The combination with the feed-hopper, of the cob-breaker consisting of the rotating arm over the feed-passage from the hopper, and the vertical flanges at the opposite sides of the lower part of the circuit of the said arm substantially as described.

5. The combination with the laterally-extended feed-receptacle and the horizontal shaft of the hopper located on the outer extremity of the receptacle the bearing-hub attached to the hopper, rotating cob-breaking arm having the sole bearing for its shaft in said hub and being mounted on the inner end of said shaft the vertical flanges at the opposite sides of the lower part of the circuit of the said arm the driving-wheel on the outer end of said shaft and the pinion on the grinding-disk shaft, substantially as described.

6. The combination with the hopper and feed-shoe suspended at its closed end from the hopper by the heel-yoke of the shoe, of the adjusting-screw in the hanger abutting against the level of the shoe and adapted to adjust the toe or open end vertically substantially as described.

7. The feed-shoe having the outwardly-upturned tongue in the mouth dividing the outflow-passage of the shoe substantially as described.

8. The combination of the hopper, feed-shoe, the feed-shoe working rod having the spring-section sprung between the retaining-prongs and detachably hooked on the upper edge of the hopper above said prongs and the tappet on the shaft substantially as described.

9. The combination with the disk-carrying shaft and the step-box, of the adjusting-screw shifting freely through said box, the adjusting-nut resting against the end of the box and the lever and spring holding the screw and nut substantially as described.

10. The combination with the lever, spring and screw, of the lever-holding link detachably connected to the standard of the shaft-bearing hub by the T-head of the link and the bifurcated ribbed end of the standard, substantially as described.

11. The combination with the notched hand-wheel of the adjusting-nut, of the gravity-latch on the lever-pivot engaging the notch of the hand-wheel said latch pivoted together with the lever substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 17th day of August, 1889.

FRANK PHILIP.

Witnesses:
JAMES A. HOVER,
ORMEROD HANSON.