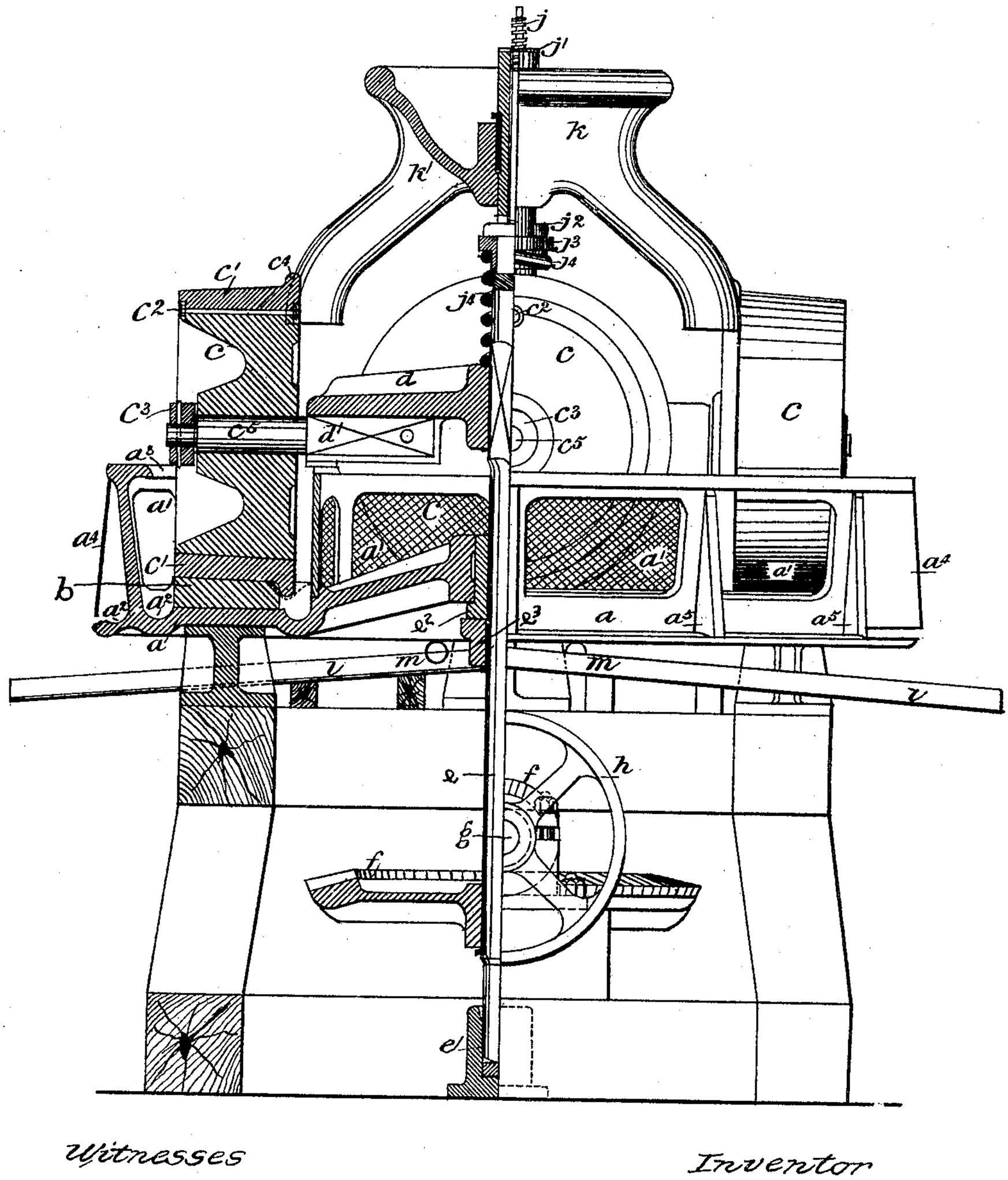
No. 822,052. PATENTED MAY 29, 1906.

H. JONES.

MACHINE FOR CRUSHING AND AMALGAMATING METALLIFEROUS ORES.

APPLICATION FILED MAY 17, 1904.

2 SHEETS—SHEET 1.



Witnesses

H. M. Kuehne

Paul Arenhurt.

Fig. 1

Inventor

Hiram Jones

By Richards & Co

Attorneys

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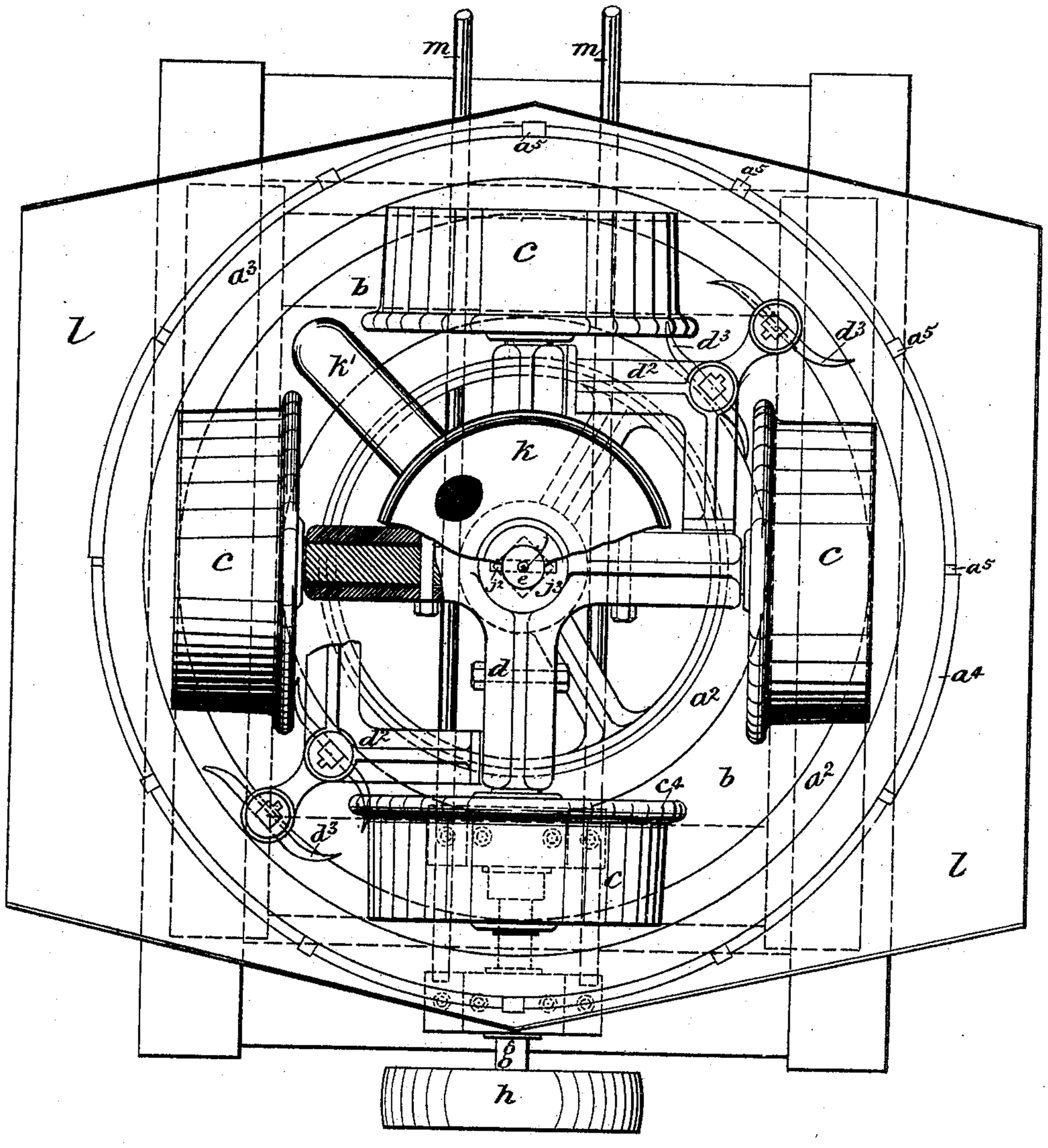

Fig. 2

Witnesses

Wm. Kuehne

Paul Newhart.

Inventor

Hiram Jones

By Richards & Co

Attorneys

UNITED STATES PATENT OFFICE.

HIRAM JONES, OF ASCOT VALE, VICTORIA, AUSTRALIA.

MACHINE FOR CRUSHING AND AMALGAMATING METALLIFEROUS ORES.

No. 822,052. Specification of Letters Patent. Patented May 29, 1906.

Application filed May 17, 1904. Serial No. 208,426.

To all whom it may concern:

Be it known that I, HIRAM JONES, engineer, a subject of the King of Great Britain and Ireland, and a resident of 99 South street, Ascot Vale, in the county of Bourke, in the State of Victoria, in the Commonwealth of Australia, have invented a certain new and useful Machine for Crushing and Amalgamating Metalliferous Ores, of which the following is a specification.

The objects of my invention are the construction of a machine for more effectually and cheaply crushing metalliferous ores for the purposes of amalgamation and concentration.

Metalliferous ores are usually crushed by means of stamp-batteries, which require their foundations to be made of great strength at considerable expense, and the stamps, moreover, have to be strongly braced at some distance from the ground.

The improved apparatus which constitutes this machine is designed normally to effect the crushing by means of the dead weight of the rollers employed, which weight is borne by the ore being crushed and the driving power required, and the wear and tear of bearings are thus proportionately decreased. The rollers are revolved by a carrier round a central shaft, and there being no vertical movement of the center of gravity of the moving parts there are no unbalanced forces necessitating firm foundations. The driving-gear is also fixed low down in the machine, near the foundations, upon the central shaft, so that there is no necessity for strongly-braced framing at a height from the ground.

As the amount of crushing power required varies with the ore to be crushed, a device to increase such power is provided whereby the pressure of a strong spring on the central shaft is distributed to the rollers by the arms of the carrier, so that a machine specially adapted for light ores may on occasion be rendered capable of dealing with heavier and more refractory ores.

Referring to the drawings, which form a part of this specification, Figure 1 is an elevation half in section, and Fig. 2 a plan with part of the hopper cut away to show the parts underneath.

a is an annular trough supported on suitable foundations. A timber pier is shown elevating the trough above the ground in order that the tailings after having been crushed may flow away by gravity. The trough *a* is joined by suitable arms to a central boss about the vertical shaft *e*, designed partly to accommodate the bearings e^2 and partly to afford increased rigidity to the machine. In both the external and internal walls of the trough are windows *a'*, covered entirely by wire-gauze, of which the size of mesh is so regulated that only tailings of the required fineness may pass. For the sake of clearness the screen is omitted from the window in front of the runner *c* on the right of Fig. 1. The external wall is outwardly inclined to enable the tailings to drop freely after passing through the wire-gauze, and round the top is the inturned flange a^3 to prevent the liquid in the trough from splashing over. Channels or grooves a^2 run round the bases of the internal and external walls of the trough, in which mercury may be placed to amalgamate with the gold when rich ores are being worked. A number of ribs a^5 strengthen the outer wall and support a light casing a^4, said casing being provided with suitable openings at intervals and protects the wire-gauze and tailings from dust. As shown, a space is left between the lower edge of the casing a^4 and the lip of the outer channel a^2. In the illustrations most of the casing is omitted in order to show the parts underneath.

On the inside bottom of the trough is fixed by countersunk screws or other suitable means an annular working surface or circular die *b*. On this surface work a number of rollers *c*, of which four are shown; but more may be used in larger machines, if desired, provided they are an even number. Each roller consists of the body *c* and a tire *c'*, fixed thereon by bolts c^2, which preferably pass through the body, so as not to cut away any of the wearing part, and grip the tire between the bolt-head and the nut.

The circular die or false bottom *b* and the tires *c'* are made, preferably, of chilled cast-iron to resist wear and are detachable, so that they may be easily renewed when worn. The rollers are so proportioned to the false bottom or die that the periphery of the one is not an exact multiple of the other, so as to avoid wear at particular points caused by the constant coincidence of any one point on a roller with a corresponding point on the die. In order to increase the pressure between the crushing-surfaces by utilizing the centrifugal force exerted by the rollers when revolving

and to prevent pressure between the boss of a roller and its collar c^3, the face of the die or false bottom is so inclined that its outer is higher than its inner edge, and the inner edge of the roller corresponding to the latter is flanged, as indicated at c^4. The angle of such inclination of the die will vary with the weight of the rollers and the speed of revolution adopted in each machine.

The rollers are revolved on the die b by means of the carrier d, to an arm of which the axle-pin c^5 of each roller is joined by the pin-coupling d'. The play of the pin-coupling in said arm is such that upon a roller being lifted in passing over specially-hard ore the axle-pin c^5 rises until the outer end of pin-coupling d' bears against the under outer extremity of the carrier d, which then becomes lifted to some degree, the inner end of said coupling d' moving downwardly. This lifting motion, however, is not communicated to the other rollers in consequence of their free play downward upon their respective pin-couplings d' and the easy fit of the axle-pins c^5 in the boss of the rollers. The amount of play between the pin-coupling d' and the carrier d is proportioned to the lift considered desirable or necessary according to the nature of the ore under treatment, a consideration which must also be taken into account in adjusting the play between the axle-pin and the boss of the roller. A certain amount of play is likewise allowed proportionately between the boss of the carrier and the driving-shaft e, as hereinafter described.

The weight of the carrier rests upon the couplings of the rollers, so that normally they bear upward against the carrier.

The effect of the device is so contrived that notwithstanding the arms of the carrier being continuous and rigid when any one roller is lifted the others remain in ordinary contact with the ore and continue crushing by dead weight, while, on the other hand, as the joints tend to become rigid when upward stresses are exerted upon the rollers it follows that additional pressure may be communicated to the latter by downward stresses upon the carrier, as hereinafter explained.

Arm d^2 on the carrier d carries plows or guides d^3, so arranged as to gather in the ore and feed it under the rollers and to keep the mass in constant motion.

The carrier d is slipped over and rotated by the driving-shaft e, which is made of square section or any section other than circular at the point where it passes through and engages with the (correspondingly-shaped) hole in the boss of the carrier. This hole is made an easy fit, so that the shaft is not burdened with any of the weight of the rollers or the carrier, and the latter, moreover, has a certain amount of play on the shaft proportionate to the distance the rollers are allowed to lift. The shaft may, if desired, be of circular section throughout and engage with the carrier by means of a feather so long as the carrier is free to move vertically and has sufficient horizontal play for the purpose described.

The driving-shaft e is mounted vertically in bearings e' and e^2, is prevented from rising by the collar e^3, and is revolved by the bevel-gearing f, which in turn receives its motion through shaft g and pulley h from the propelling-engine. The driving-gear is placed low down near the foundation.

The rollers are made sufficiently heavy to crush by their own weight; but should it be needful at any time to increase the crushing pressure the following arrangement is provided for the purpose: At the top of the shaft e a hole is bored axially, in which the screw j can move freely. A plate j' is fixed to the top of the shaft, and in a centrally-bored tapped hole the screw j works. The lower extremity of this screw projects down to a bar j^2, inserted into a longitudinal slot cut through the shaft, its two free ends resting on a ring j^3. Upon the screw j being turned by a spanner it presses down the bar j^2 and the ring j^3 and compresses the spring j^4, whose lower end rests and exerts pressure on the carrier d, which transmits it to the rollers.

A hopper k, having outlets k' so placed as to deliver the ore fed into it in front of the rollers, is fixed on and revolves with the upper portion of the shaft e, as shown in Fig. 1.

Under the trough are two inclined tables l, which catch and carry away the tailings as they drop from the openings a'. Perforated pipes m are provided to supply water to the tailings when necessary and to wash down the tables.

The action is as follows: Broken ore is fed into the hopper, where it is mixed with water and distributed in front of the rollers. These moving slowly round pass over the lumps of ore and crush them. In one revolution the distance round the circular die traversed by the outer edge of the periphery of a roller is greater than that traversed by the inside edge, while the peripheral speed is somewhat retarded by the "slip" occasioned by its contact with the ore being crushed, so that there is a grinding as well as a crushing action. The plows and rollers keep the mass of ore in constant motion. When the ore has reached the required degree of fineness, it escapes through the meshes of the gauze in the openings or windows a', the combined area of which is large compared with the crushing area. After dropping from the grinding-trough externally through the space between the lip of the outer channel a^2 and the base of the casing a^4 and internally direct from the windows a' the tailings flow down the inclined tables l to be treated for extraction of

the metal as may be required. Should there not be liquid enough at this stage, more water may be supplied from the pipes *m*.

Doors opening downward are provided in the channels a^2 for the purpose of cleaning.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A machine for reducing ores comprising an annular trough, an inclined circular die therein, said trough having discharge-openings on both sides of the die, crushing-rollers running on said die, a central rotating shaft, a carrier mounted on said shaft and having vertical movement thereon and coupling-pins connected to the rollers and having pivotal movement in the carrier.

2. A crushing-machine comprising an annular trough, an inclined circular die therein, channels on each side of said die, said trough having discharge-openings therein on both sides thereof above the channels, crushing-rollers running on said die each roller having a tire thereon provided with a depending flange on one edge, a central rotatable shaft, a carrier having radiating hollow arms mounted to rotate with said shaft, said carrier having vertical movement on said shaft, coupling-pins fitting in said hollow arms and having pivotal movement therein, said pins being connected to the rollers, a spring surrounding said shaft and pressing on the carrier and means for adjusting the tension of the spring.

In witness whereof I have hereunto set my hand in presence of two witnesses.

HIRAM JONES.

Witnesses:

GILBERT KENT MOORE,

WILLIAM CONYERS.