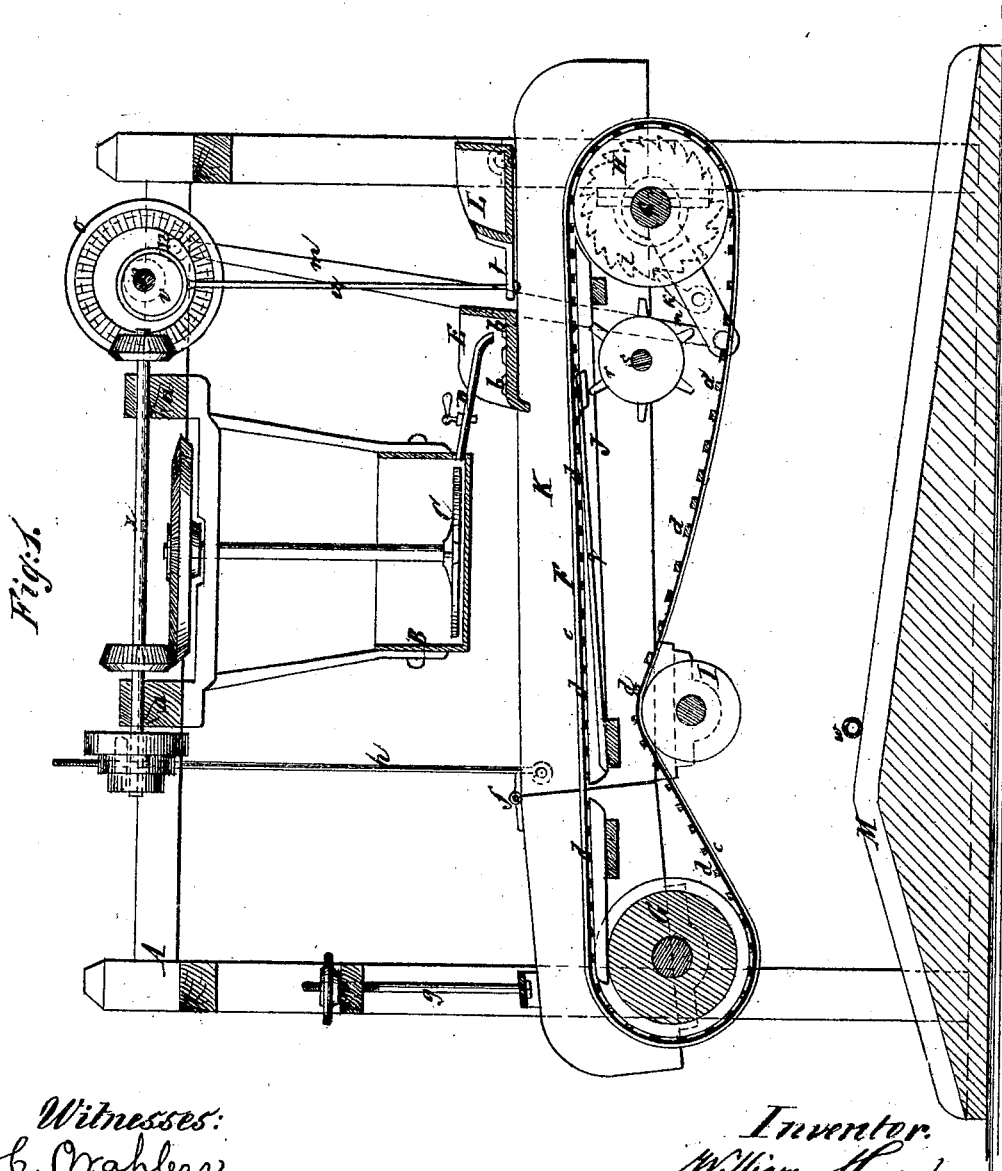


W. HOOPER.
ORE SEPARATOR.

No. 112,919.

Patented Mar. 21, 1871.



Witnesses:
G. W. Wablers
E. F. Kastenhuber

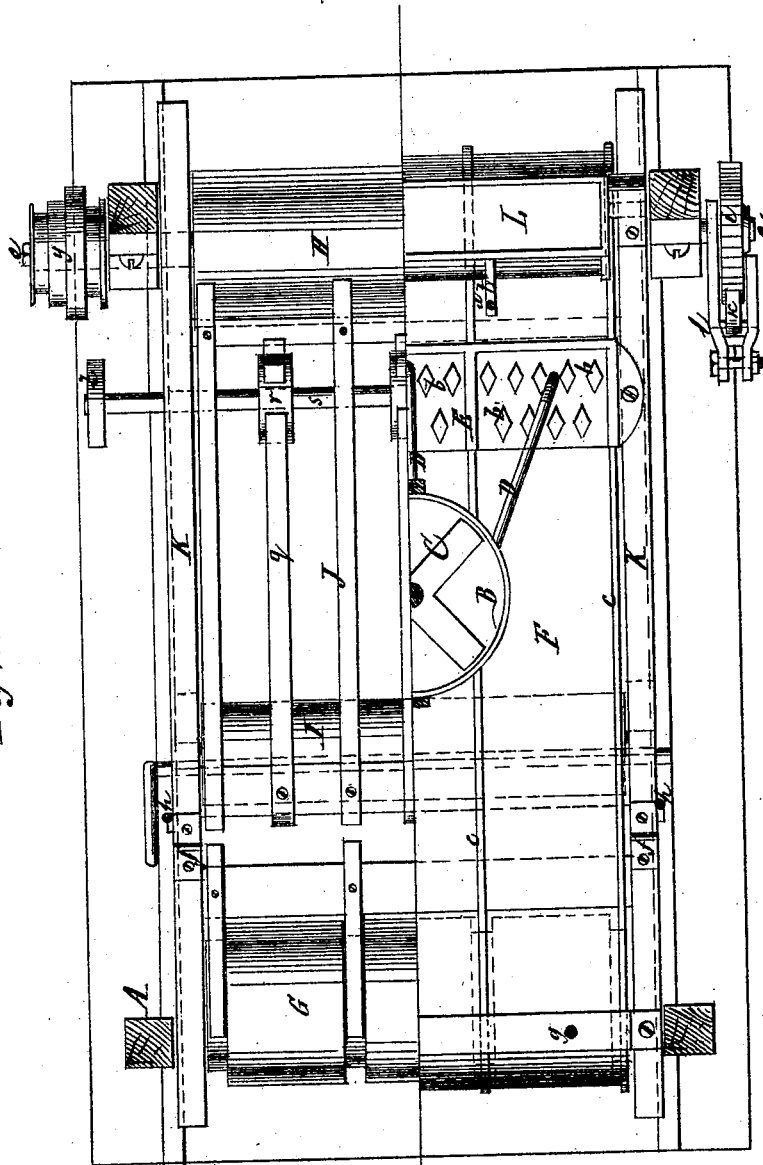
Inventor
William Hooper
per
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Fig. 2.



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United States Patent Office.

WILLIAM HOOPER, OF TICONDEROGA, NEW YORK.

Letters Patent No. 112,919, dated March 21, 1871; antedated March 10, 1871.

IMPROVEMENT IN ORE-SEPARATORS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, WILLIAM HOOPER, of Ticonderoga, in the county of Essex and State of New York, have invented a new and useful Improvement in Wet-Ore Separators; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawing forming part of this specification, in which drawing—

Figure 1 represents a longitudinal vertical section of this invention.

Figure 2 is a sectional plan or top view of the same.

Similar letters indicate corresponding parts.

This invention relates to a wet-ore separator or slime-machine, in which the separation of the light and heavy parts is effected by means of a sluiced endless apron, to which the ore is transferred through a mixing-tub, and which apron has an intermittent motion imparted to it by a ratchet-wheel and pawl. Said sluiced apron is strengthened by cross-ribs attached to its under surface, and it passes over rollers having their bearings in a frame or shoe hinged at one end, and provided at the opposite end with adjusting-screws, so that it can be set at any desired inclination.

The shoe is composed of two parts, which are connected by hinge-joints, and each of which is provided with adjusting-screws, so that one part of the apron can be set at a different inclination from the other part, and thereby the apparatus can be adjusted to suit the nature of the ore or other material to be separated.

Over the sluiced apron, and near its top end, is placed a water-tank, to which an oscillating motion is imparted; or it may be stationary, and plunging-blocks suspended over it and made to plunge in it, so that the water contained therein is splashed out at suitable intervals, and thereby the separation of the ore is materially facilitated.

Under the apron are placed two or more hammers, operated by cam-wheels, and caused to strike against said apron, for the purpose of shaking up the material lodged thereon.

A perforated pipe, extending across the bottom of the apparatus, and provided with holes, serves to throw jets of water against the apron, for the purpose of washing off such particles of ore as may adhere to the same.

The bottom of the apparatus is roof-shaped, to prevent the light and heavy parts of the ore from mixing after they have been separated.

In the drawing—

The letter A designates a frame, which supports the working parts of my invention.

In the upper part of this frame are secured two cross-beams, *a a*, from which is suspended the mixing-tub B.

This tub is supplied with ore and water, the ore having been previously reduced to the desired fineness by stamp-mills or other suitable apparatus, and by the action of the agitator C.

The mixed ore and water or the slime is caused to flow out through the pipes D, which terminate over the sluiced tank E.

This tank E is situated over the endless apron F, and its bottom is provided with a number of diamond-shaped projections, *b*, which serve to distribute the slime uniformly over the surface of the endless apron.

Said apron is divided by longitudinal strips *c* in three (more or less) compartments or sluices corresponding in width to the compartments of the distributing-tank E, and it (the apron) is strengthened by cross-ribs *d*, of wood or other suitable material, secured to its under or inner surface; and these cross-ribs also prevent the apron from wearing as it moves in its frame and over the rollers. By dividing the apron in several compartments the operation of separating the ore is rendered more uniform and the supply of slime to each compartment can be more readily controlled.

The apron is, by preference, made of India rubber, or other material impervious to water, and it is stretched over two rollers, G H, its bottom part being supported by a supplementary roller, I, while its top part rests upon a grate, J, situated between the two rollers G H.

The lower side of the apron sags or hangs loosely between the rollers H and I, which enables the hinge-joints *f* in the shoe K to be opened and shut freely, and also brings the apron in a position to be better acted upon by the jets of water from the pipe *w*, and greatly facilitates the operation of washing off the separated ore adhering to the apron. If the apron was tightly drawn the hinge-joints *f* could not be opened, and more water would have to be used to wash off the ore, and then it would not do it as well.

The roller H is mounted on a shaft, *e*, which has its bearings in suitable boxes secured to the main frame A, and on this shaft swing two arms, which, being connected by suitable cross-bars, form the shoe K. This shoe is made in two parts, which are connected by hinge-joints *f*, and the roller G has its bearings in boxes secured to the outer or lower part of the shoe.

Each of the two parts of the shoe is supported by screw-rods *g* and *h*, respectively, and by means of these screw-rods the inclination of the sluiced apron can be regulated. The lower or outer part of the shoe being hinged to the upper part can be brought in any desired inclination independent of the upper part, and the apron can be so adjusted that its upper surface is

either situated in one and the same plane, or that it forms a ridge or a depression in line with the hinge-joints *f*. I have effected very satisfactory separation without this hinged joint; but, for ores difficult to separate, this device greatly facilitates the process, and, in some instances, is indispensable.

On the end of the shaft *e* of the upper roller *H* is mounted a ratchet-wheel, *i*, to which motion is imparted by a pawl, *k*, secured to an arm, *l*, which swings on the shaft *e*, and the loose end of which connects, by a rod, *m*, with an eccentric wrist-pin, *n*, fastened in a disk, *o*, which is mounted on the end of a shaft, *p*. The wrist-pin *n* is made adjustable in its disk, so that the stroke of the pawl *k* can be changed, as may be required. By the action of this pawl and ratchet-wheel the roller *H* receives an intermittent motion, which is transmitted to the sluiced apron.

Under the upper part of the apron are situated three (more or less) hammers, *q*, which correspond in position to the compartments or sluices of the apron, and to which motion is imparted by cam-wheels *r*, mounted on a shaft, *s*, which has its bearings in the arms of the shoe *K*. By the action of these hammers the slime situated on the apron is agitated and the lighter parts are driven up, so that they will readily separate from the heavier parts. I have effected very satisfactory separation without thus agitating the ore; but, for ores difficult to separate, this agitation greatly facilitates the process.

Over the roller *H* is situated a water-tank, *L*, which is hung on gudgeons having their bearings in boxes secured to the shoe *K*.

From the tank extends an arm, *t*, which connects, by a rod, *u*, with an eccentric, *v*, mounted on the shaft *p*, so that, as this shaft revolves, an oscillating motion is imparted to the water-tank; or the rod may be connected to plunging-blocks suspended over the tank, and the water contained therein is splashed over the sluiced apron either by oscillations of the tank or by such plunging-blocks, so as to wash off the light parts raised by the action of the hammers *q*. The apron is at rest when the water is splashed on it, and the moment the splash ceases the apron is moved upward, so that the separated ore adhering to the apron at that point passes out of reach of the next splash.

The bottom *M* of the apparatus is roof-shaped, as shown in fig. 1 of the drawing, the ridge of said bottom being situated between the roller *G* and the supplementary roller *I*; and across said bottom, below the supplementary roller, is situated a water-pipe, *w*, perforated with a number of small holes, so that, if said pipe is supplied with water, under pressure, a number of fine jets will be thrown up against the apron, for the purpose of washing off any metalliferous particles which may adhere to the same.

The shaft *p* connects by a bevel-gear with the driving-shaft *x*, and on the end of the shaft *p* is mounted a cone-pulley, from which extends a belt to a corresponding cone-pulley, *y*, which connects by another belt with a pulley, *Z*, on the end of the hammer-shaft.

The pulley *y* is mounted loosely on the end of the shaft *e*, which forms the center of motion of the shoe *K*, so that, in adjusting the shoe up or down, the relation of the two pulleys *y* and *Z* is not changed.

By the action of the apron the heavy parts of the ore are carried up over the roller *H*, while the light parts are discharged down over the roller *G*. In some ores, such as graphite or plumbago, the impurities are heaviest, and pass up over the roller *H* as tailings, while the particles sought to be saved are lighter, and are consequently carried down the apron over the roller *G*. In such cases the valuable particles would be saved at the tail of the machine, where the impurities of other ores usually pass off.

In the treatment of some kinds of ores the surface of the sluices on the apron should be plain or smooth.

In the treatment of some other kinds of ores such surface should be indented, corrugated, roughened, or rifled, and in the treatment of still other kinds of ores or earths the surface of the apron in the sluices may be covered or lined with strips of blankets or other suitable woollen fabric or its equivalent. These modifications and appliances will depend on the peculiar character of the ores or substances to be treated, but for most ores and substances required to be separated a plain surface to the apron between the sluices will be sufficient.

This machine may also be used as a "picking table" and for "washing up" ores. This process is sometimes necessary. In such cases those kinds of coarsely-broken ores which are usually picked over by hand will be shoveled or fed onto the machine under the mixing-tub *B*, and water will be supplied to such tub, and discharged therefrom through the pipes *D* into the sluiced tank *E*, and thence over the sluiced apron *F* upon and among such ore. The earthy matter and lighter particles will gently pass off over the tail of the apron. The lower end of the apron, below the hinged joint *f*, can be raised so as to keep all heavy pieces on the apron, and then the intermittent upward movement of the apron will convey them to the upper end of the machine, where the cleaning process is still further carried on by the water which is splashed out of the oscillating tank *L*, and then the further upward movement of the apron finally deposits the washed ore upon the roof-shaped bottom *M* by its own gravity and by jets of water projected from the pipe below, as above described. Sometimes it will be best to have one or more persons (usually boys) stand by the machine while in motion to pick out of the washed ore, before it leaves the apron, such lumps of pure ore as may be visible, also lumps of worthless rock, and then the balance will be conveyed to the crushers or stampers for further treatment.

For most fine, light ores it will be necessary to elevate the roller *G*, to prevent any valuable metalliferous particles from passing off with the waste or "tailings."

With this machine, and the dry-ore separator described in the specification annexed to the Letters Patent issued to me by the United States dated March 22, 1870, and in the specification annexed to my application lately made for improvements in that machine, I expect to be able to satisfactorily and profitably separate all kinds of ores now capable of being separated by any known process, either wet or dry; also some ores not heretofore successfully separated. Some ores, such as magnetic iron ore, containing a gangue, may be satisfactorily separated by my dry-ore separator alone, but for many other ores it will be better to use both machines. For example, if the rock is quartz, containing, say, ten per cent. (more or less) of argentiferous galena, or of iron or copper pyrites, it should be crushed or stamped sufficiently to disengage the crystals of galena or pyrites from the quartz, and its comminution should be pushed no further than can be practically avoided. This crushed ore should be screened with, say, a No. 80 or a No. 60 screen, for the purpose of taking out the fine dust, which will, of course, contain some particles worth saving. The ore thus screened should be passed through my dry-ore separator, and the fine dust should be treated in my wet-ore separator.

The dry machine generally works best when the fine dust is first taken out of the crushed ore, although some ores do not require this to be done, while the wet machine generally works best on finely-pulverized ore, although some ores can be separated upon it when coarsely broken or granulated.

At some mines the dry machine alone will suffice, at others the wet machine will be alone sufficient, and at others both will be needed. In many cases the use of both will save much expense in crushing or pulver-

izing. My wet machine is peculiarly adapted for the treatment, more especially, of what are called "slime ores," while my dry machine is peculiarly adapted for the treatment of ores which do not require to be finely comminuted in order to free the metaliferous particles from the gangue.

Some ores containing gold or silver, and now treated with quicksilver, may be separated on my wet machine, so that the metal can be saved without employing the process of amalgamation at all; and I propose to use it in working over the tailings of such ores produced in mining operations, and containing precious metals not saved by any other process or processes employed in their treatment.

When water is not accessible for the treatment of an ore or deposit for which my wet separator is adapted, it will often happen that my dry separator can be employed with satisfactory profit, although my wet separator would do the work more efficiently if water could be had; and in some cases, where water can be had only a portion of the year, my dry separator could be used during the dry season, and the tailings and screenings, if they contained valuable particles, could be treated in my wet separator when the wet season returned. Thus it will be seen that both my machines are intended to combine all the requisites of a complete process for the separation of ores capable of being separated and which it is desirable to separate; and I have referred to my dry separator in this specification for the purpose of more clearly showing the novelty and usefulness of my wet separator, which is the subject of this application.

What I claim as new, and desire to secure by Letters Patent, is—

1. The endless apron F, having an intermittent motion imparted to it, substantially as and for the purpose described.
2. The endless apron F, with its surface in the sluices indented, corrugated, roughened, or riffled, substantially as described.
3. The arrangement of strips or blanket or other woolen fabric, or its equivalent, on the endless apron F in the sluices, substantially as described.
4. The arrangement of longitudinal strips on the endless apron, substantially as described.
5. The shoe K, divided in two parts, connected by hinge-joints, in combination with the adjusting-screws and with the endless apron, substantially as set forth.
6. The agitating-hammers g, in combination with the endless apron, substantially as described.
7. The cross-ribs d, extending over the inner surface of the apron F, substantially as set forth.
8. The tank L, oscillating or with plunging-block, in combination with the endless apron, substantially as described.
9. The roof-shaped bottom M, in combination with the endless apron, substantially as set forth.
10. The perforated water-pipe w, extending across the bottom M, in combination with the endless apron, substantially as described.

WILLIAM HOOPER.

Witnesses:

J. B. RAMSAY,
JOHN C. FENTON.