T. L. & T. J. STURTEVANT.

CRUSHING MACHINE.

APPLICATION FILED OCT. 16, 1909.

1,105,713.

Patented Aug. 4, 1914.

3 SHEETS—SHEET 1.

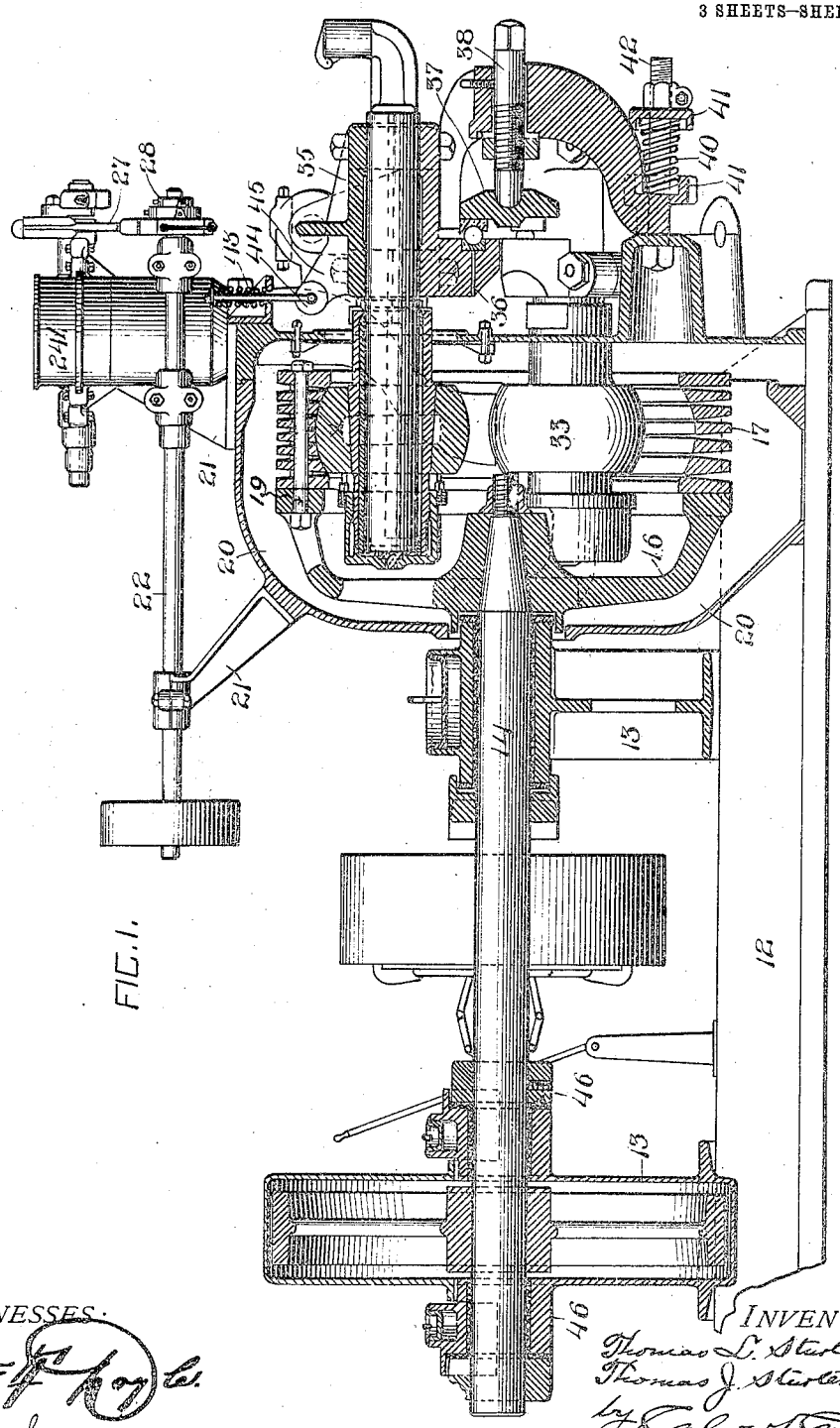


FIG. 1.

WITNESSES:

W. F. Hoge Jr.

L. M. Sweeney.

INVENTORS:

Thomas L. Sturtevant

Thomas J. Sturtevant,

by Talbert & Talbert,

Attorneys.

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FIG. 3.

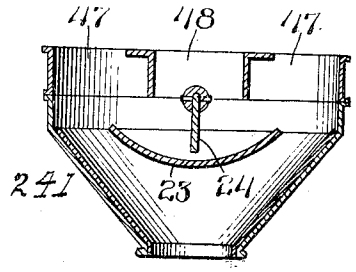
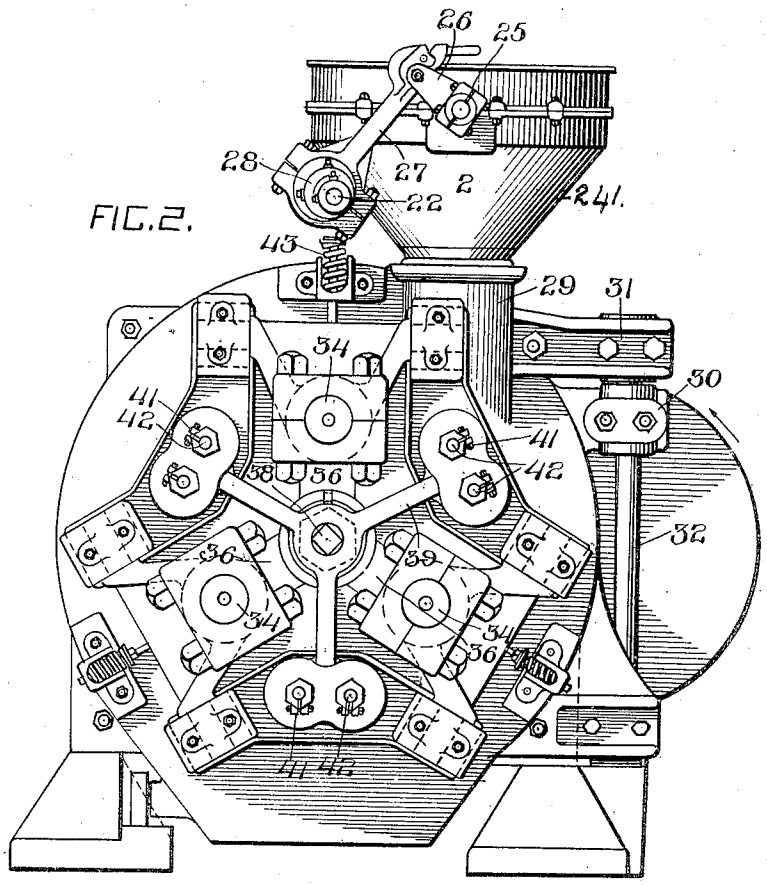


FIG. 2.



WITNESSES:

E. M. Sweeney.

INVENTORS:

Thomas L. Sturtevant,

Thomas J. Sturtevant,

BY

Attorneys.

T. L. & T. J. STURTEVANT.

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3 SHEETS—SHEET 3.

FIG. 4.

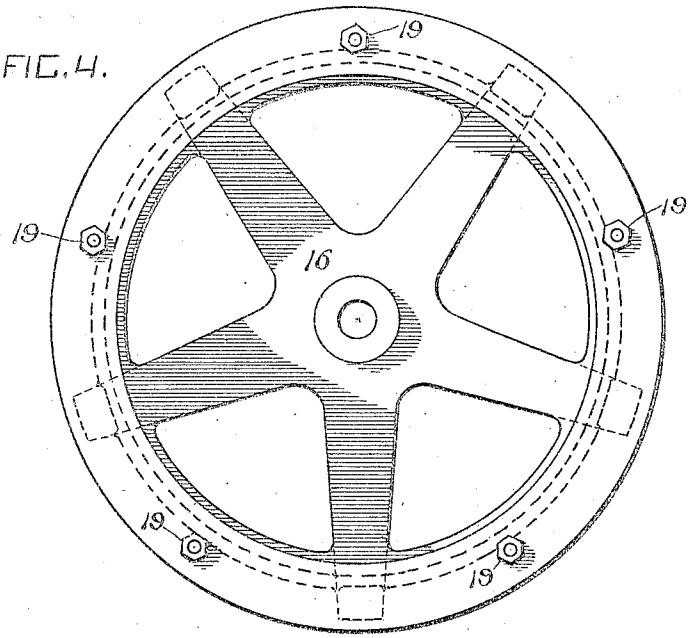


FIG. 5.

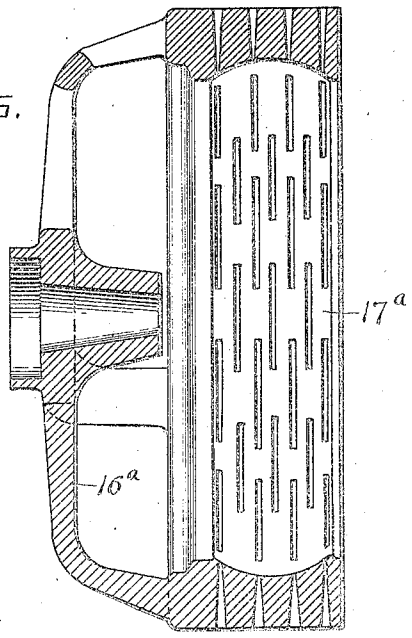
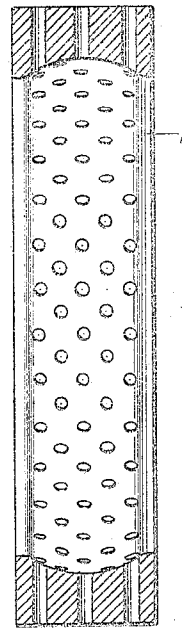


FIG. 6.



WITNESSES:

M. F. Hoyt

L. M. Sweeney.

INVENTORS:

Thomas L. Sturtevant,

Thomas J. Sturtevant,

BY Baker & Baker,

Attorneys.

UNITED STATES PATENT OFFICE.

THOMAS LEGGETT STURTEVANT, OF QUINCY, AND THOMAS JOSEPH STURTEVANT, OF WELLESLEY, MASSACHUSETTS, ASSIGNORS TO STURTEVANT MILL COMPANY, A CORPORATION OF MAINE.

CRUSHING-MACHINE.

1,105,713. Specification of Letters Patent. Patented Aug. 4, 1914.

Application filed October 16, 1909. Serial No. 523,033.

To all whom it may concern:

Be it known that we, THOMAS L. STURTEVANT and THOMAS J. STURTEVANT, citizens of the United States, residing, respectively, at Quincy and Wellesley, in the county of Norfolk and State of Massachusetts, have invented or discovered certain new and useful Improvements in Crushing-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of crushing machines in which the reduction of the material is effected by means of a rotating anvil ring and coöperating hammer rolls yieldingly forced toward said ring, the present invention relating to certain improvements in crushing machines of this class, as will hereinafter appear.

In the operation of crushing machines, of the class referred to, in reducing some kinds of materials, such as moist limestones, clay, etc., the material being crushed is liable to pack on the anvil ring, and by adhering thereto prevent the proper operation of the machine, as the crushed material does not discharge properly from the anvil ring. To obviate this objection we provide an anvil ring which will have a series of openings through which the crushed material, which might otherwise have a tendency to pack on the crushing face of the anvil ring, will be forced through the ring by the operation of the hammer rolls. This feature of our invention may be carried into effect in various ways, as by providing the anvil ring with a series of holes or slots of any desired shape or arrangement so as to form a foraminous or skeleton ring, or a skeleton or open-work anvil ring may be provided by building up such ring by a number of narrow rings or sections properly spaced apart and secured in place; and such foraminous or skeleton ring will be adapted for use in machines in which the anvil ring may be arranged to run on a series of inside or outside rollers, or in which the ring is carried by a rotating head secured to a suitable driving shaft.

The present improved machine is also provided with a series of balance springs acting on the hammer rolls in such a manner as to overcome the action of gravity and permit a uniform crushing pressure to be given against the material fed to the anvil ring. Also the present improved machine preferably comprises a feeding device by which the material to be crushed will be mechanically fed to the anvil ring but the hopper of which feeding device is of such construction as to permit the tailings to be conveyed to the delivery feed spout without being fed in at the opening through which the new material conveyed to the feed spout by the said feeder enters.

In the accompanying drawings Figure 1 is a longitudinal sectional view, partly in elevation, of a crushing machine embodying the present improvements. Fig. 2 is an end view of the same looking from the right of Fig. 1. Fig. 3 is a vertical section through the hopper of the mechanical feeder shown in Figs. 1 and 2. Fig. 4 is a side view of the anvil-ring carrying-head shown in Fig. 1. Figs. 5 and 6 show slightly modified forms of foraminous or grated anvil rings.

Referring to the drawings, 12 denotes the base of the machine from which rise standards 13 in which is journaled the driving shaft 14 having a pulley 15. To the said shaft is attached, in any suitable manner, a skeleton head or spider 16 carrying an open-work or foraminous anvil ring 17 preferably consisting of a series of separate narrow rings spaced apart by means of washers 18 on the bolts 19 by which the said separated rings are attached to the said head 16. The rings forming the built-up anvil ring 17 are preferably formed slightly outwardly tapering in cross section, so that the slots or spaces between the said rings will be slightly flaring, to facilitate the discharge of the material through the said slots or spaces. The open-work anvil ring is, as above stated, carried by a skeleton head or spider, so that it is more or less open on both sides to permit the reduced material to be discharged from the sides of the ring, as well as through the slots or openings in the said ring; the front face of the ring being entirely open, as shown.

The rotating foraminous anvil ring 17, as is usual in ring-roll crushing machines of the class to which this invention relates, rotates with sufficient rapidity to retain the material against the inner face of the ring and carry it to the upper side of the ring, and in fact all the way around with the ring, by centrifugal force, so that a very large part of the working face of the ring is utilized in the crushing operation, this being

due to the fact that a plurality of yieldingly mounted crushing rolls are employed in cooperation with said ring. Thus the crushing operation is carried on very much faster than it can be in ball and drum machines, or in machines in which the crushing is effected only at the lower parts of the rings or drums.

The anvil ring is mounted in the chamber of a casing 20 which forms a part of the frame of the machine, and which is provided with suitable standards 21 supporting bearings for the driving shaft 22 of the mechanical feeder. Said feeder is, or may be, essentially the same in principle as that covered by our Patent No. 879,423, granted February 18, 1908, in that it comprises a material-receiving pan or receptacle 23, having open sides, and a vibrating feeding bar 24 swinging in said pan and forcing the material out over the open sides of the latter. The swinging bar 24 is operated from a rock-shaft 25 having an arm 26 connected by a pitman 27 with an eccentric 28 on the rotating driving shaft 22. The feed hopper 241 communicates with a feed spout 29 which delivers material to be crushed to the anvil ring, said feed spout being preferably mounted in or formed as a part of the swinging end head 30 in which the anvil rolls are mounted. The end head 30 is provided with parts or arms 31 pivoted on the post 32, so that the said end head, when unbolted from the casing 20, may be swung outward to afford access to the chamber of the mill, and in such outward swinging movement said head will carry with it the delivery feed spout 29 which is formed separate from the hopper 241.

The coöperative action of the anvil ring and hammer rolls of the present machine is similar to that of the crushing machine covered by our Patent No. 906,829, granted December 15, 1908, in that the hammer rolls 33 are mounted on bearing pins 34 attached to carriers pivotally mounted in the end head 30 and acted on by springs which will yieldingly force the hammer rolls toward the crushing or working face of the anvil ring. In the present machine the carriers 35 are provided with inwardly projecting parts or lugs 36 acted on by the central balance washer 37 between which and the said arms or lugs are preferably interposed roller bearings for permitting of a proper relative movement of these parts. The balance washer is engaged by a central thrust screw 38 secured in a three-arm spider 39 which is acted on by springs 40 which are inside of housing plates 41 held in place by bolts 42 connected with suitable recessed parts of the said end head 30.

To properly balance the hammer rolls 33 and to counteract the action of gravity, so that said rolls may be given, as nearly as possible, a uniform crushing pressure against the material on the anvil ring, a series of balance springs 43 are provided, said springs being connected by bolts 44 with ears 45 formed on the pivoted carriers 35.

To effect a suitable adjustment of the anvil ring relative to the hammer rolls, in getting the parts into proper coöperative relation, and in keeping them in such relation, the driving shaft 14 is preferably made longitudinally adjustable in its bearings, to a limited extent, by providing abutment collars 46 which are arranged on opposite sides of the bearings for said shaft provided by one of the standards 13; so that by loosening the set screws by which said collars are attached to said shaft the latter may be shifted endwise slightly to effect a lateral adjustment of the anvil ring, after which said shaft will be secured in its adjusted position when the set screws attaching said collars to said shaft are properly tightened with the said collars abutting against the bearing portions of said standard.

To avoid undue wear of the mechanical feeder, which supplies to the anvil ring the material to be reduced, the feed hopper is provided with one or more entrances 47 through which the tailings may be returned to the mill and be entered into the hopper 241 without requiring such tailings to pass through the opening 48 through which the new material which is fed to the automatic feeder enters. With some kinds of refractory material, which is hard and cutting, the wear on the mechanical feeder is very considerable, and it has been found that by passing the tailings into the feed hopper without passing them through the said feeder a very considerable wear of the moving parts of the latter may be saved. Of course it will be understood that the tailings will be carried to the feed hopper by any sort of conveying devices such as are now in common use in machines of this kind; and that with the use, in a mechanical feeding device, of a feed hopper provided with a separate opening or openings for the entrance of tailings, the feeder will merely be used to supply the fresh material, the tailings being run into the hopper by gravity, or otherwise.

An anvil ring comprising a plurality of parts or sections properly secured in place has been found to be an advantageous construction, whether or not the said sections be spaced apart to form a grated ring, as shown in Fig. 1; for the reason that with a sectional ring, if one part becomes worn, a new part may be supplied without supplying an entirely new ring, and for this reason we do not wish to be understood as limiting our invention to the particular form of sectional anvil ring herein shown. Also instead of making the anvil ring separate

from the head by which it is carried, as shown in Fig. 1, said ring and head may be integral as shown in Fig. 5 in which the ring portion 17^a of the head 16^a is shown as being provided with slots to afford discharge openings. Also instead of attaching an open-work or foraminous anvil ring to a driving head, such ring, if it is to run on outside or inside rollers, may be formed separate from any carrying head, as is shown by the foraminous ring 16^b in Fig. 6. This ring is fully open on both sides to permit of the ready discharge of the reduced material from both sides thereof as well as through the openings in the ring. In either of the forms of anvil rings hereinbefore described the rings may be made either with plain or with concave working faces, as will be understood. It will thus be understood that the details of the machine may be varied widely from the constructions herein shown and described, without departing from the essence of the invention.

Having thus described our invention we claim and desire to secure by Letters Patent:

1. In a crushing machine, the combination with a rotating spoked or skeleton head, of a rotating foraminous or open-work anvil ring carried thereby, and more or less open on both sides, so that the reduced material may be discharged from both sides thereof, a plurality of crushing rolls coöperating with said ring, and means for forcing said rolls yieldingly outward toward said ring.

2. In a crushing machine, the combination with a rotating spoked or skeleton head, of a foraminous or open-work anvil ring attached to said head to rotate therewith and consisting of a series of spaced annular sections secured together to afford a grated construction, said anvil ring being more or less open on both sides, so that reduced material may be discharged from both sides thereof, and a plurality of crushing rolls coöperating with said ring.

3. In a crushing mill, the combination with a plurality of rotating anvil rings having interior crushing faces and separated from each other by a space or spaces affording a foraminous formation and on which faces the material is held by centrifugal force, of a plurality of hammer rolls running on the interior of said anvil ring faces and on a track in a predetermined course, and means for forcing said roll or rolls toward said crushing faces by an elastic pressure.

4. In a crushing machine, the combination with a rotating spoked or skeleton head, of a foraminous or open-work anvil ring attached to said head to rotate therewith and consisting of a series of spaced annular sections secured together to afford a grated construction on which the material to be crushed is held by centrifugal force, said anvil ring being more or less open on both sides, so that reduced material may be discharged from both sides thereof, and a plurality of crushing rolls coöperating with said ring, said sections being tapered outwardly to afford flaring spaces between the same.

5. In a crushing machine, the combination with an anvil ring, of a series of hammer rolls, pivoted carriers from which said rolls are supported, springs acting on said carriers to force said rolls yieldingly toward the working face of the anvil ring, and balance springs acting on said carriers and equalizing the action of the said first-named springs.

6. In a crushing machine, the combination with an anvil ring, of a series of hammer rolls, pivoted carriers from which said rolls are supported, springs acting on said carriers to force said rolls yieldingly toward the working face of the anvil ring, and balance springs acting on said carriers and equalizing the action of the said first-named springs by counteracting gravity, said balance springs being arranged to act on said carriers at right angles to the action of said first-named springs, or approximately so.

7. In a crushing machine, the combination with an anvil ring, and hammer rolls, of carriers for said rolls, pressure springs, a central balance washer or plate acting equally on said carriers through the stress of said springs, so as to give an equal pressure to the said rolls, and equalizing springs to neutralize the effect of gravity on each hammer roll.

8. In a crushing mill, the combination with crushing instrumentalities, of a mechanical feeding device for supplying to the crushing devices the material to be reduced, said feeding device comprising a moving feeding part and a hopper, and said hopper being provided with a feed opening for the entrance of fresh material to the feeding device, and with one or more passageways independent of the said opening, for the mill tailings, so that said tailings may be delivered to the crushing chamber of the mill without being acted on by the said mechanical feeding device.

In testimony whereof we affix our signatures, in presence of two witnesses.

THOMAS LEGGETT STURTEVANT.
THOMAS JOSEPH STURTEVANT.

Witnesses:
GRACE G. GODFREY,
H. A. TOMLINSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."