

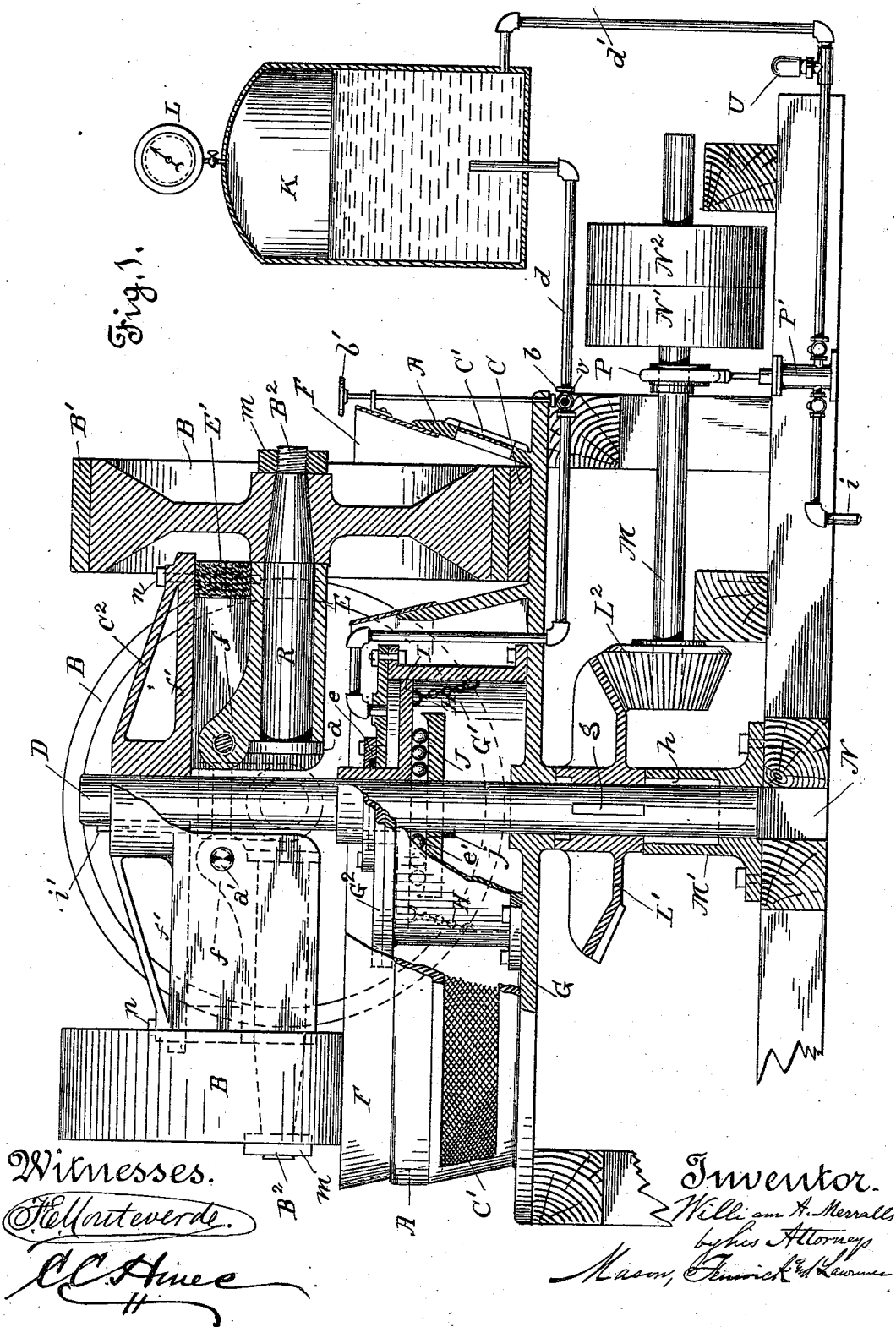
(No Model.)

2 Sheets—Sheet 1.

W. A. MERRALLS.
CRUSHING OR GRINDING MILL.

No. 501,433.

Patented July 11, 1893.



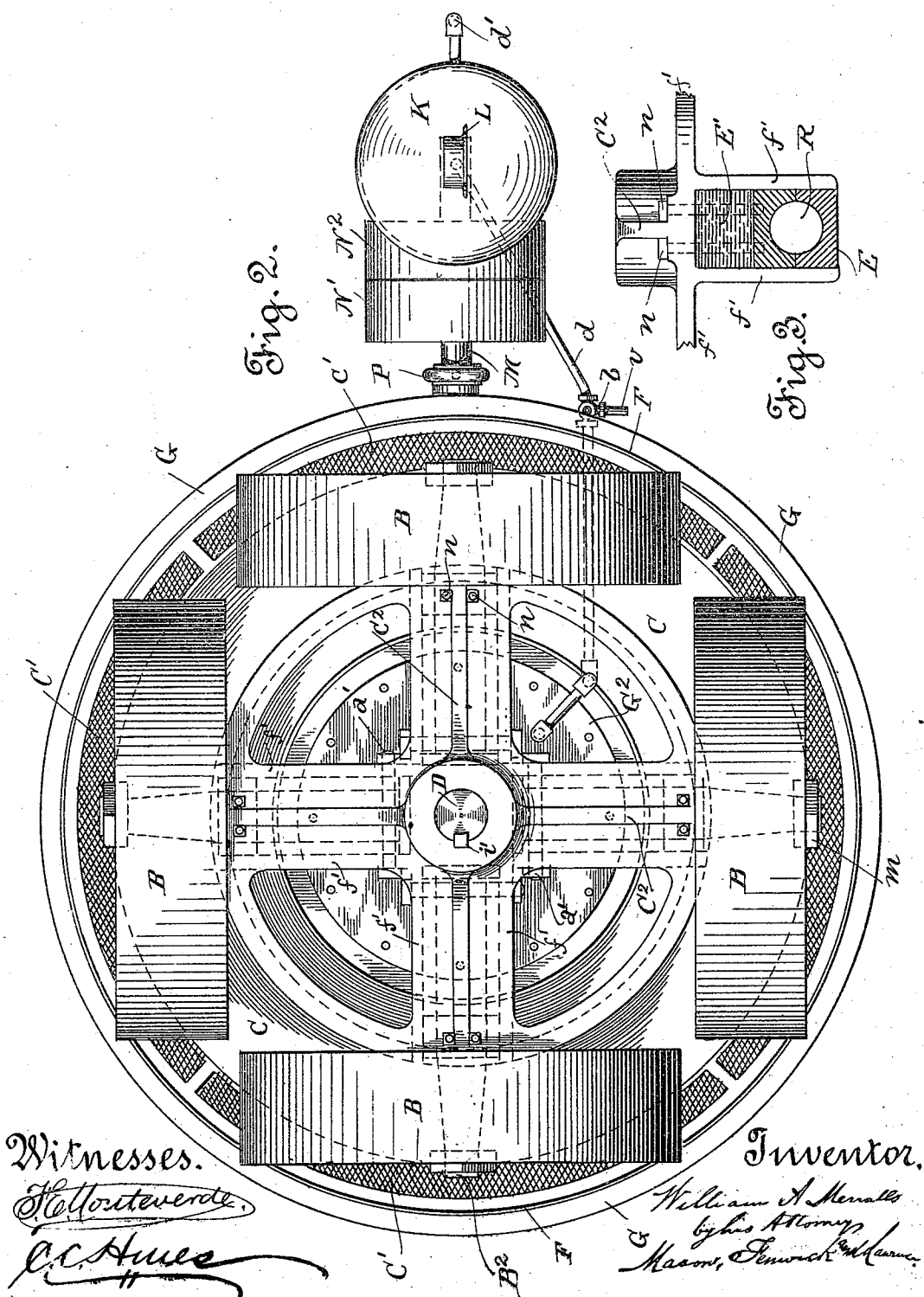
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UNITED STATES PATENT OFFICE.

WILLIAM A. MERRALLS, OF SAN FRANCISCO, CALIFORNIA.

CRUSHING OR GRINDING MILL.

SPECIFICATION forming part of Letters Patent No. 501,433, dated July 11, 1893.

Application filed February 16, 1893. Serial No. 462,548. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. MERRALLS, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Crushing or Grinding Mills; 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 to crushing or grinding mills, for ore and quartz; or such mills as are used for different kinds of pulverizing, and for grinding various materials.

My invention as herein illustrated is specially adapted for crushing ores or other materials by a rotary motion of wheels such as are used in the Chilian type of mill, but my improvements are not restricted thereto, as they can be adapted for use in an amalgamation pan or pans for regrinding; and in fact in all kinds of pans in which a rotary motion is adopted, and their operation effects the reduction of ore or other material to pulp of a given fineness.

My invention consists in certain novel features of construction, a novel combination and sub-combination and arrangement of parts, to wit: a pan or chamber, rotary wheels, hinged boxes for the shaft of the wheels to run in, a cylinder within the pan or chamber and provided with a piston working up and down in the cylinder and operated by either water, air or steam; balls, collar bearing, bearing balls running in a lubricant, a spider, suitable springs, pipe connections to a cylinder, relief valve, a pump and pressure tank for holding water or air under pressure.

In the accompanying drawings, Figure 1 represents a broken front elevation and partial longitudinal section of my improved mill; Fig. 2, a plan of the same, and Fig. 3 an enlarged detail view showing partly in end elevation and partly in section a portion of the spider.

A in the drawings represents an annular chamber or pan; B revolving, crushing or grinding wheels having hard iron or steel crushing rings B' around them, said rings serving as wearing shoes, and can be renewed when worn out.

C are hard, iron or steel dies arranged in a circle and lying on the bottom G of the annular chamber or pan, in the path of the revolving crushing wheels B, said wheels revolving with their wearing rings B' in contact with the upper surfaces of the dies.

D is an upright shaft having a spider *f'* keyed to it at its top, and a gear wheel L' splined to it near its lower end, as indicated at *g*.

E E indicate boxes in which the shafts R of the wheels B run, these boxes having, each, a broad lug *f* cast on their top half for the support of round steel bolts *a'*—forming hinged joints for the boxes to swing upon and to hold the revolving wheels in place while revolving in the annular chamber or pan; said bolts passing through the housing of the spider and through the lugs.

F is a circular rim of sheet iron applied around the annular pan or chamber A.

G' is a cylinder arranged on the bottom of the pan or chamber, so as to encircle the shaft D; and I is a piston also encircling the shaft and arranged within the cylinder.

H are stay chains inside the cylinder and fastened to the bottom of the piston I and to the sides of the cylinder G', and operating to keep the piston from turning. The piston is formed with a long sleeve which extends upward alongside the shaft D and through the cylinder cover G² and the stuffing box gland *e*.

J indicates a collar fastened by a key *j* and set screw to the shaft D. On top of the collar a number of round steel balls *e'*, are applied, the same rolling in a lubricant.

K represents an iron or steel tank for holding air and water under pressure; L a pressure gage on top of the tank and M a shaft to which is fastened at one end a gear wheel L² and on the other end a tight pulley N', and a loose pulley N².

N indicates an opening or space in the woodwork of the platform for allowing the shaft D to descend without obstruction as occasion may require.

P is an eccentric keyed to the shaft M for working a pump P', and thereby drawing water through suction pipe *i* and forcing it along a pipe *d'* into the tank K. The shafts R of the wheels B are provided with collars *a*, and the wheels B are forced upon the shafts against

these collars by hydraulic pressure, and thus the connection between the wheels and shafts is made solid and firm, and this connection is maintained by screw threaded nuts *m* applied on screw threaded ends *B*² of the shafts.

C' C' represent sections of a screen applied on the outside of the annular chamber or pan, and through these screen-sections, the ore pulp,—along with the water, discharges 10 when the ore has been reduced fine enough to be deposited as usual upon outside copper plates.

E' indicates rubber blocks, or spiral, or elliptical springs with bolts *n* running down through them and holding them in place.

M' shows a step for holding the shaft *D* in place, said step having a recess made in it as indicated at *h* for the spline or feather *g* to turn in when the shaft *D* is depressed or lowered to the extent of the spline *g*. *B* indicates a three-way cock with a stem or handle *b'*, and connected with the pipe *d* leading from the pressure tank *K* to the cylinder *G'*, said cock having an outlet *v* for waste fluid.

U represents a water, or air, or steam relief valve which can be set at any pressure desired.

The operation is as follows: To start the mill the driving belt (not shown) is shifted 30 from the pulley *N*² to the tight pulley *N'*, and thereupon the shaft *D* and its spider *f'* are caused to revolve and in turn the crushing and grinding wheels *B* are caused to swing around the shaft *D* and thereby grind the ore between their surfaces *B'* and the die *C*. The relief valve *U* is set, say, at one hundred pounds to the square inch, and by the revolution of the shaft *M*, the pump is set in operation and caused to force water along pipe 40 *d'* into the tank *K* and compress the air therein, and in a short time the desired pressure, or a pressure corresponding to the set of the relief valve is secured in the tank *K*. Ore or other material is now fed into the mill 45 either from a rock breaker or by hand or by an automatic feeder, and the crushing and grinding proceeds. The three-way cock is now opened so as to allow the water to pass from the tank *K* by the pipe *d* to the top 50 of the piston *I*, and by this means the pressure on top of the piston becomes the same as that in the tank *K*, and when this occurs, great pressure is exerted on said piston, and it is forced down upon the top of the steel balls *e'* and in turn upon the bearing collar *J* which is revolving with the shaft *D*. By having the steel balls between the piston *I* and bearing collar *J* friction is reduced, and by having the balls roll in a lubricant the friction is very slight indeed. The 60 pressure upon the piston pulls down the shaft *D* and spider *f'* bears forcibly against the rubber blocks or steel springs *E'*, and these rubber blocks or steel springs, by resting on top of the hinged boxes at one end, receive the full power or force of the water pressure used on top of the piston *I*, and thus a great

pressure is brought on the crushing wheels *B*, as said wheels swing around on top of the dies *C*, and the ore and other substances, being fed to the mill, are powerfully acted upon 70 and quickly reduced to a powdered condition, and being carried along with the water escape through the screen section *C'*, and discharge upon copper plates (not shown) outside the mill—that is, if free milling ore is 75 being crushed; or the crushed substances are discharged into a concentrator or barrels or any other receptacle for the crushed pulp. Any desired pressure can be brought upon the 80 crushing wheels *B* while the mill is running, by simply turning the set screw of the relief valve, this manipulation either increasing or diminishing the pressure. If it is desired to relieve the pressure on the wheels instantly, 85 all that is necessary is to turn the three-way cock so as to allow the water to flow from the top of the piston *I* down the pipe *d* and out at the waste *v*. The respective wheels act independently of one another, as each has its own hinged bolt *a'*, and should there by accident be some improper obstruction from hard 90 substances getting under the wheels,—for instance, a bolt, a nut or a sledge hammer,—each wheel is free to yield upward against 95 such obstruction and pass over the same without straining the central shaft. As the crushing rings *B'* and the dies *C* wear, the space *N* permits the shaft and other movable parts above the dies, to descend, the shaft passing 100 through the passage *N* to the extent required. The spline or feather in the shaft is sufficiently long to keep the shaft in gear with the wheel *L'*, notwithstanding its descending to an extent equal to the wear of the shoe rings *B'* and dies *C*. Leakage at the top 105 of the cylinder is prevented by the stuffing box. The long sleeve of the piston, permits the collar and the piston to descend, as the above mentioned wear takes place; and the stay chains *H* are fastened far enough down to not interfere when the piston descends, and, as hereinbefore stated, these chains keep the piston *I* from revolving with the shaft *D*. 110 If these chains were not employed the piston would soon destroy the cylinder by revolving with the shaft *D* and also injure the packing between the cylinder and the piston; and inasmuch as there is a very close relation between the long sleeve of the piston *I* and the packing of the stuffing box, the shaft will be kept 115 steady and plumb. Under my construction the mill can be driven either from below or at top; and either toothed gears, or ropes, belts, or any other known means for producing a 120 rotary motion may be adopted. By having air inside the tank *K* on top of the water, it acts as a cushion or spring, and should some dangerous obstacle get into the annular chamber, or pan, in the path of the crushing wheels, 125 there would be a yield of the parts instead of a breakage thereof, this resulting from the expulsion of the water from the top of the piston *I*, and returning into the tank *K*, the 130

air in the tank on the entrance of the water giving away, or becoming compressed so that it receives the force the same as a spring. The driving gear L' is so arranged between
 5 the bottom of the pan and the top of the step box, that it remains in place while the shaft D works up and down through it on the spline or feather g . In constructing the mill the oil passages are located in convenient positions
 10 for oiling it.

By my invention a very heavy crushing weight is brought on the ores or other substances being ground, without adding any auxiliary weights such as iron or stone in a
 15 tank on top of the revolving wheels; or by using large heavy wheels for cushioning. My wheels are light in themselves, but by the aid of the water pressure, I am enabled to get about twenty five tons pressure on each
 20 wheel on the four used in each pan or chamber. Any desired number of wheels may be used, the number depending upon the size of the mill in diameter.

What I claim as my invention is—

25 1. In a mill of the type described, the combination of a crushing chamber or pan having a discharge screen in its periphery, a cylinder, a piston, a vertically sliding and horizontally revolving shaft, a bearing collar, friction balls
 30 between the piston and the collar, hinged bearing boxes, grinding wheels, a spider to which the boxes of the wheels are hinged, suitable springs between the spider and the boxes of the wheels, means for supplying water or other fluid under pressure to the cylinder above the piston, and means for operating
 35 a fluid pump and the shaft that revolves the grinding wheels, substantially as described.

40 2. The combination of the shaft D, grinding wheels carried by the shaft, cylinder G' , collar J, balls e' , piston I, and means for supplying fluid under pressure to the cylinder, substantially as and for the purpose described.

45 3. The combination of the pan or chamber A, shaft D, cylinder G' , piston I, and chains H, substantially as and for the purpose described.

50 4. The combination of the pan or chamber having a screen applied in its periphery, cyl-

inder G' having die C on its bottom, piston I, bearing J provided with balls e' , spider f' , grinding wheels B having their shafts in boxes E hinged to the spider f' , springs E' applied between the boxes and the spider f' ,
 55 shaft D provided with a key g , gear L' , step M' having recess h , and the supporting platform having an opening N through it for the shaft D to move in, substantially as described.

5. The combination of the pan or chamber 60 A having a screen in its periphery, cylinder G' having a stuffing box or gland at its top, piston I having a long upwardly extended collar passed through the stuffing box, and chained against revolution; bearing plate J, balls e'
 65 and step M' having recess h , shaft D having spline g and gear L' , substantially as described.

6. The combination of the platform having opening N, pan or chamber A having die C, step M' having recess h , shaft D, piston I,
 70 cylinder G' , spider f' , shaft boxes E keyed to the spider, axles R having collars a , screw threads B^2 , wheels B, nuts m and springs E', substantially as described.

7. The combination with the pan or chamber 75 having a screen in its periphery and provided with a revolving and sliding shaft D having a splined gear L' , cylinder G' , piston I, and a dished bearing plate J having friction balls on its top, of the air and water
 80 tank K, pipes d d' and i , three-way cock b having a regulation stem b' , safety valve U, pump P', eccentric P, and gearing consisting of shaft M having fast and loose pulleys N' , N^2 and gear L^2 ; and with the step M' having
 85 recess h , and platform having opening N, substantially as described.

8. The combination of the relief valve U on pipe d' with the air and water tank K, pan or chamber A, pipe d having a three-way
 90 cock b , cylinder G' , piston I bearing plate J having balls on its top, shaft D, spider f' and hinged wheels B, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses. 95

WILLIAM A. MERRALLS.

Witnesses:

A. J. BASFORD,
 L. SMALL.