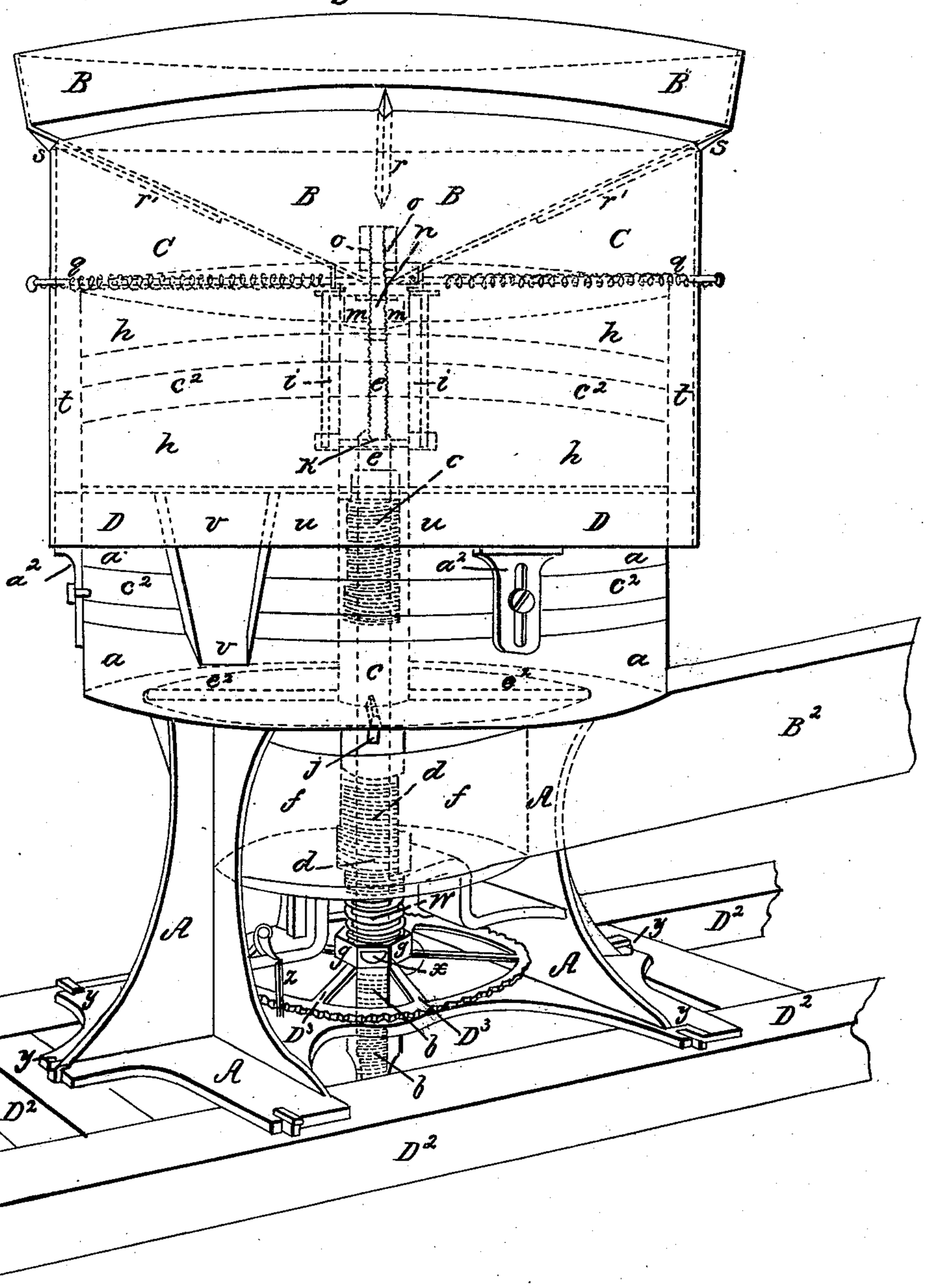
2 Sheets—Sheet 1.

# E. S. CURTIS.

## Grain Mill.

No. 477. Patented Nov. 23, 1837.

*Fig: 1.*



2 Sheets—Sheet 2.

# E. S. CURTIS.

## Grain Mill.

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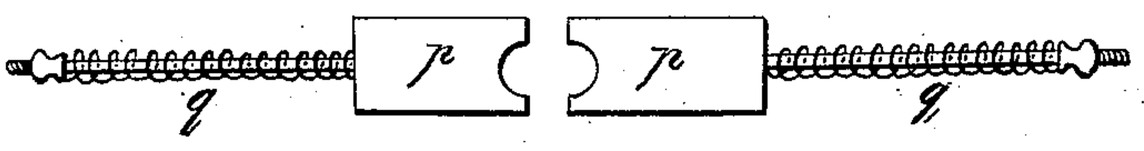
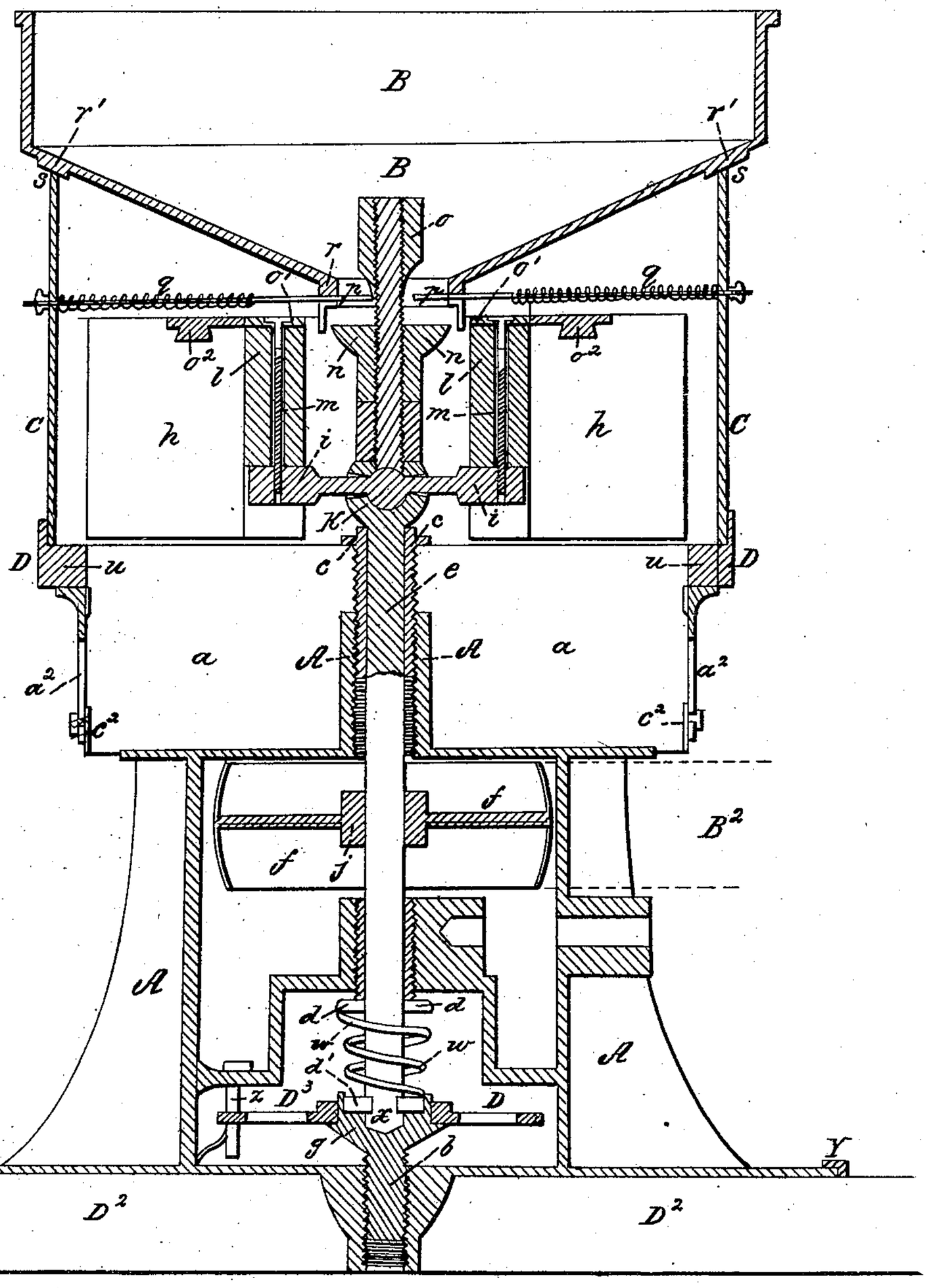
*Fig: 3.*




*Section.* *Fig: 2.*



# UNITED STATES PATENT OFFICE.

ELIJAH S. CURTIS, OF BOSTON, MASSACHUSETTS.

## CONSTRUCTION OF MILLS.

Specification of Letters Patent No. 477, dated November 23, 1837.

*To all whom it may concern:*

Be it known that I, ELIJAH S. CURTIS, of the city of Boston, in the county of Suffolk and State of Massachusetts, have invented and made a new and useful Improvement in the Construction of Mills for the Grinding of Corn, Grain, and All Such Substances as are Usually Ground by a Grist or Such like Mill—which improvement is described and specified as follows—that is to say, the drawings hereto annexed are intended to represent the various parts of a mill constructed upon my improved plan and are to be taken and considered as a part of this my specification, Figure 1 being a perspective view and Fig. 2 a vertical section thereof through its center.

The stones, or grinders are to be made of any suitable material of which stones, or grinders in grist mills are commonly made; but I prefer the French bur stone for this purpose. These stones, or grinders may be of any such size as may be required; those in the mill from which the annexed drawings were taken are twenty inches in diameter and nine inches in thickness; and the dimensions of the different parts of the mill, which I here describe, are adapted to stones, or grinders of this size and must be varied at the discretion of the millwright for stones or grinders of larger or smaller dimensions.

The lower stone, or grinder is designated on the drawings hereunto annexed by the letter *a*, and is mounted on a casting or frame, commonly of cast iron, which I usually make in one piece; this frame is designated by the letter A, and forms the foundation for the mill. In this frame is screwed a step for the spindle, designated by the letter *b*, an upper screw collar, designated by the letter *c*, and a lower screw collar, designated by the letter *d*. This step, and these collars, which are each separate pieces, have screws cut upon the outer sides of them, whereby they may be screwed into and out of the frame, in which there are corresponding female screws; and they may, therefore, be raised or lowered, as may be required, at pleasure, for the purposes hereinafter mentioned. The female screws in the frame are formed most conveniently by placing the collars and step in their proper places in the mold, covered with a thin coat of clay, or other suitable material, at the time of casting the frame, and allowing the metal to run around them. The step, upon which the shaft turns, for a mill of the above mentioned dimensions, should be about six inches long and two inches in diameter, and should be about in that proportion for a larger, or smaller mill. The upper end of this step, designated by the letter *g*, is enlarged to make a suitable box for the lower end of the shaft; and this step may be screwed up or down about three inches, whereby the shaft may be raised or lowered, as may be required to raise or lower the upper stone, or grinder, which upper stone is designated by the letter *h*, and also to enable the miller thereby to regulate the distance between the stones, or grinders in grinding different kinds of grain and other substances, and to lower and adjust the upper stones, or grinders as they wear away.

The spindle, or shaft is designated by the letter *e*, may be made of malleable cast iron, and stands on the step before mentioned, and extends upward through the two screw collars, the pulley that drives it, the lower and upper grinder, and the neck of the hopper. Upon the lower end of the shaft is screwed a ring, or collar *d'*, by means of a strong screw the head whereof is designated by the letter *x*. This lower end of the spindle, or shaft, however, may be made solid, without any screw, by making a neck in the shaft and making the ring, or collar *d'* in two parts; this latter method I prefer.

The pulley which drives the mill is connected with the shaft by means of a clutch and set screw, designated by the letter *j*, and may be disengaged at pleasure so as to become a loose pulley. The upper stone grinder, near, and a little below, the center, is firmly attached to, and balanced upon the shaft, by means of what I have denominated a rinder, designated by the letter *i*, which rinder passes through the center of the shaft, at right angles, having a ball on and being a part of it, in the center, designated by the letter *k*, to which ball a corresponding cavity in the shaft makes the socket. This ball and socket joint may be made by casting the shaft around the ball upon the rinder, protecting the parts of the rinder, where liberty to move is required, from the approach of the metal by means of an iron tube, or other suitable appendage fitted to the rinder, or by a coat of clay cov-

ering the same for the time being, and to be removed after the spindle, or shaft has been cast. It may, however, be made in any other convenient way as will be obvious to the millwright. In each end of the rinder which projects into and moves the upper stone, in which there are suitable grooves cut to receive their ends, *i*, *i*, is inserted a screw, which comes down from the top of the stone, their heads resting upon a strong iron ring, let into the stone, as shown at *o′*, *o′*, in the sectional drawing. The screws are designated by the letters *l*, *l*.

Between the heads or ends *i*, *i*, of the rinder and the ring, in the grooves cut in the stone are inserted pieces of wood *m*, *m*, or any other suitable material to support the stone. These pieces can be shortened so as to lower the stone to correspond with the wear. The ring on the upper part of the stone is fastened thereto by inserting in the stone a dovetailed projection $o^2$, $o^2$, from the under side of the ring, around which I cast lead to keep it firm. By means of the rinder and ball and socket joint the upper stone or grinder is held firmly and at the same time, while it is balanced upon the shaft, it is allowed a motion in every required direction, but cannot move directly up or down without a corresponding motion of the shaft, to which it is thus attached. The upper stone, or grinder may, instead of using the rinders with its ball and socket joint, be balanced in the like manner as the mariner's compass is balanced by means of a gimbal, or universal joint. Upon the shaft, just under the valve which feeds the mill to be presently described, is fixed a cap or collar, spreading out and forming a flat table, or disk, on its upper side; this cap or collar or platform is designated by the letter *n;* it is movable up and down upon the shaft to regulate the distance between it and the valve (to be presently described) as may be required according to the size and quantity of the substances intended to pass into the mill. The design of this table or disk is to arrest the corn or other substance to be ground in its passage and to prevent its passing into the mill except when it is in motion, when the corn or other substance will be driven from its lodgment by the centrifugal force, and scattered and set into the mill. On the upper end of the shaft is secured a small arm, or arms, leaf, or leaves, designated by the letter *o*, which, when in motion, stirs the corn or other substance to be ground, acting as a shaker, and preventing its clogging in the valve.

The hopper is designated by the letter B, and is, in preference, made of cast iron. The neck of it is designated by the letter *r*, and the valve for regulating the quantity admitted, by the letter *p*. The upper part of the hopper is cylindrical, lower part of its interior funnel shaped. The valve by which the feeding is to be regulated is opened and closed, more or less, as may be required to admit more or less of the substance to be ground into the mill, by means of two horizontal screw rods, or slides, designated by the letter *q*, which rods come through the curb, and are there adjusted by the hand. The manner of constructing these valves is shown separately in Fig. 3. The curb is made of sheet iron and is designated by the letter *c*. A hoop D with a spout to allow egress to the ground material, is placed on the outside of the upper edge of the lower stone, and is supported by movable brackets, $a^2$, $a^2$, attached to the stone. The upper side of this hoop is level with the surface of the lower stone, having a rim on its outer edge, within which the curb supporting the hopper is placed or fitted. The hopper B, which has ribs to strengthen it on the lower side of its bottom, designated by the letters *r′*, *r′*, these being notches at *s*, *s*, where they rest upon the curb. The curb, and the hopper which rests upon the hoop D, are supported by brackets designated by the letters $a^2$, screwed to an iron hoop $c^2$, on the lower grinder, by screws passing through a slot, allowing them to be raised or lowered. The interior of the curb is two inches larger in diameter than the grinders, so as to leave a space of one inch around them, in mills of the above dimensions. This space may be greater or less as the mill shall be larger or smaller.

The hoop D, is filled with a wooden lining designated by the letter *n*, in the sectional drawing, it is one inch thick and two inches in width so as to fill, completely, this space, and be tight against the lower grinder. The meal is taken from the hoop by means of the spout V, open in front, about six inches wide at the top, and three at the bottom, and is nearly perpendicular to the stones or grinders.

Between the lower screw collar *d*, which is screwed into the frame, and the step *b*, is a spiral or other spring, designated by the letter W, through which the shaft passes, bearing at its upper end against the lower collar *a*, aforesaid and at the lower end upon the ring or collar, *d′* which is in two parts or is otherwise fitted into a neck, or groove upon the lower end of the shaft. The object whereof is to keep the upper stone, or grinder at whatever distance from the lower grinder the miller may choose to have it, and at the same time to cause it to act upon the corn, or other substance to be ground, with a regulated elastic power, or force, proportioned to the resistance to be overcome when the motion is faster, or slower, or the mill is fed with a greater or less quantity than usual, in a given time. Whenever an un-

usual quantity of grain or other substance to be ground or any hard substance, is by accident, or otherwise, let into the mill, producing a tendency to clog, stop, or break the mill, the spring, by its elastic force being overcome, will give way and permit the substance so introduced to pass out without injury or impediment to the mill, or its operations.

The action of the spring may be increased or diminished as required, by raising or lowering the lower screw collar *d*, in the frame, and the exact degree of elastic force required may be thus obtained; and the mill may therefore be run with the smallest power required.

From the manner in which the spiral, or other spring, or weighted lever, is made to operate no additional friction is caused on the step or on the lower end of the spindle, during the running of the stone, excepting when it tends to rise, the tension, of the spring being exerted between the lower collar *d*, which screws into the frame and the ring or collar *d'*, confined in the neck or groove on the spindle with its lower side resting on the upper edge of the step, which thus frees it from all friction in the neck or groove which retains it in place, until the rise of the stone raises it from this bearing. The same may be said of a weighted lever, or of any other pressure made upon the collar *d'*. The spring may be loosened or tightened, as will be obvious to the millwright, by various other methods, but the above mode is deemed best. Instead of the spiral, or other spring, or springs, bearing upon the ring or collar *d'*, there may be a weighted lever made to act upon it and to perform the same office; but this would be less compact and convenient than the spiral-spring, which I therefore prefer. The upper screw collar *c*, screwed in the frame has a flanch bearing on the lower grinder, or stone, so that this stone or grinder may be screwed down firmly in its place, where it is prevented from turning by means of ribs $e^2$ in the casting. The casting or frame A, A, for the mill is usually so shaped that it will slide on the frame or floor $D^2$, to tighten the band $B^2$, and save the inconvenience of a friction pulley, and loss of power. The casting may be fastened to the floor or frame by means of iron dogs *y*, *y*. The step has attached to it a cog wheel $D^3$, furnished with small teeth, and governed by a catch, Z, to enable the miller to raise and lower the upper grinder, at pleasure, and to retain the step in its place. When it is required to stop the mill while the machinery that drives it is in motion, one turn of the wheel will raise the shaft and disconnect the clutch, and set screw, whereby the driving pulley is confined, and enables this pulley to move without turning the mill. This pulley is best made of cast iron, and is designated by the letter *f*. A pulley fixed to the shaft may be used instead of a loose pulley, but the clutch and set screw or other contrivance for changing it to a fast, or loose pulley, is deemed best.

Although the frame, collars, step, shaft, curb, and hopper are described as made of iron, yet, as will be obvious to the millwright, this is not essential, as they may be made of any other hard metal, or of wood; but iron or hard metal is preferable. It will also be obvious to the millwright, that the above described method of regulating the feeding of the mill, is not essential to the use of the other improvements above mentioned, as the mill may be fed in either of the ordinary ways now in use, if the miller shall prefer it, and the particular kind of frame above described is not essential to the use of the other improvements above mentioned, although it is deemed better than the method of supporting the lower stone or grinder now in general use. For grinding large quantities of any substance, where there is sufficient power, a much larger mill than that above described will be preferable; and for grinding small quantities where but little power is required a much smaller mill will be convenient; and such small mill may be turned by hand by making use of beveled, or other cog wheels, and a winch, or crank, instead of a pulley; and such mill will be very useful to families for grinding such substances as they may have occasion to grind for family use.

I will here observe that although the runner, or upper stone, in my mill will be effectually held down by the spring, or springs, or a weighted lever, and collar, which I have described, it is still a point of importance to give that weight to the runner which shall suffice to keep it from rising under ordinary circumstances, and at its proper speed.

What I claim as new, and as of my own invention, in the above described machine is:

1. The manner of balancing the upper stone, or runner, or grinder, and of connecting it to the spindle, or shaft, by which it is turned, by means of what I have denominated a rinder, consisting of a ball and socket, with its appendages, constructed and arranged substantially in the way described, so that said stone, or grinder, shall move freely in every required direction, as a runner ordinarily does upon a balance rynd, while it cannot rise without a corresponding motion of the spindle. And it is to be further understood that I claim, under this head, the balancing of the stone by means of a gimbal, or universal joint, in the manner of the mariner's compass, or any modifications thereof, substantially the same in principle and results.

2. I claim the manner of arranging the collars and the spiral or other spring or a weighted lever, upon the lower end of the spindle, or shaft, for retaining the runner in its place, and yet allowing it to rise when from the introduction of hard substances, or other causes, it is desirable that it should do so.

3. I claim the manner of constructing the step as herein described, so as to screw up or down in the frame, thus answering all the purposes of a bridge tree, and adapting itself to the spindle as the stones wear, and the whole superstructure descends.

4. I claim the manner of constructing the valve, and the other parts of the feeding apparatus, including the cap, or platform on the upper end of the spindle, the whole operating together in the manner and for the purposes set forth.

5. I claim the manner of constructing and arranging the step, which supports the spindle, with its screw, allow it thereby to be raised or lowered, so as to answer all the purposes of a bridge tree, and adapting it particularly to the kind of mill above described.

6. I claim the manner of constructing and connecting the hopper curb and hoop, and the brackets by which they are sustained, in combination, as above described.

7. I claim the general arrangement and combination of the respective parts of this mill, as herein described, and for the purposes set forth, whether the whole, or only a part of my said improvements are so connected and combined.

ELIJAH S. CURTIS.

Witnesses:
W. THOMPSON,
LINTON THORN.