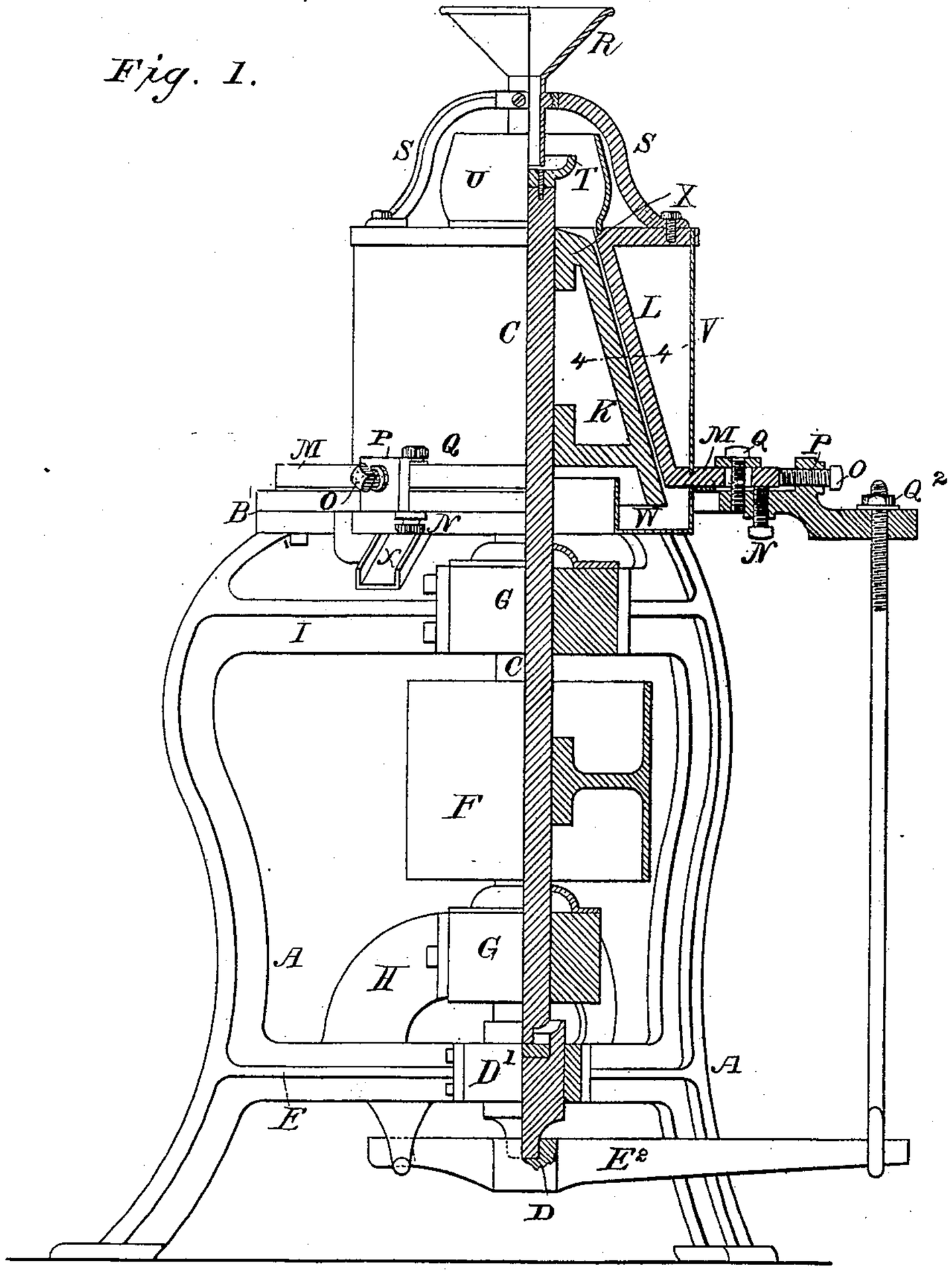
(No Model.) 3 Sheets—Sheet 1.

C. L. GRATIOT.

METHOD OF AND APPARATUS FOR MILLING.

No. 267,516. Patented Nov. 14, 1882.

Fig. 1.



WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

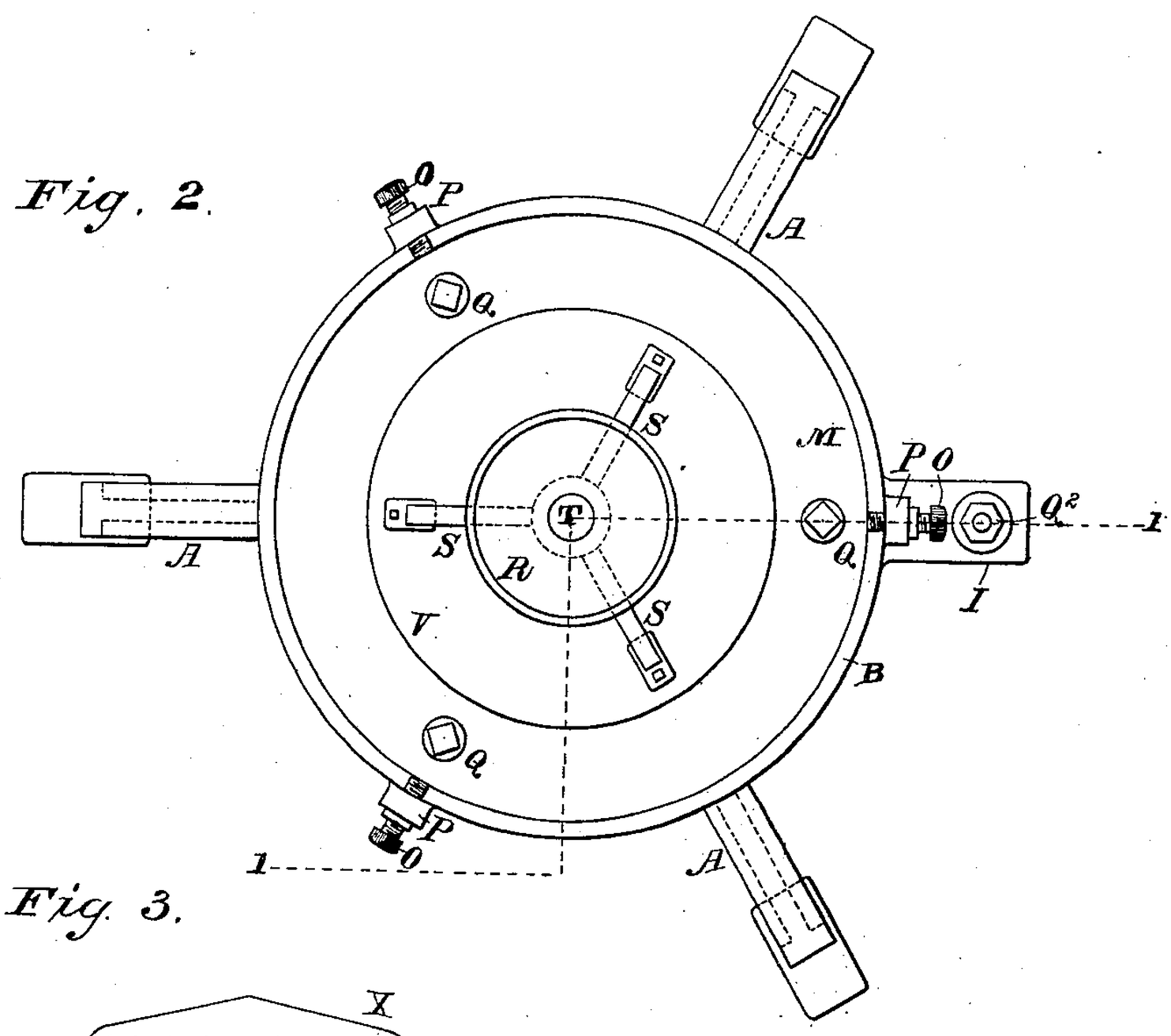


Fig. 3.

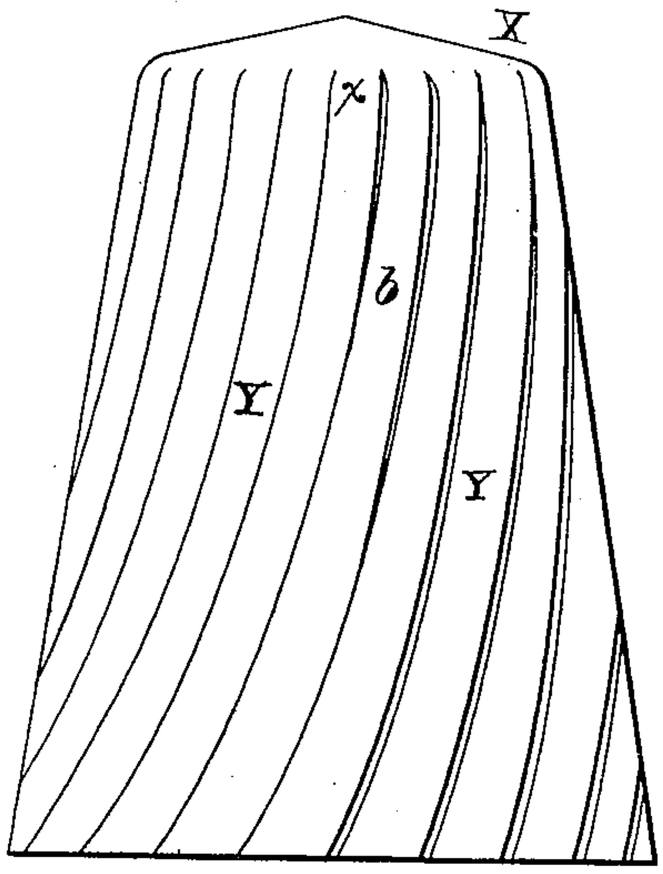
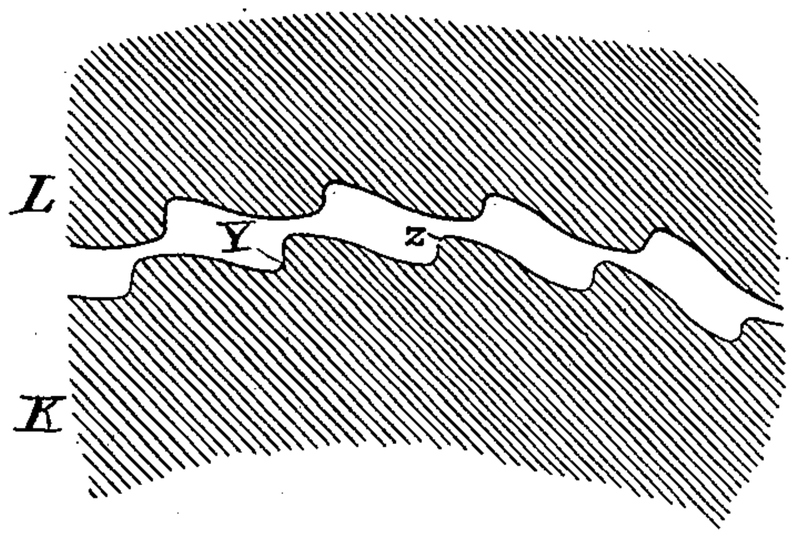


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 5.

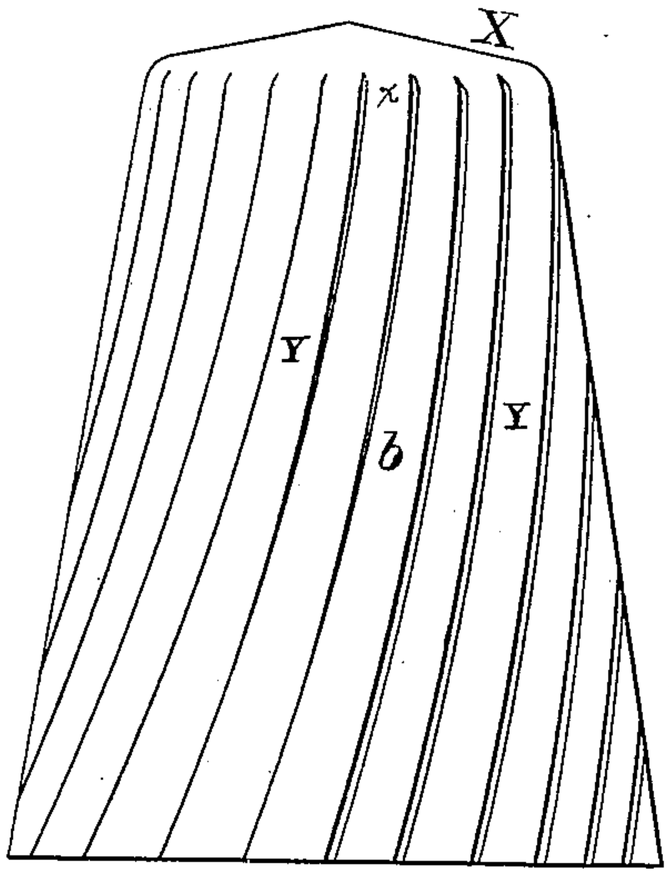


Fig. 7.

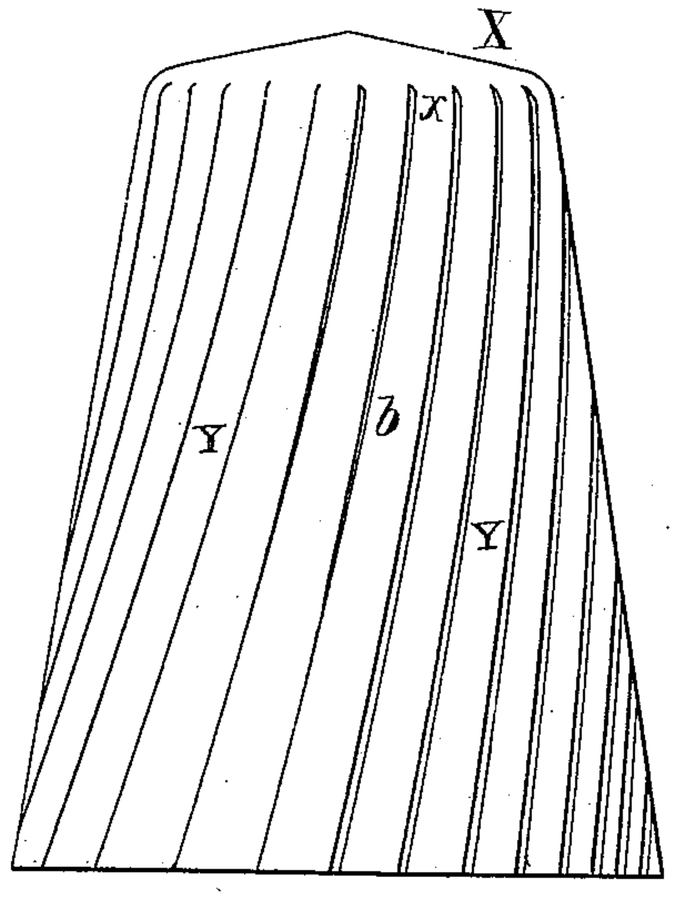


Fig. 6.

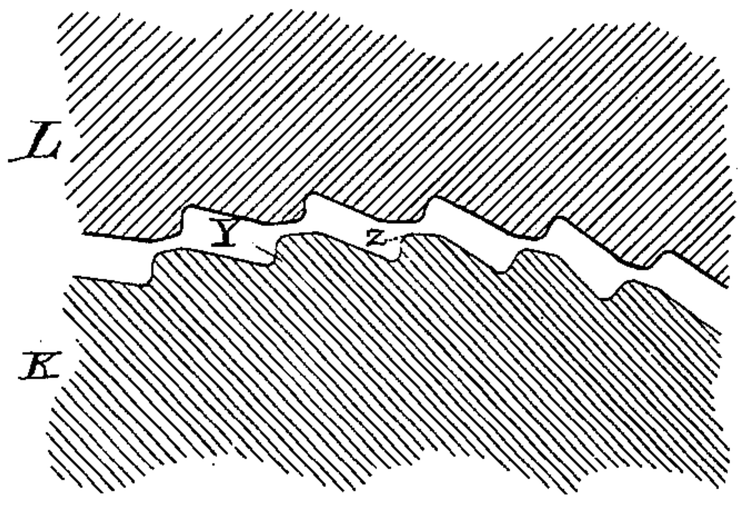
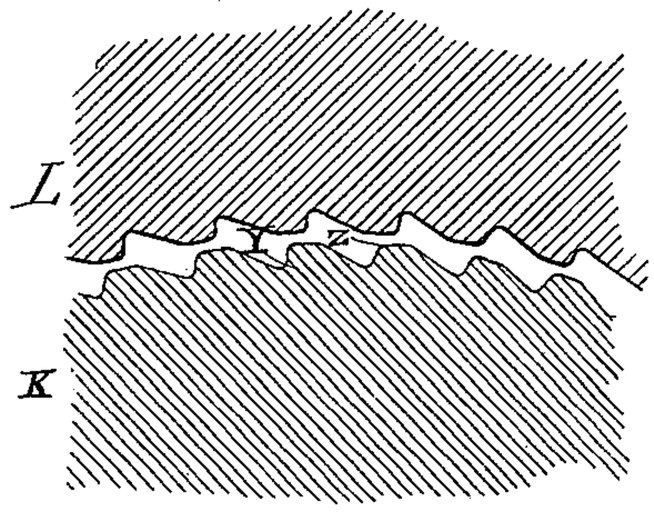


Fig. 8.



WITNESSES

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INVENTOR

Charles L. Gratoit

By his Attorneys,

Baldwin, Hopkins & Peyton.

UNITED STATES PATENT OFFICE.

CHARLES L. GRATIOT, OF CHICAGO, ILLINOIS.

METHOD OF AND APPARATUS FOR MILLING.

SPECIFICATION forming part of Letters Patent No. 267,516, dated November 14, 1882.

Application filed June 19, 1882. (No model.) Patented in England July 11, 1882, No. 3,283.

To all whom it may concern:

Be it known that I, CHARLES L. GRATIOT, of Chicago, in the State of Illinois, have invented certain new and useful Improvements in Method of and Apparatus for Milling, of which the following is a specification when read in connection with the appended drawings.

My invention relates to a new method and a new mechanism for degerminating, cleaning, and reducing wheat. I have recently patented in the United States an improved mill operating by an improved method for breaking or splitting grains of wheat longitudinally and cleaning the divided kernels of the germs, fuzz, and crease-dirt, so far as practicable, by one operation, which invention I have termed "improvements in a method and an apparatus for degerminating wheat." In connection with such a mill, which is illustrated as heretofore patented on Sheets 1 and 2 of the appended drawings, I use other mills of similar character, but differing in the dress of the rolls and cases, in depth and number of furrows, in rate of speed of working, and in adjustment, as set forth below, by means of which other mills I carry the breaking, reducing, or granulating operation further than in my said patented mill, and also continue the rubbing and degerminating operation with good results.

In the appended drawings, Figure 1 is an elevation, partly in vertical section on the line 1 1 of Fig. 2, of a complete primary breaking, cleaning, and degerminating machine such as I have patented. Fig. 2 is a plan or top view of the same. Fig. 3 is an elevation of a frustum-shaped roll of the primary mill; and Fig. 4 is a section of the roll and case, showing their furrows. These four figures are the same as the drawings of my said patent.

Referring to the letters upon these figures of the drawings, A indicates a main supporting-frame, of any suitable construction, having an annular flat top, B.

C indicates a vertical burr spindle or shaft, resting upon its lower end in a suitable vertically-sliding bearing-socket, D, within a laterally-adjustable bearing, D′, mounted in an opening through a cross-beam, E, of the main frame. The socket D is supported upon a lever, E^2. The spindle is provided with a belt-pulley, F, and with two ordinary adjustable journal-bearings, G G, movable laterally in the bracket H and in the top cross-beam, I, whereby the vertical shaft may be always positively maintained in a perpendicular position. Fixed and truly centered upon the upper end of the shaft is a hollow frustum-shaped metallic cracking-roll, K, fitting within a corresponding case, L. The operating-faces of the roll and case are preferably of chilled iron or porcelain. The case is provided with a flat annular bottom or bearing, M, which rests over the flat annular top of the frame, and is made adjustable vertically and horizontally by means of screws, so that its inner inclined surface shall be at equal distances from the outer surface of the frustum-roll at all points.

N N indicate set-screws passing through the annular top of the table and bearing against the case-bottom. There should be at least three of these screws, and there may be more.

O O indicate screws passing through lugs P P, which serve to adjust the case horizontally. There should be at least three of these screws, and four may be employed.

Q Q indicate screws and nuts, which, when the case has been duly adjusted vertically and horizontally with respect to the roll, serve to hold the case firmly to the table-top in the adjusted position, the screw-holes through the bearing M being large enough to permit sufficient lateral adjusting movement.

The operation of these parts for the adjustment of the roll and roll-case into proper relations to each other is as follows: The case is first suspended, as it were, upon the roll, the screws Q Q being retracted and the lever E^2 being operated by means of the hand-wheel or nut Q^2 to lift the roll and case, so that the annular bottom bearing of the case shall be clear of its bearing on top of the frame. As the case exactly fits the roll, this will insure the adjustment of the interior inclined surface of the case exactly parallel with the outer surface of the roll. Then the screws N N and O O are to be merely set up snugly in contact with the bottom of the case. The roll is then lowered by the operation of the lever E^2 and hand-wheel to the proper position for spacing the

roll and its case, according to the size of the kernels of grains to be cracked. This having been done, the holding-screws Q Q are advanced so as to firmly clamp the case down upon the ends of the screws N N, when the mill will be in condition for work. Any other suitable means of adjustment may be employed.

R indicates a hopper secured in a bracket, S, on top of the case. This hopper delivers the grain into a saucer-like receptacle, T, secured on top of the spindle, and surrounded by a glass globe, U, resting on the case. From this receptacle the grain falls over on the top surface of the roll, which preferably inclines outward, as shown in the drawings, and thence is fed down by gravity between the roll and case.

V indicates an exterior casing, which may be of wood or sheet metal, surrounding the case. After the grain is passed through the mill it is delivered into an annular receptacle, W, thence out at one side through the inclined delivery-spout X. The receptacle W is secured to the bottom of the case L, so as to move with it during its adjustments, and thus always be in position to receive the products of the mill and permit their removal by a suitable ordinary brush or scraper. The operating-face of the roll is preferably slightly beveled or more inclined, as at X, near its top, as indicated in Figs. 1 and 3, in order that the grain may more readily find its way, end foremost, between the roll and its case.

In order to effect the chief object of my invention, I provide furrows Y in the frustum-roll, of a depth of about three-eighths of an inch at the deepest part, extending from top to bottom upon an inclination with reference to the axis of the frustum of about thirty degrees, more or less. These furrrows, however, I prefer not to have run around upon the same incline from the top to the bottom, but to incline less from the perpendicular for about one-fifth of the way from the top, and then to increase their inclination the balance of the way to the bottom, substantially as illustrated, These furrows in this mill should be, say, about three-fourths of an inch wide at the top and about an inch and a half wide at the bottom in a full-sized roll, leaving corresponding oval cleaning-surfaces, Z, between the shallowest parts of the furrows. These cleaning-surfaces or ridges Z of the furrows, being rounded slightly, do not cut, but simply break, and then afterward rub or wear and clean the broken grain, with only very slight, if any, flouring.

The roll of this machine I prefer to make about fourteen inches in length, seven inches in diameter at the top, fourteen inches in diameter at the bottom, and provided with about twenty-five furrows. These figures may be varied somewhat in the construction of the machine; but the roll must not be too long, on account of danger of heating and flouring the grain, or too short, on account of danger of not doing its proper work effectively.

The case is provided with corresponding-shaped furrows and ridges, except that they are reversed with respect to those of the roll. The result of this construction is that as the grain is delivered between the roll and its case the kernels will assume with great regularity a position to enter the furrows end foremost. In this position they will first, by the action of the upper part of the roll, be cracked or broken apart longitudinally through their creases, the grain by preference having been previously screened or sized, and the case having been previously trued and set in place about the roll accordingly at a suitable distance for accomplishing this result. The cracked and divided kernels will then pass rapidly down the furrows. Between the point *b* and the bottom the half-sections of the kernels will be turned over and thoroughly rubbed on all sides, and their fuzz, crease-dirt, and exposed germs are disconnected from them without breaking the germs.

Instead of having the case adjustable vertically, as described, I may adjust the roll vertically within a fixed case by means of lever E^2 at the bottom of the frame.

Instead, also, of having the angles of the furrows changed, as described, I may have the furrows of the same angle of inclination with respect to the roll-axis from end to end.

I am aware that it is not new to split or break kernels of wheat longitudinally through their creases, and that methods and apparatus have been devised to degerminate and clean wheat.

I am also aware that frustum-shaped rollers with diagonal furrows have been used for grinding coffee and other substances.

I am also aware that horizontal disk-rolls with radial furrows and rounded ridges, and that parallel cylindrical rolls with similar furrows and ridges, have been employed for cracking kernels of wheat, as a step toward complete degermination and cleaning of the half-sections of the grain; but I am not aware that a degerminating-roll has been made of frustum shape, with proper inclined furrows and ridges, adapted not only to crack the grain, but afterward, during its gradual passage downward under the action of gravity, to turn it repeatedly in the continuous operation of the mill and rub off and release the germs and crease-dirt from their attachment to the kernels, and finally deliver the products uncut and unground out of the mill at the bottom of the roll. The practical results of the use of such a frustum or nearly conical shaped degerminating-roll are demonstrated by experiment to be highly satisfactory.

It will be readily understood that by my method the kernels, immediately after being broken along their creases, are subjected to the influences of gravity and centrifugal force, by which treatment the too rapid discharge of the kernels is prevented by their being over and over again thrown off from the roll by

centrifugal force and against the case, with a tendency to turn over in being thrown off and to rub against each other as well as against the roll and case, and that the half-kernels, in falling from the case downward against the roll, are gradually fed along or caused to approach the point of discharge in constant rubbing motion, tending to clean all their sufaces.

It will thus be seen that I have provided a new method as well as an improved apparatus for longitudinally dividing and then turning, rubbing and cleaning kernels of wheat without grinding either the grain or its germs, the operation of which is continuous, speedy, economical, and thorough.

The foregoing is a description of my said patented invention, with which I employ other mills that I will now set forth.

Fig. 5 is an elevation of a frustum-shaped roll such as I employ in the second mill, to which the screened products of the first mill are delivered in any usual way in common practice in connection with gradual-reduction milling, in which a series of mills successively operate to reduce the grain and produce flour and middlings.

Fig. 6 is a section of the second roll illustrated in Fig. 5, and its case, showing their furrows. This second roll and case may be, and in practice in accordance with my invention are preferably, set up in a similar frame and provided with adjusting and operating mechanism like that above described and illustrated with respect to the primary mill, and not necessary to again illustrate and describe in detail.

The products of the first mill are delivered directly to a screen or "scalping-reel" and screened, and then the split grains are elevated into a bin above the second machine, to be fed through it. I do not describe in detail and illustrate this screening and elevating mechanism, because it is old and well known, and I do not confine myself to the use of any particular variety of mechanism of that kind. I may use any well-known kind merely to secure the feeding of the products of the first mill to the second, the second to the third, and so on, in order that I may conveniently secure the successive operation of my mills, the practical advantage of which is due to the construction of the cones and shells and their employment in a series, as set forth, by the aid of ordinary connecting and driving mechanism.

Fig. 7 is an elevation of a frustum-shaped roll such as I employ in the third mill, to which the screened products of the second mill are delivered in the same way as from the first to the second. Fig. 8 is a section of the third roll illustrated in Fig. 7, and its case, showing their furrows. All three of the rolls are of about the same length and the same top and bottom diameters. The second roll differs from the first (and its case correspondingly differs) in having more furrows—say about twenty-nine—and in having its furrows more shallow—say about five-sixteenths of an inch at the deepest part—and also in having its furrows less inclined from the axis of the roll—say about twenty-five degrees, more or less. The third roll differs from the second (and its case correspondingly differs) in having more furrows—say about thirty-five—and in having its furrows more shallow—say about one-fourth of an inch at the deepest part—and also in having its furrows less inclined from the axis of the roll—say about twenty degrees, more or less. The second roll should be more closely adjusted to the case than the first and the third more closely than the second, to accord with the reduction of the wheat or the diminished size of the granulations. The rate of speed I have found preferable for the rolls—although this is capable of considerable variation, and must be left somewhat to the observation and judgment of experienced millers—is about three hundred revolutions per minute for the first roll and about four hundred per minute for the second and third rolls.

The operations of the second and third mills upon the broken or granulated parts of the grain under centrifugal force and the force of gravity, causing the utmost change of position of the granular parts and constant rubbing action at all points, are the same in the second and third rolls as above described with respect to the first, and whatever cleaning or degerminating, if any, is not perfectly accomplished by the first mill is finished by the second and third. These second and third mills have only a breaking or cracking and then a gentle rubbing action, so that they do but very little flouring.

I have found the use of three mills differing in their rolls and cases, their adjustments and speeds, as above set forth, gives exceedingly good results in degerminating, cleaning, granulating, and reducing wheat. They show remarkably good capacity so far as both amount and quality of work are concerned; but the new method of milling wheat I have invented, and which is well carried out by employing a series of such mills having frustum-shaped spirally-furrowed rolls and corresponding but oppositely-furrowed cases, does not depend absolutely upon the use of three such mills. A greater or less number in series may be used with good effect; but I find three sufficient for all ordinary purposes and generally necessary, and I recommend that number constructed and operated as above set forth. If more are employed to further reduce the grain, they should follow about the relative differences of construction and adjustment above indicated; but while three mills in series, as above described, fully indicate and operate my invention, in practice it will be found that the product of the first mill, even after screening, will largely exceed in bulk the grain originally fed to that mill. Again, on account of the closer adjustment of roll and case of the second mill,

its capacity is not so great as that of the first mill. The same is true upon a comparison of the third mill with the second. Therefore, in practice, in order to work the first mill constantly at its full capacity, it will be necessary to have two of the second mills and three, or even four, of the third mills in place to work in concert with the first mill. After the operations of these three mills any ordinary grinding-mills—preferably roller-mills—in common use may be employed to finish the further reductions, so that the flour and middlings will be free from bran.

My improved method of cleaning and reducing wheat may be practiced with benefit with frustum-shaped rolls and corresponding cases with furrows of different inclinations from those above mentioned. For instance, the furrows of the rolls might radiate from the top of the roll to its base—that is to say, run fan-like in straight instead of spiral lines—while the furrows of the case might be inclined or spiral, and vice versa; or the furrows of both the roll and case might even be straight or fan-like in their spread from top to bottom of the roll and case; but the construction I have first above described is preferable.

I claim nothing herein upon the primary degerminating-mill or method of degerminating, *per se*, as set forth in my said patent and illustrated upon Sheets 1 and 2 of my appended drawings; but

What I claim herein as new, and desire to secure by Letters Patent, is—

1. The herein-described improved method of degerminating, cleaning, and reducing wheat by a continuous operation, consisting in passing it through a series of mills, whereby it is first cracked longitudinally through the creases, the germs, fuzz, and crease-dirt released and again successively cracked, reduced, and the granules rubbed clean of flour and impurities, the granulated parts in each mill being subjected to the influences of gravity and centrifugal force, whereby they are thoroughly agitated, repeatedly turned and rubbed, and gradually fed along, substantially in the manner set forth.

2. The combination of a series of mills having frustum-shaped furrowed rolls and furrowed cases, as set forth, constructed and arranged to successively reduce, agitate, and rub first the natural kernels and then the successive granulated products, as and for the purposes specified.

In testimony whereof I have hereunto subscribed my name this 7th day of June, A. D. 1882.

CHARLES L. GRATIOT.

Witnesses:
MARCUS S. HOPKINS,
WM. J. PEYTON.