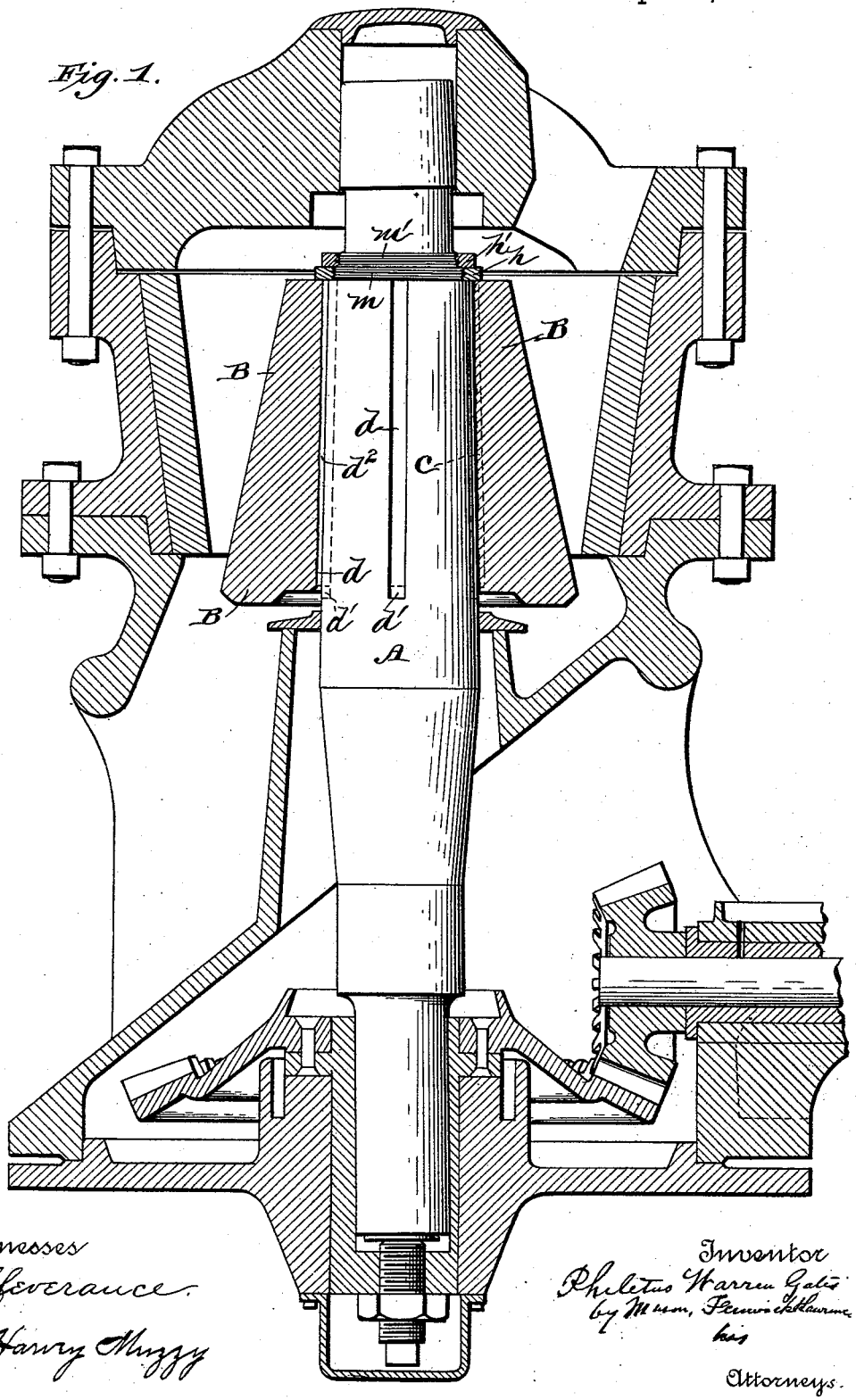
(No Model.) 3 Sheets—Sheet 1.

P. W. GATES.

METHOD OF AND MEANS FOR SECURING STONE CRUSHER HEADS TO SHAFTS.

No. 525,407. Patented Sept. 4, 1894.

Fig. 1.



Witnesses
Severance.
W Harry Muzzy

Inventor
Philetus Warren Gates
by Munn, Pennie & Lawrence
his
Attorneys.

(No Model.) 3 Sheets—Sheet 2.

P. W. GATES.

METHOD OF AND MEANS FOR SECURING STONE CRUSHER HEADS TO SHAFTS.

No. 525,407. Patented Sept. 4, 1894.

Fig. 2.

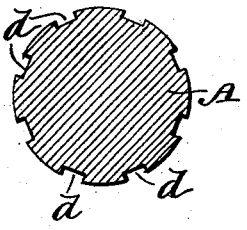


Fig. 3.

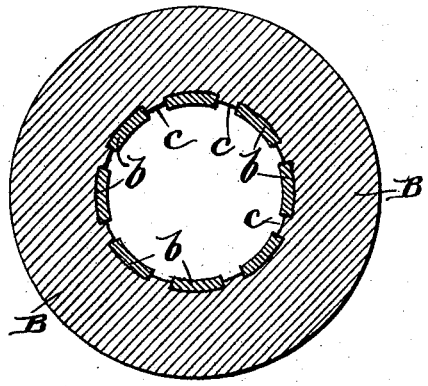


Fig. 4.

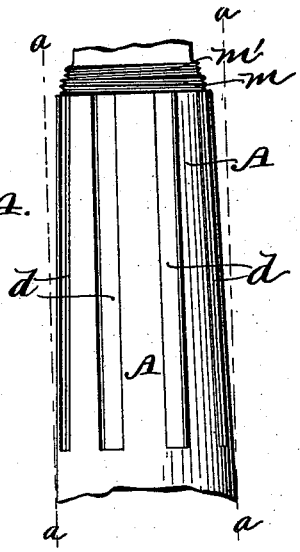


Fig. 5.

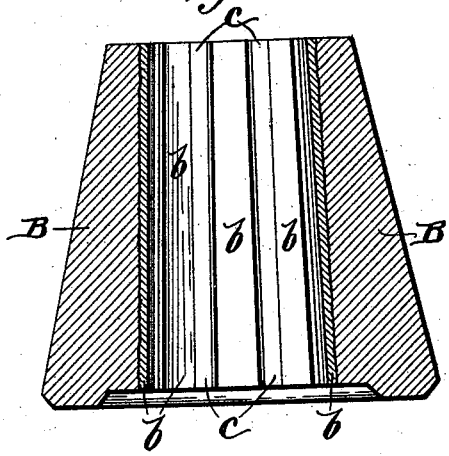
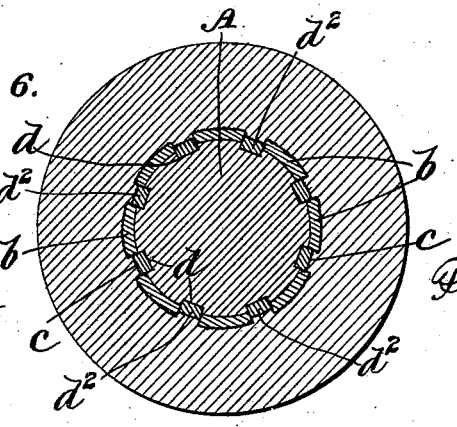


Fig. 6.



Witnesses
Geo. Breck.
W. Harry Muzzy.

Inventor
Phelatus Warren Gates
by Mann, Fennick & Mann
his
Attorneys

(No Model.) 3 Sheets—Sheet 3.

P. W. GATES.

METHOD OF AND MEANS FOR SECURING STONE CRUSHER HEADS TO SHAFTS.

No. 525,407. Patented Sept. 4, 1894.

Fig. 7.

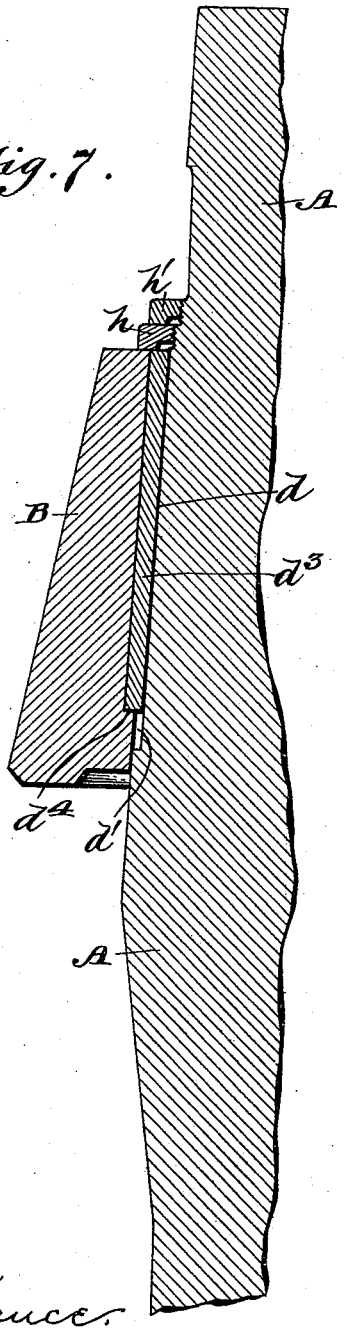
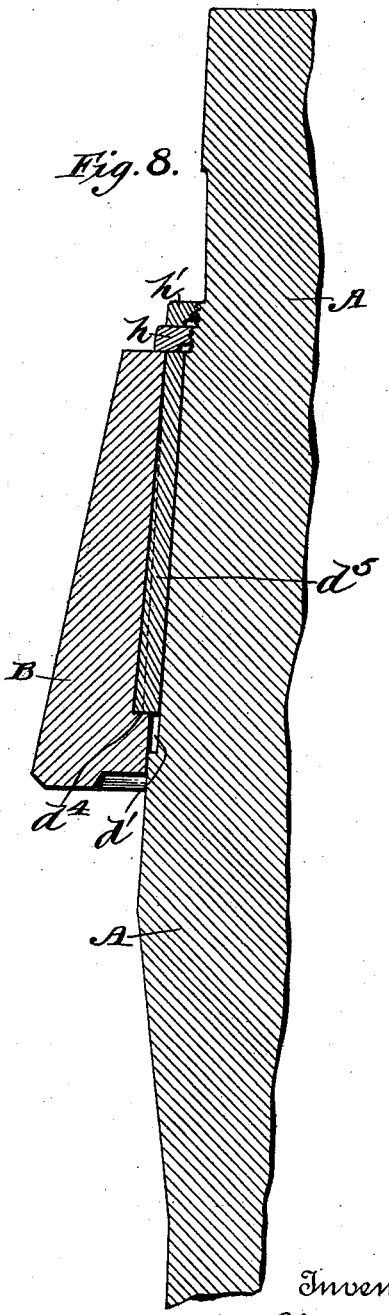


Fig. 8.



Witnesses
Severance.
W. Harry Muzzy.

Inventor
Phileteus Warren Gates
by Mason Fenwick & Lawrence
his
Attorneys

UNITED STATES PATENT OFFICE.

PHILETUS WARREN GATES, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE GATES IRON WORKS, OF SAME PLACE.

METHOD OF AND MEANS FOR SECURING STONE-CRUSHER HEADS TO SHAFTS.

SPECIFICATION forming part of Letters Patent No. 525,407, dated September 4, 1894.

Application filed October 26, 1893. Serial No. 489,219. (No model.)

To all whom it may concern:

Be it known that I, PHILETUS WARREN GATES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of and Means for Securing Stone-Crusher Heads to Shafts; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates especially to gyratory stone breakers wherein the upper end of the gyrating shaft is tapered upward and the crusher head has a tapered bore corresponding substantially to the taper of the shaft; and its objects are to obviate certain objections to the present mode of applying the crusher head to the shaft whereby provision is made for the settling down of the head upon the shaft to such an extent as is necessary to secure for it a firm and practically solid connection with the shaft, and at the same time an iron-to-iron contact between the head and the shaft, such contact extending nearly the whole length of the head; and, to avoid the head becoming loose on the shaft by jarring or other causes.

My invention consists—

First. In the novel construction of the wearing surfaces of the gyrating crusher head, arranging the key seats therein, constructing the gyrating shaft and arranging the key seats therein, and of applying the keys in the key seats of the crusher head and shaft; whereby the head, while held from revolving on the shaft by the keys, is allowed a chance to settle on the tapered portion of the shaft.

Second. It consists in a certain novel construction of the chilled crusher head with iron or other suitable metal bearing strips firmly secured in or formed on the head, and projecting out beyond its bore on an incline corresponding to the taper of the shaft, whereby spaced key seats are formed in the bore of the head, and suitable metal bearing surfaces are secured for the gyrating shaft to come in contact with, no matter how much the head may settle on the shaft.

Third. It consists in a novel combination of a confining nut and a jam nut with a gyrating shaft provided with differential screw threads, and having a crusher head keyed to it in accordance with my invention; the said differential screw threads serving for receiving the nuts, and the head and keys by said nuts being firmly held against upward movement and kept from working loose under the jarring motions of the machine when in operation; and it consists fourth in a novel means whereby crusher heads may be secured to their shafts by pouring molten metal to form the keys, against roughened surfaces of key seats in the head, and against smooth surfaces of key seats in the shaft, and also against plugs of clay or other material at the bottom of the key seats, as will be hereinafter described.

In the drawings Figure 1. is a vertical central section of a known type of gyratory stone breaker, except that it is provided with a truncated cone crusher head, gyratory shaft, metal bearing ribs, metal keys and other features hereinafter named, constructed in one of the peculiar ways that I adopt in carrying out my invention. Fig. 2. is a detail, horizontal section of the upwardly tapered portion of the gyrating shaft. Fig. 3. is a detail horizontal section of the crusher head. Fig. 4. is a detail broken elevation of the tapered portion of the shaft. Fig. 5. is a detail vertical section of the crusher head. Fig. 6. is a horizontal section of the crusher head and shaft as keyed with soft metal keys in accordance with my invention, and Figs. 7 and 8 are broken detail vertical sections, showing two other ways in which the head may be keyed to the shaft, by employing feathers or keys which are constructed of wrought iron or steel separately from the head, and applied in the key seats of the head and shaft.

In nearly all of the stone crushers of the type shown in my drawings, or as shown in Letters Patent Nos. 279,146, 279,147 and 507,118, it has been customary to form abrupt enlargements or shoulders on the gyrating shaft, A, just below the larger end of the crusher head B; and, owing to this, the following difficulty has been experienced: When the head is in place on the shaft, and the molten zinc is run into the channels between the head and the shaft, to form the keys

which prevent the head from turning on the shaft, the head cannot follow down on the shaft, but will become seated on the above mentioned shoulder; and therefore this is not the best construction, because it is very difficult at the first, or in the finishing of the machine, to drive the head in place on the shaft so firmly that there will be no further tendency to settle down to an additional extent. It is found in practice that the amount of resistance which the head has to bear in doing the work of crushing, is greater than the pressure that can be given to the head by driving it down on the shaft; and therefore it is important to make provision for the head settling down on the shaft; for under old constructions, after the head is driven down on the shaft and it becomes necessary for it to settle, under the great amount of work being done by it, the enlargement or shoulder interferes with its so settling.

Under ordinary constructions the head in settling upon the shoulder loses the iron to iron contact between itself and the shaft, and consequently the pressure or wear comes on the shoulder, and thus the benefit of the iron to iron fit between the shaft and iron or steel strips or collars, and the zinc used between the head and the tapering shaft is not secured, and the head becomes loose and is allowed movement on the shaft, which causes undue wearing, and lessens the effectiveness of the machine. To overcome these difficulties and further improve the machine the shaft A is turned on a given taper the entire length of the head B, or even some distance beyond the head. This is illustrated by the dotted parallel vertical lines *a*—*a* in Fig. 4.; and in the head B, as represented, dovetail or other suitably shaped metal strips *b* are cast, the same being preferably soft iron and set in the mold in which the chilled iron head is cast, so that one part of their thickness will be dovetailed or otherwise suitably secured in the chilled iron crusher head, while the other part of their thickness will project out into the bore of the crusher head, and by this means spaced iron or other suitable metal bearing surfaces, for the shaft A, are formed, as illustrated in the drawings—most plainly in Figs. 5 and 6. These strips are the full height of the head, or nearly so, and are constructed practically with the same taper that the shaft is turned; and, as shown, are set some distance apart in the eye of the head, which distance is increased or decreased accordingly as the diameter of the head is increased or decreased. The strips thus constructed and arranged remain firmly in place, being held by their dovetails or other suitable confining means; and between each pair of strips a key seat recess *c* is formed.

In the shaft A are cut as many key seats *d* as there are key seat recesses between the strips, the same being respectively about the same width as the recesses *c*. These key seats are cut to any desired depth—usually to about the same depth that the iron or other metal strips *b* project into the bore of the chilled head; and when the keys d^2 are cast of soft metal, they are formed parallel with one or both faces of the key seats of the shaft. The key seats of the shaft are made to extend down about half an inch below the lower ends of the metal strips *b* of the head. The head and shaft thus constructed, are united by slipping the head upon the tapered upper portion of the shaft so that the key seats between the metal strips are in coincidence with the key seats *d* in the shaft of the crusher head; then the bottom of the key seats of the shaft and the key seats of the head are "clayed up" and the molten metal poured into the key seat channels between the head and the shaft until said channels are filled nearly to the top of the head. When the keys are thus cast and the clay plugs removed the lower portion *d'* of the key seats of the shaft will contain no metal, and room is left for the keys along with the head to descend, as necessity may require. The soft metal keys are held in position in the head by means of the rough surfaces thereof, against which it is flowed in the casting operation, and, while this is so, these keys, where they project into the key seat channels of the shaft, are free to move in said channels, such movement being provided for by the unfilled portions *d'* of the key seats in the shaft, as shown in Fig. 1. of the drawings.

It will be understood that the head positively carries the keys with it, whenever it becomes necessary for it to settle down on the shaft; also that the iron to iron contact is maintained, the iron or other suitable metal strips always bearing from the bottom to top of the head upon the tapered portion of the shaft.

In Fig. 7. I have shown a key d^3 which is constructed separately from the head and shaft. This key is seated upon a shoulder d^4 formed in the head, in all other respects the invention shown in Fig. 7. is the same as that shown in Figs. 1 to 6 of the drawings.

The key d^3 is inserted at the top of the head and confined with the head by means of nuts *h*, *h'*, as will be presently described. Under this construction the keys are parallel on all sides and also parallel with the key seats in the head and shaft; and in the operation of the crushing machine either the head slips down on the keys, or the keys go down with the head, the keys being free to slip within the smooth key seats of the shaft and kept in position by the ring nuts.

In Fig. 8. I have shown a key d^5 and key seats differing from the construction shown in Fig. 7., as follows: The key seat in Fig. 8. is made to deepen gradually in the head from top to bottom, and the key d^5 is gradually thickened downwardly, by tapering that side thereof which comes in contact with the base of the key seat in the head; or, in other words, said side of the key is tapered to form an in-

cline which is less steep than the side which is parallel to and comes in contact with the base of the key seat in the shaft. By this construction the keys are held from rising in the seats of the head but are allowed to descend with the head independently of the nuts h, h'.

It is obvious that by making the key seat in the shaft to extend down below the crusher head, and inserting clay or other suitable plugs in the lower ends of the seats in the manner hereinbefore described and illustrated in the drawings, the keys d^5 may be formed of cast metal, such metal being poured into the key seats shaped as shown in Fig. 8.; such cast keys will not rise in the key seats of the head but will be compelled, irrespectively of any roughened surface of the key seats of the head, to descend with the head; and while this will be the case, the roughened surface of the metal of the head might or might not be utilized as a retaining means for the keys. It is also contemplated to employ a cast steel or other hard metal crusher head with metal strips, as b, formed on it by coring so as to form rough surfaced key seats in the casting process—or to mill out key seats for the wrought metal keys.

On the shaft A, at a point above the crusher head, differential screw threads m, m', are cut, and on these threads the two ring nuts h, h', are applied, these nuts being screwed on the shaft so that the lower one h comes against the upper end of the head and key, and the upper one h' against the nut and acts as a jam nut. These nuts serve to overcome the effect of the jar of the shaft caused by the heavy work performed, and thus the tendency that there might be of the head getting loose on the shaft, is avoided. They also serve for keeping the keys shown in Figs. 7 and 8. in position, and for clamping the head and keys in proper relation to each other after the head has settled down on the shaft. These ring nuts by being screwed down from time to time, as the head settles on the tapered part of the shaft, finally secure the head and keys in a properly seated position, and no further movement of one upon the other is likely to occur; and the nuts by having differential screw threads are not liable to jar loose, because the nut h by having the coarser pitch of thread, travels the fastest and locks itself against the nut h', and thus prevents further turning.

What I claim as my invention is—

1. In a gyratory crusher, a gyrating shaft having a tapered portion extending from below the crusher head toward its upper end, for receiving the crusher head, and said tapered portion provided with one or more key seats which are of such a relative length to the keys that they form a settling space or spaces for the head below the keys; and which are parallel with the taper ends of the shaft; in combination with a crusher head provided with a key seat or seats coinciding with the key seat or seats in the shaft, and with a key or keys having projecting edges and faces which are parallel with the surfaces of the key seats in the shaft, substantially as described.

2. The combination of a crusher head, a gyratory shaft having a taper from below the crusher head toward its upper end, the head and shaft being provided with key seats—those of the shaft extending down lower than those of the head, metal bearing strips of the head projecting into the bore of the head, and keys entered into the key seats of the head and shaft, and having a loose fit in the key seats of the shaft, substantially as described.

3. The combination of the gyratory shaft having a taper from below the crusher head toward its upper end, and provided with differential screw threads above its tapered portion, and formed with key seats in its periphery parallel with said tapered portion and of greater length than the keys by which the head is held from turning, a crusher head having spaced metal bearing strips projecting into its bore, metal keys of less length than the key seats in the shaft, and entering into the key seats of the head and shaft, and having a smooth loose fit within the key seats of the shaft, and confining nuts screwed on the differential threads of the shaft, substantially as described.

4. The means herein described for keying a crusher head to a gyratory shaft, the same consisting in one or more retaining key seats in the head and one or more smooth key seats in the shaft, the key seats in the shaft being parallel with the projecting edges and faces of the keys, and of greater length than the keys which hold the head from turning; and keys formed of metal poured in a molten state against the retaining surfaces of the key seats in the head and against the smooth surfaces of the key seats in the shaft and against removable plugs at the bottom of the seats, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

PHILETUS WARREN GATES.

Witnesses:

ALBERT JUSTIN GATES,

HENRY W. HOYT.