J. MERRITT.

GRINDING MILL.

APPLICATION FILED OCT. 16, 1909.

1,141,898.

Patented June 1, 1915.

6 SHEETS—SHEET 1.

Fig. 11.

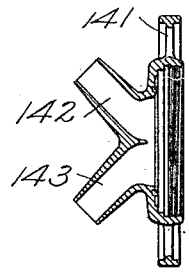


Fig. 1.

Witnesses.

C. F. Storrs

S. S. Grotta

Inventor.

Joseph Merritt.

per Wm. H. Howiss

Attorney.

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GRINDING MILL.

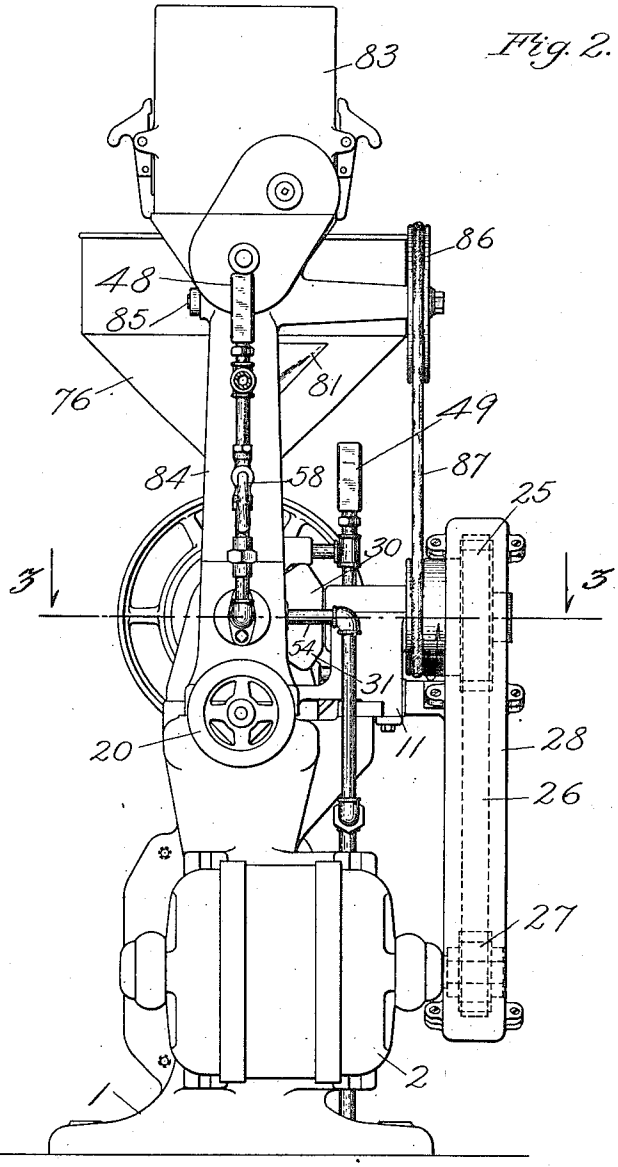
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6 SHEETS—SHEET 2.

Fig. 2.



Witnesses.

C. F. Storm

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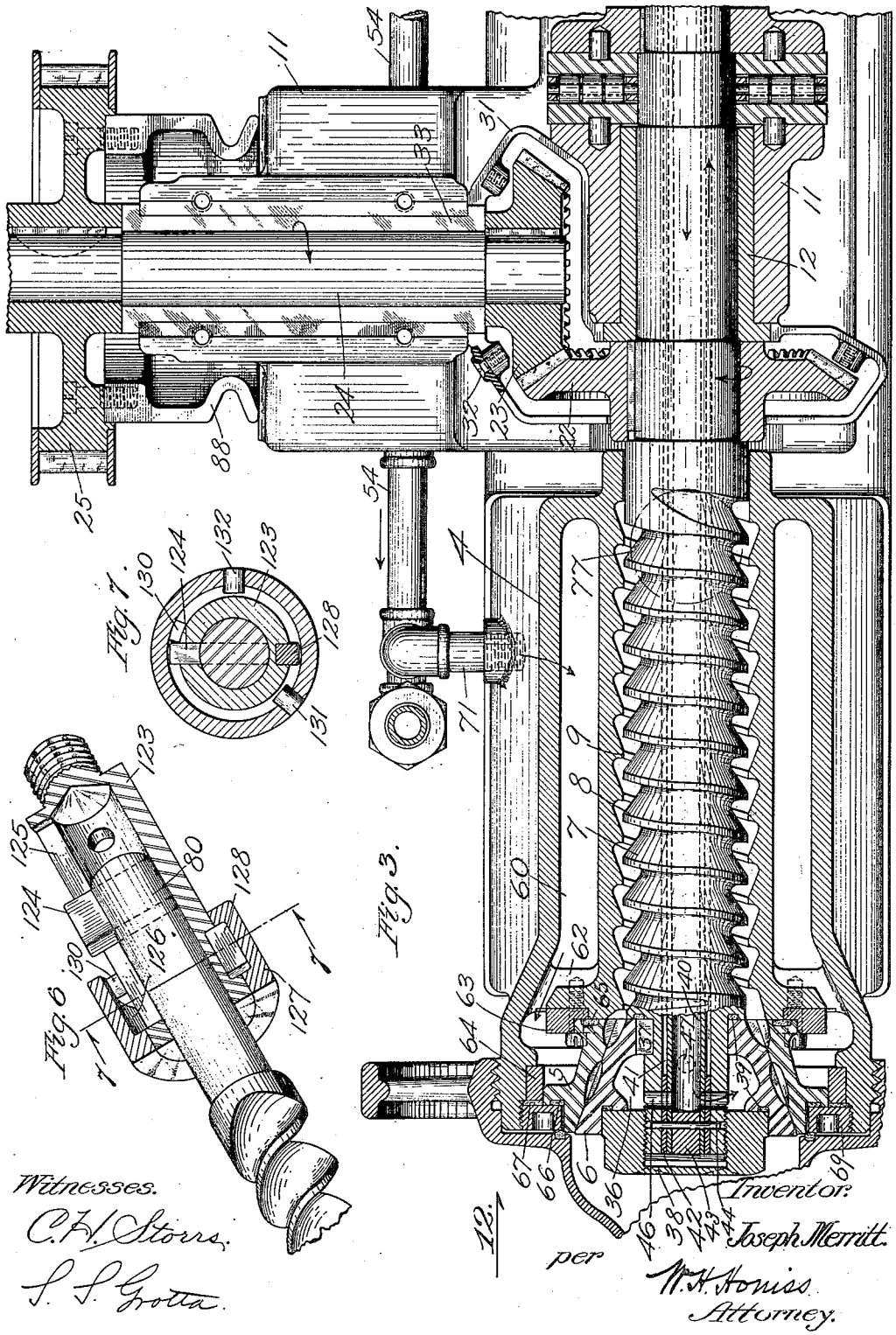
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6 SHEETS—SHEET 3.



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6 SHEETS—SHEET 4.

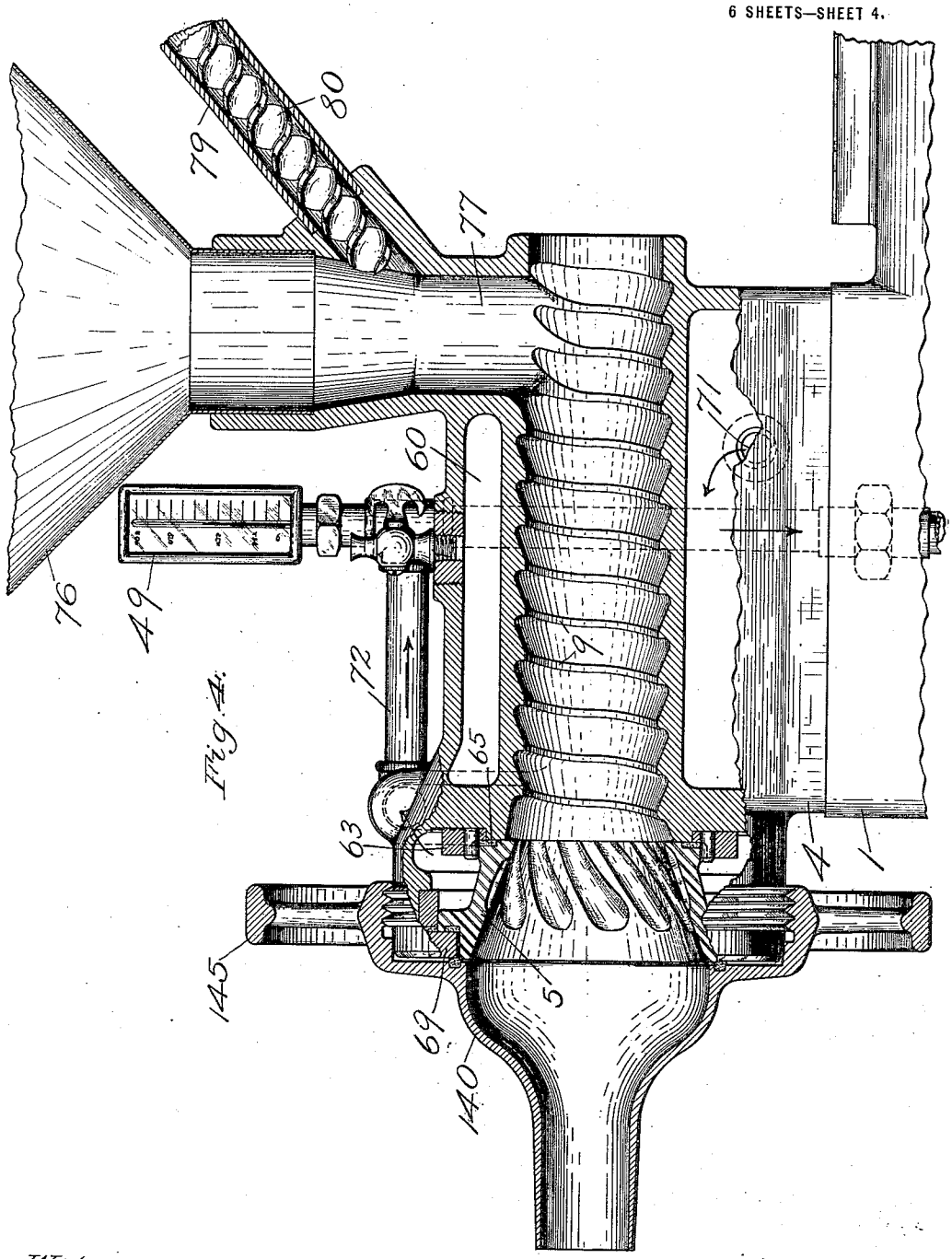


Fig. 4.

Witnesses.

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6 SHEETS—SHEET 5.

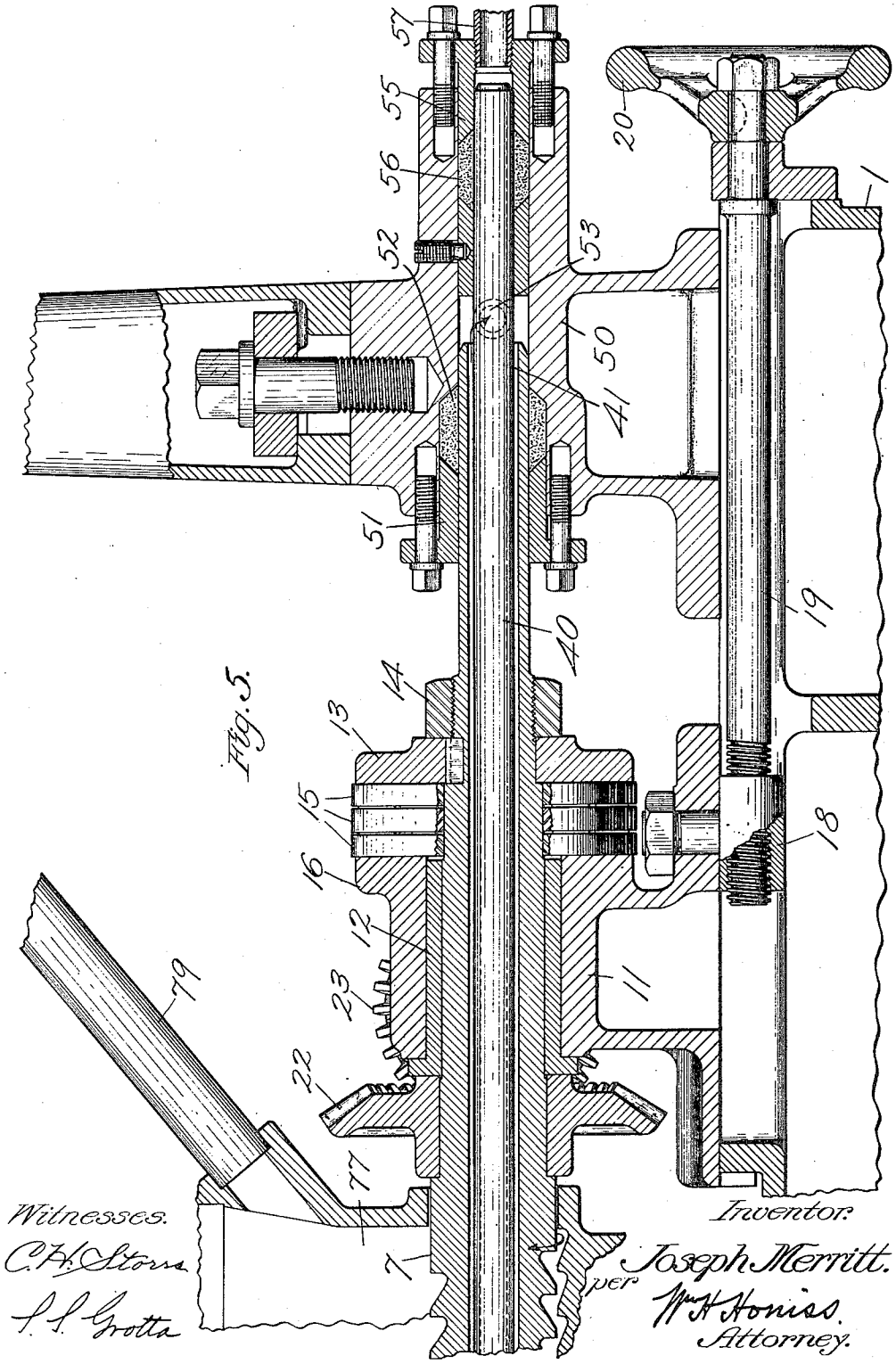


Fig. 5.

Witnesses.

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Patented June 1, 1915.

6 SHEETS—SHEET 6.

Fig. 8.

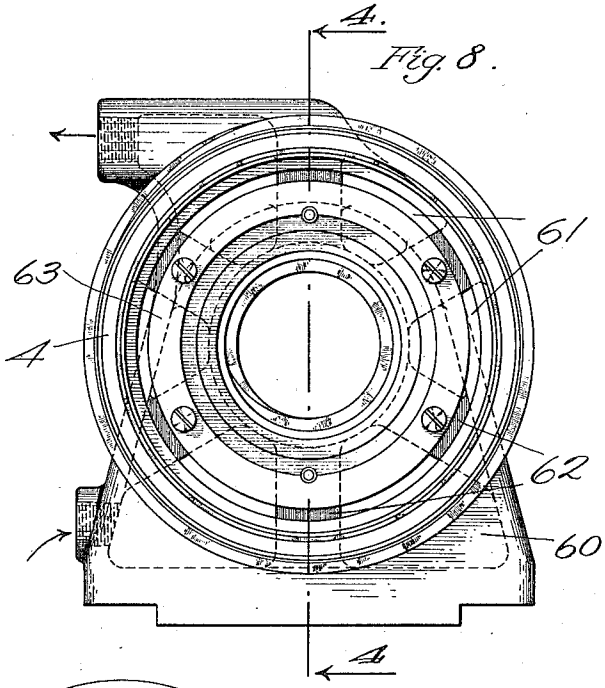


Fig. 9.

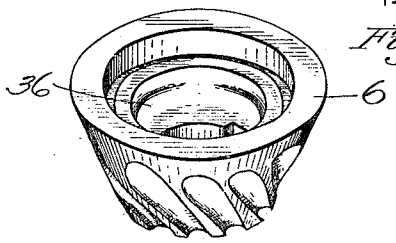
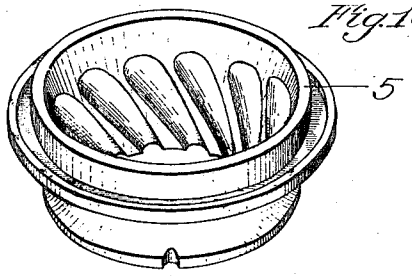


Fig. 10.



Witnesses.

C. F. A. Stone

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UNITED STATES PATENT OFFICE.

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GRINDING-MILL.

1,141,898. Specification of Letters Patent. Patented June 1, 1915.

Application filed October 16, 1909. Serial No. 523,095.

To all whom it may concern:

Be it known that I, JOSEPH MERRITT, a citizen of the United States, and resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Grinding-Mills, of which the following is a full, clear, and exact specification.

This invention comprises an improved and highly organized grinding mill for grinding grains, nuts, and many other articles or materials.

The principal features of the present invention reside in means for supporting, driving and adjusting the grinding instrumentalities; and for uniformly conveying, and if necessary forcing, various materials to the mixing and grinding devices of the mill; also for tempering the devices and the material to be ground, so as to maintain them at the desired temperature, conducting away undesired heat and adding heat when desired, by the circulation of a tempering medium in a simple comprehensive manner, keeping the ground material and the tempering medium separate, so that neither can become mixed with the other.

The invention also includes the organization of the various devices whereby they may be conveniently assembled, disassembled and adjusted, and which permits the operation of each without interfering with the function or operation of another, and whereby the various parts are protected from injurious corrosion, especially where it would tend to rust together the parts which should remain separable.

The invention also includes various details of construction and arrangement, all of which will be hereinafter described and set forth in the claims.

A preferred and desirable embodiment of the present invention is shown in the accompanying drawings, in which—

Figure 1 is a side view, and Fig. 2 an end view, in reduced scale. Fig. 3 is a plan view, in enlarged scale, of the main feeding and grinding devices and their environment, in section taken on the line 3—3 of Figs. 1 and 2. Fig. 4 is a side view in section taken on the line 4—4 of Fig. 8, showing mainly the casing of what is shown in Fig. 3, with the revolving screw and grinder removed. Fig. 5 is a side view in central longitudinal section, showing the means for driving the revolving grinder, supporting and adjusting the end thrust thereof, and for admitting and releasing the circulating tempering fluid. Figs. 6 and 7 are views showing details of the detachable and telescoping coupling employed for connecting the auxiliary feed screw, Fig. 6 being an isometric view and Fig. 7 being an end view in section taken on the plane indicated by the line 7 of Fig. 6. Fig. 8 is an end view of the upper portion of the machine looking in the direction of the arrow 12 in Fig. 3, with the delivery nozzle, grinding members, and feed screw removed. Figs. 9 and 10 are isometric views of the grinding members shown in the other figures of the drawings, Fig. 9 showing the revolving, internal member and Fig. 10 showing the fixed external member. Fig. 11 is a plan view in central longitudinal section, showing a multiple form of delivery nozzle for the mill.

The machine shown in the drawings is provided with a base or frame 1 upon which the various parts may be mounted, including a motor 2 and starting box 3 for driving the various mechanisms. The principal grinding head of this machine is shown to consist of a casing 4 fixed upon the base and containing the grinding members 5 and 6, the first of which is stationary, being fixed to or integral with the casing, while its coacting grinding member 6 is mounted for rotation in the casing. The inner grinding member 6 may be made separate from, or integral with its shaft or stem 7, extending rearwardly through and out of the casing to connect with means for rotating and adjusting it, but for convenience of construction, and to enable the grinding member to be replaced when worn out, or when others of different form are required, they are preferably made separable as herein shown (Figs. 3, 9 and 10). In this instance the inner rotating grinding member 6 is attached to a shaft 7, which may be provided with spirally arranged threads or ribs 8, coacting with other threads or ribs 9 on the interior of the casing to advance the material to be ground longitudinally through the casing to and between the grinding members. This form of feed screw or conveyer being well known, no more detailed description of it is needed. The rearward end of the rotating shaft or feed screw 7 extends out of the casing 4 and is journaled in a

bracket or slide 11, which is mounted for sliding movement upon the base 1 in a direction parallel with the axis of the shaft 7. A bushing 12 is preferably employed in the slide 11. At its rearward end the rotary grinder shaft 7 is provided with a thrust bearing consisting of a collar 13 fastened upon the shaft in any convenient way, as by the nut 14, and of anti-friction washers 15 situated between the collar 13 and the face or flange 16 of the bracket 11. This thrust bearing sustains the endwise thrust of the grinder shaft 7, due to the grinding action and should be adapted to the direction of that thrust.

As a means for rotating the inner grinding member, the shaft 7 is herein shown to be provided with a bevel gear 22, which meshes with the gear 23 fixed on the shaft 24, journaled in the sliding bracket 11. That shaft may be driven in any convenient way from any motor or countershaft. It is herein shown to be driven from the motor 2, by means of the pulley or gear 25 driven by a chain or belt 26 from the pulley or gear 27 of the motor 2.

A projecting guard 28 for the chain 26 is provided, being preferably clamped or screwed to the sliding bracket 11, and being left sufficiently large at the bottom where it encircles the pinion 27 to allow the required amount of adjustment of the slide and its appurtenances. The beveled gears 22 and 23 are also preferably inclosed by projecting guards 30 and 31, which form upper and lower halves of complete encircling guards for both of the gears, being fastened together by means of screws 32, or in any convenient way. The bearing portions of these guards are herein shown as encircling and resting upon the ends of the bushings 12 and 33, respectively.

As a means for adjusting the grinders to regulate the space between them, and the consequent fineness of the material to be ground, the bracket 11 is made adjustable upon the base 1, being provided with a nut 18 engaging with a screw 19, which is journaled on the base 1, and is provided with any convenient means, as the handwheel 20, by which the coarseness or fineness of the grinding may be regulated at any time without otherwise interfering with or interrupting the grinding operation, since the driving mechanism for the adjusted grinding member is also carried by the bracket 11. This adjustment is also made without interfering with the circulation of the water or other tempering medium, the means for which will next be described.

In grinding mills, particularly those intended for the grinding of drugs, food, or food ingredients, it is desirable to avoid production by the grinding action of heat sufficient to effect the material as to its flavor or consistency. In some instances it will be found desirable to maintain the materials being ground at certain definite temperatures, which may be either above or below the temperature produced by the grinding action, which varies according to the refractory character of the material, the fineness of the grinding, the condition of the grinding members, the rapidity of the grinding action, or the length of time it is in action. With this in view the mill of the present invention is provided with spaces and conduits for the circulation of a tempering medium, generally and preferably water, around and adjacent to the grinding members, the bearings, or other members most likely to generate heat by friction or attrition, so as to conduct undesired excessive heat away from those members or from the material, or to conduct additional heat thereto through the walls of those members; while excluding the tempering medium from direct contact with the bearings, the grinding surfaces and the material being ground. In the embodiment herein shown, the circulation is reduced to a single system, the same flow or circulation being conducted first to one of the grinding members and then around, past or through the bearings to the other grinding member. Obviously, however, separate systems may be employed where different temperatures are required for the various parts. For example, where it is desired to keep the bearings cool, and the material at a higher temperature, separate systems may be employed, each employing a tempering medium of the desired temperature. Although this circular system may thus be employed to conduct additional heat to the materials, or to the parts, yet, for the main uses contemplated for this invention, it is commonly desirable to keep the parts cool rather than to add more heat, in which case a single circulating system, employing a cooling medium, is sufficient.

As herein illustrated, the water or other cooling or tempering medium is first conducted to the inner grinder and then to the outer grinder; but obviously this course may be reversed or each may be separately and independently cooled or tempered by separate systems, by a suitable arrangement of the piping and connections.

In arranging the tempering system, it is desirable to exclude the tempering fluid from between the grinding surfaces, the bearings, and from the material ground. It is also important to avoid interfering with the means for rotating and adjusting the grinding members. The inner grinding member 6 is chambered or recessed annularly at 36, thus providing an annular space for the circulation of the tempering fluid, and also thinning the wall and thereby increasing the conductivity and reducing the

weight of the grinding member. That member is herein shown to be mounted on the shaft 7, being secured thereon by means of a key 37, and a nut 38. Suitable gaskets 39 are employed if necessary to prevent the water or other circulating medium from escaping through the joints; and in making the nut 38 it is preferably not bored entirely through for the same reason.

The shaft 7, which may also serve as the feed screw or conveyer, is axially bored to receive the tube 40, which is smaller than the bore, so as to leave the annular space 41 around the tube, the end of which is closed by means of a short piece of tubing 42. The end of the tube 40 is closed by means of a plug 43. A cross pin 44 may be employed to hold the tubes and the plug in position in the end of the shaft 7. The passages 46 allow the water to flow between the inside of the tube 40 and the annular space 36 of the grinder 6, while one or more apertures 47 through the wall of the shaft 7 afford communication between the space 36 and the annular space 41 around the outside of the tube. Thus the water or other tempering medium may be conducted through the interior of the tube, out through the passages 46, to the circulating space 41; and thence axially along the shaft. Or this direction of flow may be reversed, making 41 the inflow and the interior of the tube 40 the outflow.

In order to provide the interior of the tube 40 and the annular space 41 around the tube with external connections, the rearward end of the shaft 7 and the tube 40 are extended beyond the thrust bearing, through the stuffing boxes in the frame or bracket 50 (Fig. 5). The gland 51 and its packing 52 encircles the end portion of the hollow shaft 7, the port or passage 53 beyond the end of the shaft 7 communicating through the side of the bracket between the passage 41 and the pipe 54. The tube 40 extends beyond the outlet 53, through an independent stuffing box, including a gland 55 and packing 56. A supply tube 57 in the end of the stuffing box provided with a valve 58 communicates with the interior of the tube 40. The pipe 57 is provided with suitable extensions or connections leading from a source of supply for the water or other tempering medium, or it may be used as the discharge pipe, the pipe 54 being employed as the inlet. Thermometers 48 and 49 may be employed at or near the inlet and outlet, or wherever it may be desired to observe the temperature of the circulating fluid.

To provide circulating space for the tempering fluid to and around the outer grinding member 5, the casing 4 is provided with a chamber 60, which preferably extends lengthwise of the casing and annularly around the central opening for the feed screw or conveyer 7. This chambered circulating space extends to and around the grinding member 5, through openings 61 between the ribs or arms 62, by means of which the inner wall of the casing, inside of the chamber 60 is tied to the outer wall, outside of that chamber. Thus the tempering fluid is allowed to flow directly in contact with and around the outer grinding member, which in turn is utilized as a means for closing the outer end of the chamber 60, to prevent the escape of the cooling medium therefrom. Inasmuch as the casing 4 would generally be made of cast iron, which would be corroded by the action of the water, the seating rings 63 and 64 of non-corrosive metal, such as bronze, are provided, for receiving and seating the outer grinding member so that the latter will not become rusted into place, thus perhaps interfering with its removal and replacement. Suitable gaskets 66 and 67 are provided between the grinding member and its seat, to insure making liquid-tight joints. The grinding member, its gaskets and seating rings, are firmly held to their place by means of a screw ring 69 threaded into the outer end of the casing.

Inflow and outflow of the cooling medium is provided for the circulating space 60 by means of piping 71 and 72. Either of these may serve as the inlet or outlet, being connected with suitable supply and discharge pipes or conduits. In the present instance, however, the chamber 60 receives the discharge of the cooling medium from the inner grinding member through the discharge pipe 54 and the inlet 71, the outlet 72 leading to a suitable discharge conduit beneath the floor or elsewhere. A connecting pipe 73, provided with a valve 74, is herein shown connecting the two pipes 54 and 72 (Fig. 1) to facilitate draining the water out of the respective pipes and passages, or to permit the water to be discharged without passing to the casing 4. The preferred circulation of the cooling medium in a single system, inwardly through the valve 58 and outwardly through the passage pipe 72 is indicated by small arrows in Fig. 1 and in other figures. Obviously, however, this arrangement may be modified in various ways, by reversing the direction of the circulation, or by dividing it into two systems, one for the outer and the other for the inner grinding member and their respective adjuncts.

This machine is shown to be provided with two independent feed mechanisms for the material to be ground, it being assumed in this instance that the principal mass can easily be fed by gravity from an ordinary hopper 76 through the main throat 77 of the machine. The hopper 76 may be made removable so as to substitute other forms of hopper, suited to various materials or purposes. A second and independent feed sup-

ply is herein shown as an auxiliary feed entering the main throat at one side thereof, as shown in Fig. 1 directly above the conveyer or feed screw. Obviously other feeding conduits may be added, either of a simple character like the hopper 76, discharging by gravity, or a more complex device employing a forced feed of any desired kind. That shown in the drawings comprises an auxiliary feed screw 80 in a tube 79, which extends from the side of the throat 77 upwardly at an angle and opening at its upper side with a throat or hopper 81, which receives its supply from the discharge outlet 82 of a reservoir 83, which is preferably detachably mounted upon a suitable column 84, supported by the base or frame 1. In this instance the discharge opening 82 of the reservoir is above the throat or hopper 81, with a clear space between, thus enabling the amount and character of the material fed from this source to be observed, forming in effect a sight feed.

This auxiliary feeding device is provided with stirrers and conveyers, suitable for use with material which is liable to cling or pack together, as for example, salt, during a humid condition of the atmosphere. These stirring and feeding devices are mounted in the upper end of the column 84. The initial driving shaft 85 is provided with a pulley 86, which receives rotary motion in any convenient way, as by a belt 87 from the pulley or gear 25.

In order to facilitate the assembling and disassembling of the parts for their construction or inspection, the connecting mechanism of the feed screw 80 is made to telescope and may be detachable from its driving connection with its gear 121. The latter is fixed upon a shell or spindle 122, journaled in the column 84, its outer end being threaded or otherwise suitably recessed for receiving and holding the quill 123, within which the upper end of the auxiliary conveyer or feed screw is fitted for sliding movement. The telescoping end of the screw 80 is provided with a spline 124 which projects outwardly through and beyond the longitudinal slot 125 in the quill 123 and into the annular recess 126 in the clutch collar 127. A key 128, seated in the quill 123 also projects outwardly into the said annular recess of the thrust collar 127, holding the collar longitudinally in place upon the quill while permitting it to be rotated relative to the quill. A splineway 130 through the adjacent side of the collar enables the key 124 of the feed screw 80 to be slid out of the clutch collar when the collar is rotated to the position shown in Fig. 6, with the splineway 130 in register with the slot 125. The slot 130 also permits the key 128 to enter the recess 126 in the initial assembling of the parts. In order to facilitate bringing the splineway 130 into register with the slot 125, the clutch collar may be provided with a pin or screw 131, so located as to engage with the key 128, when the keyway 125, and consequently the spline 124, are in register with the splineway 130. An additional pin 132 may also be provided on the other side of the key 128, as shown in Fig. 7, to prevent that key from being turned into coincidence with the splineway 130. Thus the operator wishing to disconnect the parts may, upon turning the thrust collar 127 by the sense of feeling alone, stop it in proper position for endwise disengagement of the key 124, through the splineway 130, either by pushing the feed screw endwise in the quill 123, or by unscrewing the latter from its shell or spindle 122, in which case the feed screw 80 and its appurtenances may be entirely removed.

In order to enable the various materials which may be ground in this mill to be properly discharged from the mill, provision is made for attaching different forms of discharge nozzles, suited to the different materials to be ground, or suited for the receptacles into which the ground material is to be packed or conveyed. Thus the nozzle 140 of Figs. 3 and 4 is provided with a single discharge spout, in line with the axis of the feed screw and the grinding members, whereas the nozzle 141 of Figs. 1 and 11 is shown to be provided with two nozzles, 142 and 143, dividing the discharging material into two streams. For convenience in attaching and detaching these nozzles they are preferably screw-threaded upon the end of the casing 4 and are provided with a hand-wheel portion 145, by means of which the nozzles may be easily screwed to and unscrewed from the casing.

In the operation of the machine described herein the materials are placed independently in the hopper 76 and the reservoir 83. The motor being started, the feed screw 17 and its internal grinding member 6 are rotated. The material from the hopper 76 passes directly through the throat 77 into the feed screw and is thence fed forward through and between the grinding members 5 and 6 and out of the spout or spouts of the delivery nozzle. The desired fineness or coarseness is secured by turning the adjusting screw 19, thereby sliding the bracket 11 backward or forward and carrying the internal grinding member 6, its shaft or feed screw 7 and their driving and thrust devices bodily forward or back in the direction for securing the desired change in the fineness of the grinding.

The supply of water or other tempering medium is turned on through the inlet valve 58, passing through the tube 41, and the passages 46 to the circulating space 36 of the grinding member 6, passing thence through

the passages 47, 41 and 53, and the pipes 54 and 71, to the circulating space 60 in the casing 4, which surrounds the feed screw 7, from which the water continues through the openings or passages 61 to and around the external grinding member 5, discharging thence through the pipe 72 into any convenient drain. Or it may discharge into a reservoir from which, after being cooled, or otherwise modified, it may again be circulated through the machine. Water or any other suitable tempering fluid may be employed. Under some conditions, or for some purposes, the circulating medium may be employed for heating instead of cooling the parts through and around which it is circulated. The construction, arrangement, and operation of this mill may be modified in various ways to suit different uses or conditions.

The auxiliary stirring and feeding devices shown herein are made the subject matter of a division of this application, Serial No. 700,969, filed June 1, 1912.

I claim as my invention:—

1. The combination, in a grinding mill, of a casing provided with a fixed grinding member, a rotatable forcing screw within the casing, provided with a grinding member, respectively coöperating with the casing and with the fixed grinding member to feed material in an axial direction to, and grind it between the said grinding members, means for conducting a tempering medium longitudinally through the forcing screw into contact with the rotating grinding member and longitudinally back again within the forcing screw.

2. The combination, in a grinding mill, of a casing provided with a fixed grinding member, a rotatable forcing screw within and coöperating with the casing to feed material in an axial direction along the screw, a grinding member carried by the screw, and coöperating with the said fixed grinding member to grind the material fed to it by the screw, means for conducting a tempering medium longitudinally through the forcing screw into contact with the rotating grinding member and longitudinally back again through the forcing screw, and means for directing the tempering medium outside of the forcing screw and around the fixed grinding member.

3. The combination, in a grinding mill, of a casing provided with a fixed grinding member, a rotatable forcing screw provided with a grinding member, and disposed within the casing and the fixed grinding member, respectively, and coöperating therewith to feed the material in an axial direction toward, and grind it between, the said grinding members, means for conducting a tempering medium longitudinally through the forcing screw into contact with its grinding member, and longitudinally back again through the forcing screw, and means for conducting the same tempering medium thence to the casing, around the forcing screw, and around the fixed grinding member.

4. The combination, in a grinding mill, of a casing having a seat for receiving a rotary forcing screw, an inclosed space for circulating a tempering medium around the said seat, a grinding member removably seated in the casing with its outer surface exposed to the flow of the circulating medium, and means for making fluid-tight joints between the outer surface of the grinding member and the inner and outer walls of the said circulating space, whereby the tempering medium may circulate from the casing to and around the grinding member without escaping through said joints.

5. The combination, in a grinding mill, of a casing provided with a fixed grinding member, a forcing screw mounted for rotation within the casing, a rotary grinding member carried by the said forcing screw, in coöperative relation to the fixed grinding member, and means for conducting a tempering medium longitudinally within the forcing screw directly to the rotary grinding member, and a separate conduit for conducting the water from the grinding member longitudinally back again through the forcing screw.

6. The combination, in a grinding mill, of a casing provided with a fixed grinding member, a forcing screw mounted for rotation within the casing, a grinding member carried by said rotating screw in coöperative relation to the fixed grinding member, a conduit extending longitudinally through the forcing screw to the rotary grinding member, for conducting the tempering medium into contact with the rotary grinding member, and a separate conduit for returning the tempering medium from the grinding member longitudinally through the forcing screw.

7. The combination, in a grinding mill, of a casing, coacting grinding members within the casing, one of which projects axially out of the casing, a bracket mounted for sliding movement adjacent to the casing and having the said projecting grinding member journaled therein for rotation, driving means journaled on the bracket including gearing for transmitting rotary movement to the said grinding member, and means including a screw for moving the sliding bracket to adjust its grinding member and driving means relative to the coacting grinding member.

8. The combination, in a grinding mill, of a casing, coacting grinding members within the casing, a bracket mounted for sliding movement adjacent to the casing, and hav-

ing one of the grinding members journaled therein for rotation, driving means including gearing and a shaft also journaled in the bracket, for transmitting rotary movement to the grinding member, and means also carried by the said bracket for inclosing the said gearing.

9. The combination, in grinding mills, of a casing, coacting grinding members, a bracket mounted for sliding movement adjacent to the casing and having one of the grinding members journaled therein for rotation, means including a shaft, a pair of bevel gears and a driving gear also journaled in the bracket, for transmitting rotary movement to the grinding member, and guards also carried by the bracket for inclosing the said bevel gears and the driving gear.

10. The combination, in a grinding mill, of a casing having space in its wall for the circulating of fluid, and a grinding member secured to the casing with its surface exposed to and closing said space to prevent the escape of the fluid past the grinding member.

11. The combination, in a grinding mill, of a casing having a space in its wall for fluid circulation, a seating ring fitted against the end of the wall within the space, a grinding member seated against the said ring with its surface exposed to the circulating space outside of the ring, and means for closing the joint between the outer side of the circulating space and the grinding member.

12. The combination, in a grinding mill, of a casing having fluid circulating space in its wall, a seating ring for the wall inside of the circulating space, a grinding member seated in said ring with its surface exposed to the circulating space outside of the ring, a seating ring for closing the joint between the grinding member and the outer wall of the space, and gaskets for closing the joints between the said rings and the grinding member.

13. The combination, in a grinding mill, of a casing having fluid circulating space in its wall, a seating ring secured to the wall inside of the space, another ring seated in the wall outside of the space, a grinding member seated in the said rings, gaskets against the outer face of the latter ring, and the face of the grinding member, respectively, and a clamp ring screw-threaded in the casing and bearing against the said gaskets to hold the said grinding member in place and to close the joint outside of the said member to prevent escape of the fluid from the circulating space.

14. The combination, in a grinding mill, of a casing, a separable shaft and grinding member mounted for rotation within the casing, with an annular space between them for the circulation of a tempering medium, a tube within the shaft and an annular space around the said tube, both communicating with the said annular space of the grinding member for conducting the tempering medium to and away from the grinding member.

15. The combination, in a grinding mill, of a casing, a separable grinding member and feed screw mounted for rotation in the casing, with an annular space in the grinding member for the circulation of a tempering medium, and means for conducting a tempering medium to and from the said space, including a bore extending longitudinally through the feed screw, a tube seated therein smaller than the bore, means for closing the inner end of the tube and the inner end of the bore, and passages leading from the annular space of the grinding member to the bore and to the tube.

16. The combination, in a grinding mill, of a casing, a feed screw within the casing, a grinding member secured to the feed screw with a fluid circulating space between them, inflow and outflow passages for fluid extending within the feed screw and communicating with the said water space between the feed screw and the grinding member.

17. The combination, in a grinding mill, of a casing provided with a circulating space for a tempering fluid, a grinding member also provided with a circulating space for a tempering fluid, and mounted at one end for rotation in the casing, with its other end mounted for rotation in a separate bearing, inlets and outlets for the fluid, having a telescoping connection at the said bearing with the circulating space of the rotating grinding member, and a thrust bearing engaging the said rotating member between the casing and the said bearing, and means for rotating and axially adjusting the said grinding member.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH MERRITT.

Witnesses:
FRANK M. MATHER,
MARY G. F. CUNNINGHAM