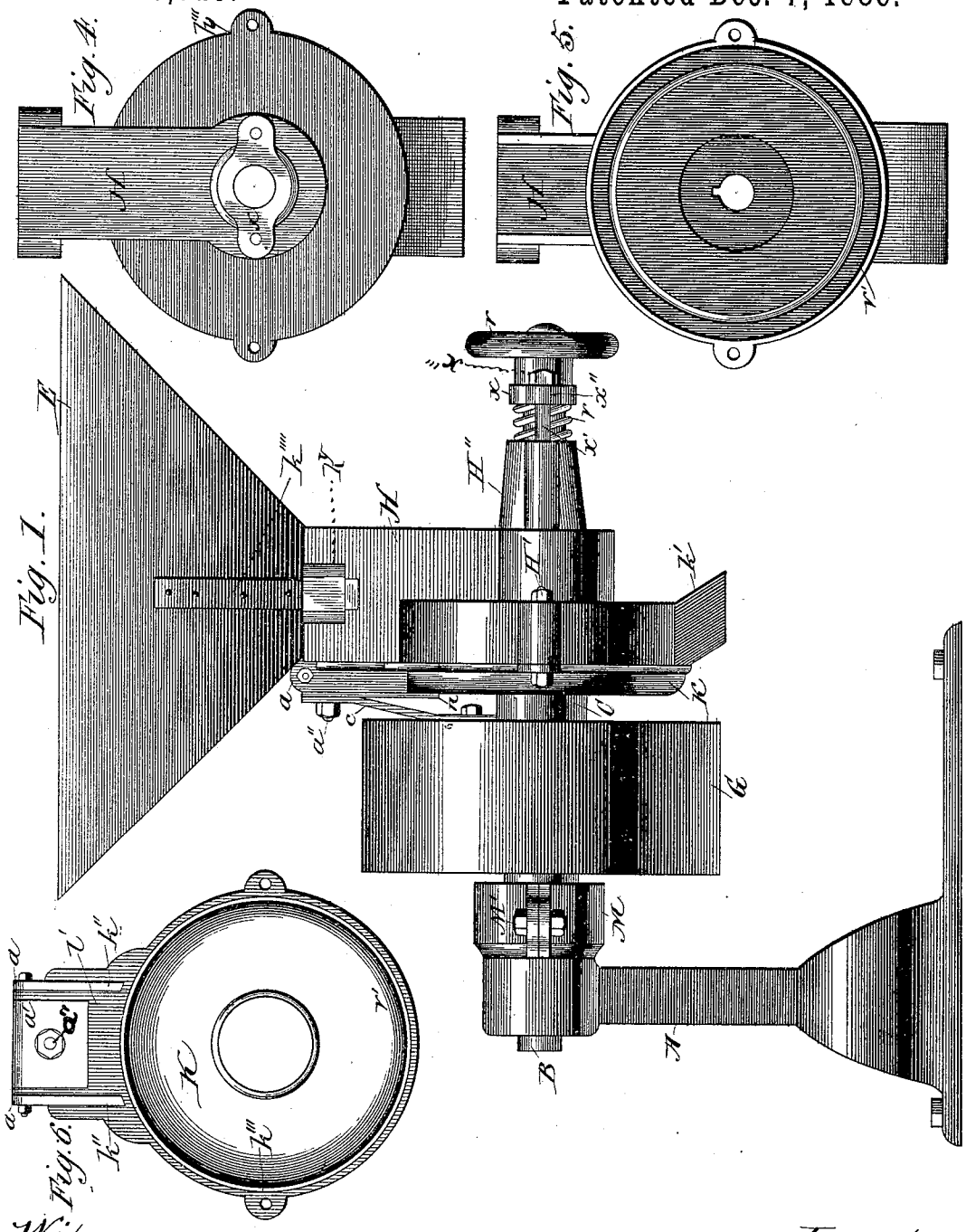
(No Model.) 4 Sheets—Sheet 1.

# G. & A. RAYMOND.

## GRINDING MILL.

No. 353,710. Patented Dec. 7, 1886.




Witnesses,
L. F. Mann
F. C. Goodwin

Inventor
George Raymond,
Albert Raymond,
By Offield, Sawle & Rhodes,
Attys.

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 2.

# G. & A. RAYMOND.

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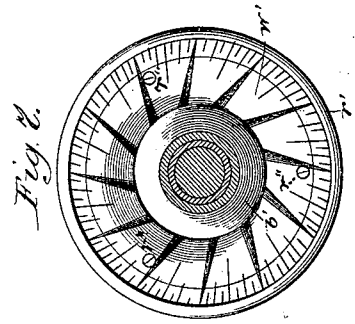

Fig. 1.

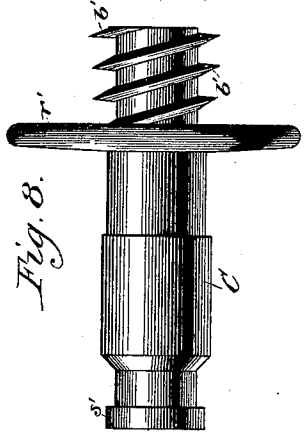

Fig. 3.

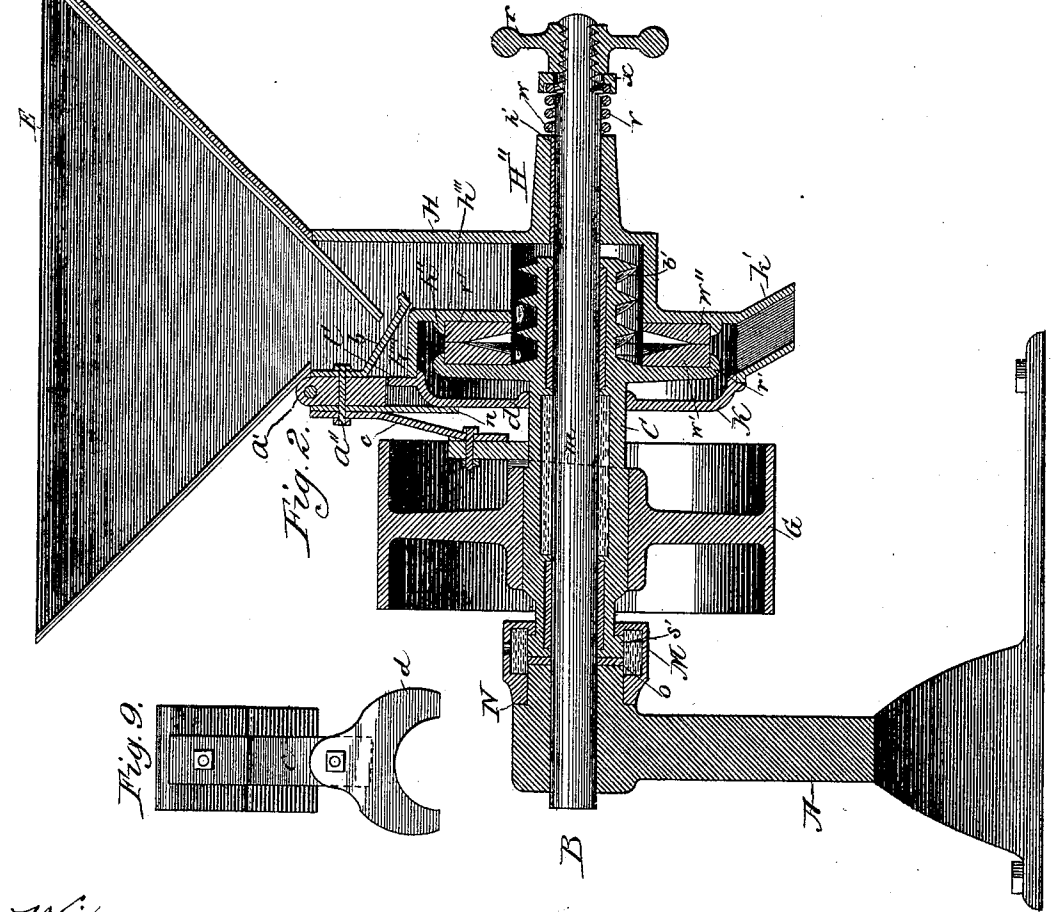

Fig. 2.



Fig. 9.

Witnesses,
L. F. Mann
F. C. Goodwin

Inventor,
George Raymond,
Albert Raymond
By, Offield, Towle & Graves,
Atty's.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 3.

# G. & A. RAYMOND.

## GRINDING MILL.

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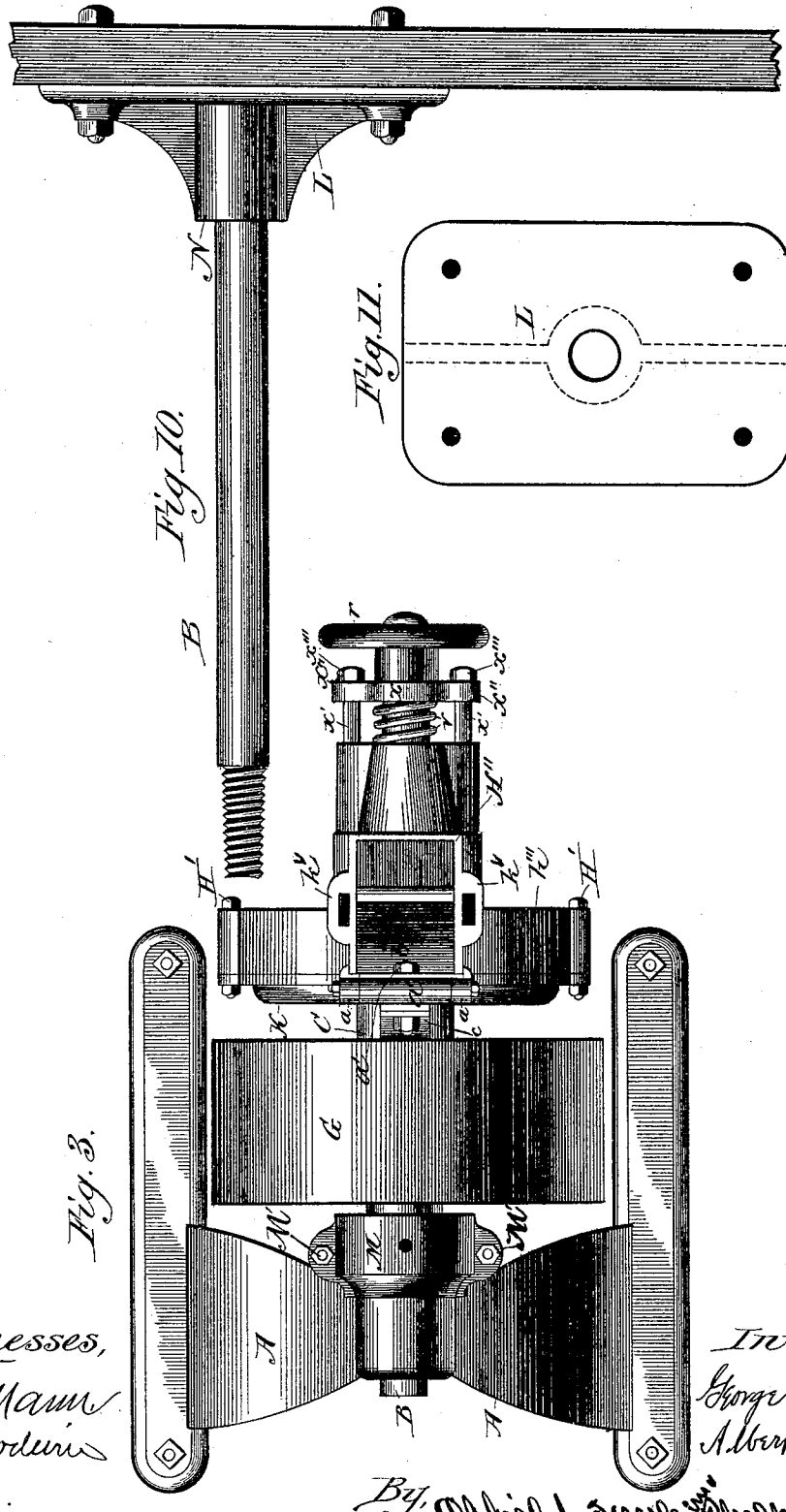


Witnesses,
L. D. Mann
F. B. Goodwin

Inventor,
George Raymond,
Albert Raymond

By Offield, Towle & Phelps Atty's.

N. PETERS. Photo-Lithographer. Washington, D. C.

(No Model.) 4 Sheets—Sheet 4.

# G. & A. RAYMOND.

## GRINDING MILL.

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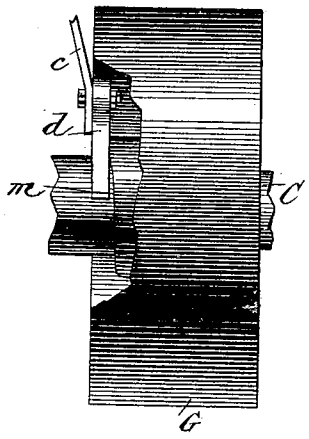
*Fig. 12.*




Witnesses,
L. F. Mann.
E. L. Huber.

Inventors
George Raymond
Albert Raymond
By. Offield Towle & Phelps
Atty's.

N. PETERS. Photo-Lithographer, Washington, D. C.

# UNITED STATES PATENT OFFICE.

GEORGE RAYMOND AND ALBERT RAYMOND, OF CHICAGO, ILLINOIS.

## GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 353,710, dated December 7, 1886.

Application filed August 3, 1885. Serial No. 173,475. (No model.)

*To all whom it may concern:*

Be it known that we, GEORGE RAYMOND and ALBERT RAYMOND, citizens of the United States, residing at Chicago, in the county of Cook, and in the State of Illinois, have invented certain new and useful Improvements in Grinding-Mills, of which the following is a specification.

A leading object of our invention is to secure greater compactness of parts, simplicity of arrangement, and economy in space and in expense in a grinding-mill. We attain these objects, in brief, by employing a single central shaft, which affords a support for the entire mechanism of the mill, the running-stone being mounted upon a sleeve surrounding said shaft, and the bed-stone being fitted in a casing also provided with a sleeve fitted to the shaft, and having a forward and backward movement thereon to provide for the proper adjustment of the faces of the stones. An important advantage attained by this construction is found in the effective maintenance of accurate adjustment between the faces of the stones, this being secured by the connection of the two stones with their respective sleeves mounted upon the same shaft.

Another object of our invention is to provide means for determining the relative positions of the two stones and their pressure upon the grain between them, in order to regulate both the amount and quality of the work which they perform, and which at the same time shall not have a tendency to push the stones upon each other to their injury when the mill runs empty, and which, again, shall be adapted to yield, so as to allow the stones to separate in case any foreign substance—such as a piece of metal—comes between their faces, to prevent injury thereto.

It has been proposed heretofore to press millstones together by means of a spring bearing upon the casing or shaft carrying one of the stones, and this spring has been made of adjustable tension. This mounting permits, to a certain extent, both the quantity and the quality of the work done by the mill to be regulated, and it also permits the stones to separate to avoid injury from a foreign substance coming between the faces; but it is subject to the great disadvantages that no adjustments for quality can be made without interfering to a great degree with the adjustment for quantity, and vice versa, and that the pressure put upon the stones for the purpose of increasing the grinding capacity of the mill is sufficient to push the faces of the stones together whenever the mill happens to run out of grain, to the injury of the stones. This difficulty we propose to overcome in mills of this kind by using a spring so mounted that it shall at no time have a tendency to force the stones toward each other beyond a certain fixed and adjustable limit, while at the same time its power may be varied, as desired, within this limit, thus giving a mill which can be adjusted to grind fine or coarse at the rate of a small or large quantity in a given period of time, and in which the stones will be at liberty to move apart upon the introduction of a foreign substance between their faces. The means which we have devised to accomplish these ends, as well as other features and details of construction, also constituting parts of our invention, are fully described in the following specification, and pointed out in the claims.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side elevation of the mill. Fig. 2 is a vertical longitudinal cross section of the same. Fig. 3 is a plan view of the mill with the hopper removed. Fig. 4 is an end view of the principal casting inclosing the feed and grinding chambers of the mill and supporting the bed-stone, as seen from the right-hand side of Fig. 1. Fig. 5 represents the opposite side or interior of the same casting. Fig. 6 is an inside view of the cap or end piece applied to the principal casting at its rear, said end piece forming one side of the grinding-chamber. Fig. 7 shows the face of the running-stone and the manner of securing the same to the supporting-flange on the sleeve. Fig. 8 is a side view of the sleeve which carries the running-stone, the driving-pulley, and the worm-carrier which feeds the grain to the stones. Fig. 9 is a rear view of the pivoted block carrying the shake-pan to which is attached an arm carrying a shoe which bears against a cam carried by the revolving sleeve by means of which the shake-pan is caused to vibrate and the grain to feed. In this figure the spring-plate, hereinafter described, attached to the pivoted block and bearing upon the outside of the cap or end

piece of the grinding-chamber, conceals the lower part of said pivoted block. Fig. 10 shows an alternative means of supporting the central shaft of the mill, it being supported in a casting bolted to the side of the building, a post, or other upright. Fig. 11 is a rear view of the casting shown in Fig. 10. Fig. 12 represents in perspective a cam on the revolving sleeve and the hub of the driving-pulley, the arm and the shoe for operating the feed-mechanism.

Simplicity of construction is secured in our mill by the use of a fixed central shaft, which furnishes a support for the other parts, serving, also, as an axis for the revolving parts of the mill, and also supplying a basis for the accurate and permanent adjustment of the faces of the stones to each other, each of the stones being supported by sleeves fitted upon this shaft.

The shaft B is fixed in a frame work or casting, A or L, as respectively shown in Figs. 1, 2, and 10, attached to the floor, the wall, or other suitable support. The running-stone of the mill, $w'$, is attached by bolts $r''$, as shown in Fig. 7, to the flange $r'$, cast upon the sleeve C, revolving upon the shaft, and driven by power applied to the pulley G, mounted upon the enlarged portion of the sleeve.

The sleeve is held in its position upon the shaft and kept from lateral movement by the engagement of the combined oil-box and clamp M with the flange $s'$, formed on the rear end of the sleeve, said rear end abutting against a washer or friction-ring, $o$, resting in turn against a bearing-face formed on the casting in which the central shaft is set. This casting is cut back in cylindrical form from the face against which the friction-ring $o$ rests, forming a shoulder, N, against which the rear end of the oil-box abuts. The oil-box is made in two parts, and is connected by bolts M', one on each side, passing through flanges formed on the two halves of the box. By tightening these bolts properly the two halves of the oil-box are clamped upon the projecting cylindrical portion of the casting A, so as to hold it firmly and retain the sleeve against any tendency to move toward the front end of the shaft. The inner surface of the sleeve is cut away, so as to leave but four narrow circular bearings, as is usual in such constructions, to diminish friction.

The bed-stone of the mill, $w''$, is carried by the principal casting H, the flange $h''$ being provided on the said casting to receive the stone. The flange $h''$ is formed upon the circular part $h'''$ of the casting H, which forms one end of the grinding-chamber, the other end being closed by the cap-piece K, (shown in Figs. 1, 2, 3, and 6,) and which is united to the circular part of the casting H by bolts, (shown at H' in Fig. 3.) This circular part $h'''$ of the casting has a circular flange at its outer edge, $h''''$, which forms the circumference of the grinding-chamber, and from which extends the downwardly-projecting-spout $k'$ for the discharge of the meal. The grain is introduced into the grinding-chamber through a central aperture in the plate $h'''$, being carried through the same by a screw-conveyer, $b'$, formed on the front end of the sleeve C. The cap-piece K has also a central aperture of sufficient size to permit the free rotation therein of the sleeve C. The grinding-chamber we have designated as $v'$. The casting H extends in rectangular form above the grinding-chamber, inclosing a rectangular feed-chamber on three sides, and is provided on two of these sides with ears, (see Fig. 3,) these ears having central slots for the reception of cleats $k''''$, fixed to the hopper, and by which the latter is held in place. The fourth side of the feed-chamber is partially closed by an upward extension, $l'$, from the cap-piece K. The inner face of the cap-piece K is provided with flanges $k''$ and $k'''$, adapted to engage with the corresponding flange, $h''''$. On each side of and projecting above the said extension $l'$ rise from cap-piece K two standards, $a$, between which is pivoted a block, $a'$, closing the remainder of this side of the feed-chamber. A bolt, $a''$, passing through this block, secures to the inside thereof a shake-pan, $b$, and to the outside a spring, $n$, and an arm, $c$, the latter carrying the shoe $d$, as shown in Figs. 2 and 9.

The shoe $d$ rests upon the exterior surface of the sleeve C, being curved to fit it, and presses laterally against a cam, $m$, formed upon the enlargement of the sleeve and the hub of the pulley G. (Shown in detail in Fig. 12.) As this cam revolves, it communicates a vibrating motion to the shoe $d$, and through it to the pivoted block $a'$ and the shake-pan $b$, causing the feed of grain into the feed-chamber. The shoe $d$ is pressed against the cam by the action of the spring $n$, which is made so as to bear at its lower end against the cap-piece K, and so tends to cause the block $a'$ to swing outward, and consequently push the shoe against the cam. The effect of this will be, that besides holding the shoe against the cam the spring will exert a certain pressure upon the entire casing inclosing the feed and grinding chambers, this casing being made up of casting H and cap-piece K, tending to push it out over the sleeve C; and said spring $n$ should be of such strength as to of itself move the entire casting outward when there is no counteracting pressure, and thus prevent the faces of the stones from coming together when the mill is empty. The usual slide, $d'$, is provided within the hopper by which the size of the opening from the hopper, and consequently the rate of feeding, is regulated. The casting H is mounted upon the shaft by means of an extension, H'', which is bored out so as to fit closely upon the shaft, forming, in effect, a sleeve of sufficient length of bearing to always maintain a perfectly proper angle between the face of the bed-stone carried by the casting and the shaft as the casting is moved forward and backward upon the shaft in effecting its adjustment. The sleeve H'' is fitted

to the shaft by means of a spline, $h'$, set into the sleeve and entering a seat or groove, $w$, (shown in dotted line in Fig. 2,) in the shaft. The relative location of the spline and its seat as between the sleeve and the shaft could, of course, be reversed, if desired.

The pressure of the stones upon the grain passing between them is regulated by the spring $v$, made of bent or coiled wire, metal, rubber, or other elastic material placed between the forward end of the casting H and the tension-plate $x$. This tension-plate has a central aperture slightly larger than the shaft, so that it moves to and fro upon it easily; and also two laterally-projecting ears, $x''$ $x''$, through holes in which pass bolts $x'$ $x'$, fixed in and projecting from the casting H. The normal tension of the spring $v$ is regulated by the position of the nuts $x'''$ on these bolts. The outer end of the shaft is screw-threaded, and the hand-wheel $r$, fitted to it, forms an adjustable bearing for the tension-plate $x$. The object of this feature of our invention has been set forth above, and its operation will now be described.

The tension of the spring $v$ is regulated according to the amount of pressure desired upon the grain between the millstones. This pressure will depend largely upon the rate at which it is desired that the grain should be ground. For instance, a much greater tension will be required to keep the stones from separating where twenty bushels are to be ground per hour than where the requirement is only ten bushels. Having obtained the normal tension of the spring $v$ by proper adjustment of the nuts $x'''$, the next thing is to set the mill for the quality of flour or meal to be ground. This depends largely upon the distance between the faces of the grinding-stones, and will be determined by the point at which the spring $v$ is set to take effect—*i. e.*, upon the position of the hand-wheel $r$—for it is obvious that the spring $v$ will have no tendency to drive the casting H back until the said casting has been forced out to such a point that the bolts $x'$ $x'$ have been pushed through the tension-plate, and the tension-plate comes to bear, not against the nuts $x'''$ $x'''$, but against the hand-wheel $r$. The hand-wheel will, therefore, be set at such a position that the spring $v$ will act upon the casting H only after the faces of the stones have passed beyond the degree of separation fixed on for the grade of meal or flour desired. It will be observed that the action of the spring $n$ will be to force the millstones apart up to this fixed limit—*i. e.*, up to the point where the force of the spring $n$ is met and overcome by that of the spring $v$. With this construction and arrangement of parts, every desired combination as to degree of pressure and distance between the stones may be secured without incurring any liability that the faces of the stones will be forced together should the mill run empty, while the stones are always free to move apart on the introduction of any foreign substance likely to injure their faces.

An advantage of our construction is the ease with which the mill may be taken apart and access had to the running-stones for the purpose of repair or replacement. It will be noticed that it is only necessary to remove the hand-wheel $r$ and disconnect the cap-piece K from the casting H by taking out the bolts H′, in order to slip the casting off from the shaft and expose both stones. The sleeve carrying the running-stone can also be removed from the shaft by simply loosening the oil-box. This ready separation of the parts is due to the peculiar mounting of the feed mechanism, one part (the hopper) being attached to the casting H, and the other part (the shake-pan) being attached to the cap-piece K, there being no connection between the hopper and the shake-pan. The mill is practically made in two halves, each half carrying one of the millstones, these two halves being connected merely by the bolts H′ H′, one half consisting of the hopper and the casting H, and the other half of the sleeve C, the shake-pan, and the shaft.

The grinding-disks used may be of any material, quality, or form desired, that shown in Fig. 7 being merely illustrative of the position of the stone and one manner of attaching it.

We wish it understood that we do not limit ourselves to the particular forms of construction we have shown in detail, but claim, broadly, the combinations of parts shown, as more specifically indicated in the following claims.

We claim—

1. The combination, in a grinding-mill, of a central fixed shaft, a revolving sleeve thereon provided with a flange, a running-stone secured to said flange, a casing adjustably mounted upon said shaft and adapted to be moved forward and backward thereon, and a bed-stone supported by said casing, substantially as described, and for the purpose set forth.

2. In a grinding-mill, the combination of a fixed shaft, a supporting-casting in which the rear end of said shaft is fixed, a sleeve revolving on the said shaft and provided with two flanges, one at each end thereof, a box formed in two parts adapted to be clamped together upon the said casting and sleeve, and provided each with a flange for engaging with the flange formed on the rear end of the sleeve, bolts for clamping said parts together, a casting mounted upon said shaft, and two grinding-stones, one attached to said casting and the other to the forward flange of the sleeve, substantially as and for the purpose set forth.

3. The combination, with the central shaft of a grinding-mill, of a casting mounted thereon and adapted to be inwardly and outwardly adjusted, two millstones, one of them being attached to said casting, a hand-adjusting wheel working upon said central shaft, a tension-plate against which said hand-wheel operates, a spring held between said tension-plate and said casting, and bolts extending from said casting to the aforesaid tension-plate and pro-

vided with adjusting-nuts, whereby the tension of the spring may be regulated, substantially as described and shown.

4. In a grinding-mill, the combination of a fixed shaft, a revolving sleeve provided with a cam, a grinding-stone carried by said sleeve, a casing secured to and adjustable inwardly and outwardly upon said shaft, a bed-stone, a hopper, and feed mechanism carried by said casing, an arm attached to the feed mechanism, and a spring adapted to press the arm out from the casing and against the cam, substantially as described, and for the purpose set forth.

5. The combination, in a grinding-mill, of a shaft, a supporting-casting in which the rear end of said shaft is set, and having a cut-away portion provided with a bearing-face on its inner end, an oil-box provided with a flange, a sleeve provided with two flanges, one on each end thereof, revolving upon said shaft, a friction-ring placed between said bearing-surface and the rear end of said sleeve, a casting mounted on said shaft, near its forward end, and two grinding-stones, one attached to said casting and the other to the forward flange of the sleeve, substantially as and for the purpose set forth.

6. The combination, in a grinding-mill, with the central shaft, of a casing carrying the fixed millstone and mounted upon and adapted to be moved either way in the direction of the length of the shaft, a running stone, a hopper supported upon said casing, a spring placed at the front or outer end of said casing for regulating the pressure of the stones, means attached to the casing for adjusting the tension of said spring, and an adjusting hand-wheel at the front or outer end of said central shaft for adjusting the casing thereon, substantially as described and shown.

7. The combination of the central shaft of a grinding-mill, a casing supported by said shaft and adjustable in the direction of the length thereof, said casing and shaft being fitted to each other by a spline and groove, a bed-stone carried by said casing, means for adjusting said casing to and fro lengthwise of the shaft, a sleeve adapted to revolve upon the shaft, and a running-stone carried by said sleeve, substantially as described, and for the purpose set forth.

8. In a grinding-mill, the combination of a fixed shaft, a casting provided with a sleeve fitted to said shaft, a bed-stone attached to said casting, a sleeve adapted to revolve upon said shaft, and a running-stone attached to said sleeve, the said sleeves being of such length as to maintain accurate alignment of the surfaces of the stones, substantially as described.

9. In a grinding-mill, the combination of a shaft, a casting fitted upon said shaft and adapted to be adjusted lengthwise thereof, a bed-stone attached to said casting, a running-stone, a spring adapted to press the bed-stone away from the running-stone, a spring of adjustable tension adapted to press the bed-stone toward the running-stone, and a tension-plate bearing against the same, attached to the shaft and adapted to be adjusted forward and backward thereon, substantially as and for the purpose set forth.

10. In a grinding-mill, the combination of a shaft, a casing mounted thereon and adapted to be moved forward and backward, a hopper, bed-stone, and shake-pan carried by said casing, a running-stone, a revolving sleeve carrying the same, a spring of adjustable tension adapted to press the bed-stone toward the running-stone, an arm connected with the shake-pan and bearing upon a cam formed on said sleeve, and a spring adapted to force said arm out from the casing and against the cam, substantially as and for the purpose set forth.

11. In a grinding-mill, the combination of two millstones, the fixed shaft, a casting mounted thereon and carrying one of said stones, and adapted, also, to be adjusted forward and backward with reference to the other stone, a tension-plate, a spring mounted on said shaft between said plate and said casting, bolts passing from the casting loosely through the tension-plate and provided with nuts on their outer ends, and a bearing for said tension-plate mounted upon a fixed part of the mill and adapted to be adjusted forward and backward with reference to the plate, substantially as and for the purpose set forth.

12. In a grinding-mill, the combination of a hopper, a shake-pan, a pivoted block therefor, an arm attached thereto, a shoe fixed to said arm, a revolving sleeve provided with a cam, and a spring adapted to force the arm against the cam, substantially as and for the purpose set forth.

13. In a grinding-mill, the combination of a fixed shaft, a running-stone, a sleeve carrying the same and mounted on said shaft, a bed-stone, a casting carrying the same and provided with a sleeve fitted to said shaft, a nut screw-threaded on the end of the shaft, a tension-plate, a spring held between the casting and the tension-plate, and bolts passing from the casting loosely through holes in the tension-plate, and provided with nuts at their outer ends, substantially as described and shown.

14. In a grinding-mill, the combination of a shaft, a casting mounted on said shaft and providing a feed-chamber, a bed-stone carried by said casting, a sleeve rotating on said shaft and provided with a flange, a running-stone mounted in said flange, and a cap-piece bolted to said casting and provided with an aperture for said sleeve, substantially as and for the purpose set forth.

GEORGE RAYMOND.
ALBERT RAYMOND.

Witnesses:
FREDERICK C. GOODWIN,
E. L. HUBER.