No. 676,679. Patented June 18, 1901.

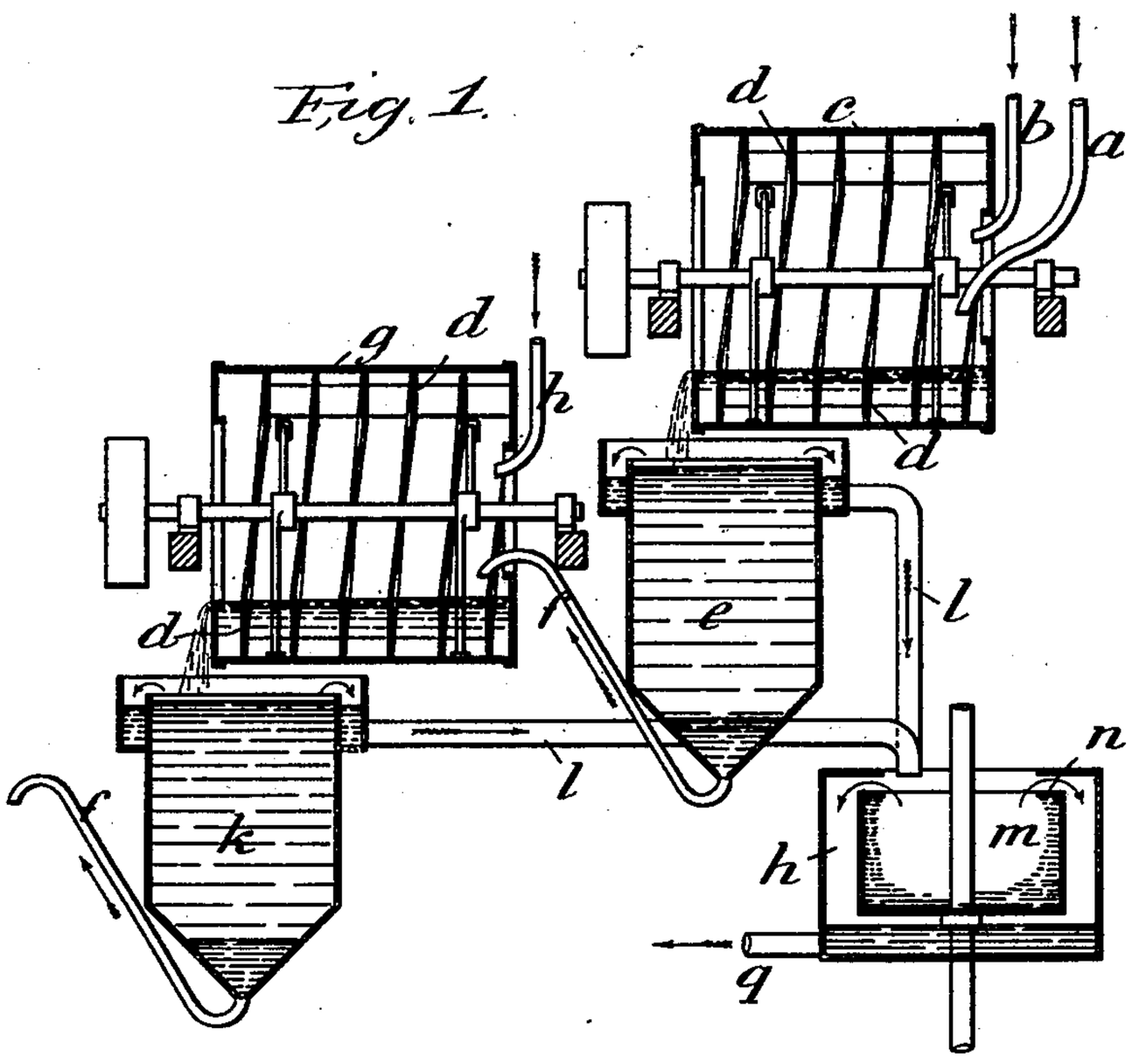
F. E. ELMORE.

PROCESS OF SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

(Application filed Apr. 10, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses
W. B. Keeler
Bruce S. Elliott.

Inventor
Francis E. Elmore
By James L. Norris
Atty

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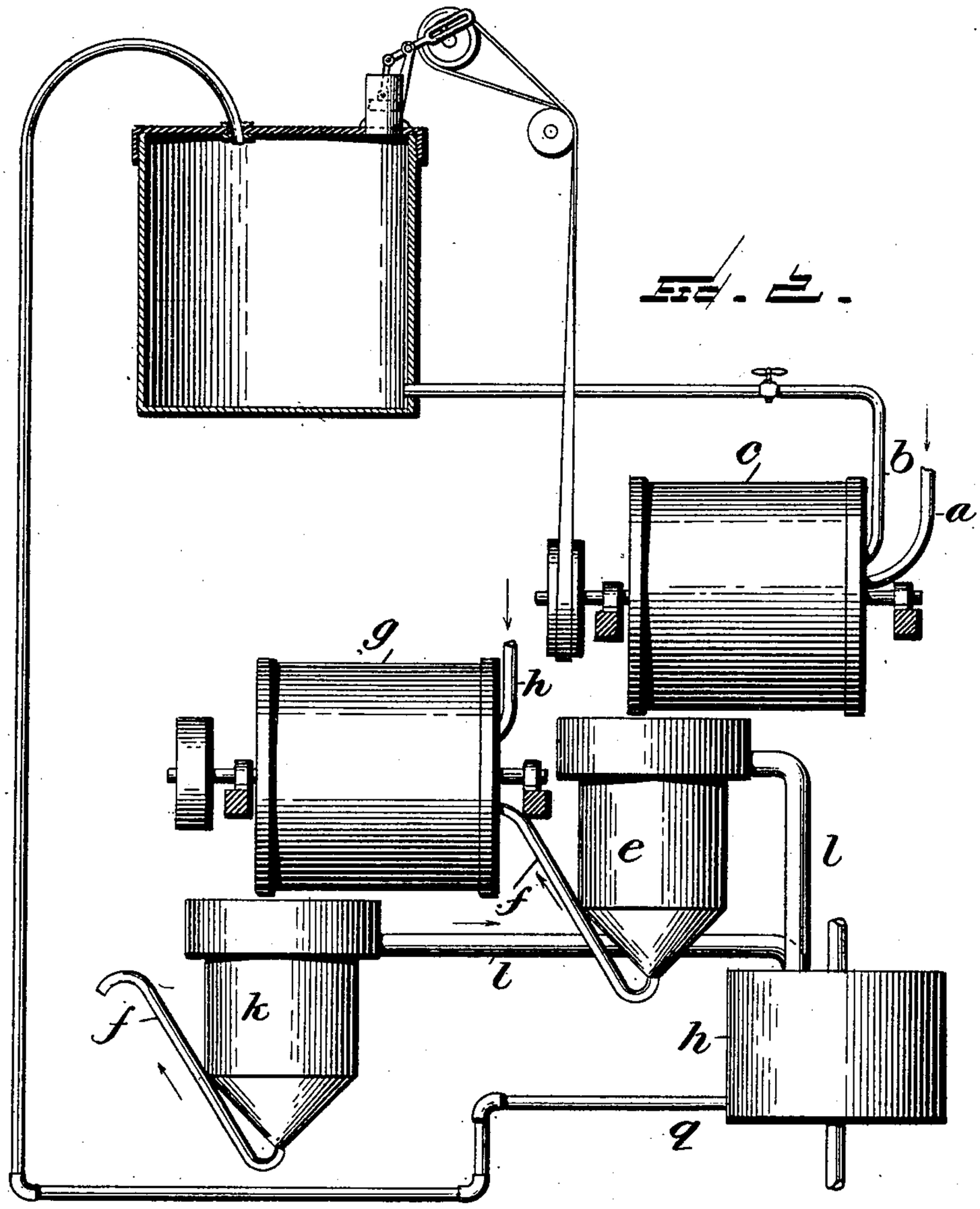

Witnesses:
L. C. Hills.
W. O. Keeler

Inventor
Francis E. Elmore
By James L. Norris.
Attorney

UNITED STATES PATENT OFFICE.

FRANCIS EDWARD ELMORE, OF LEEDS, ENGLAND.

PROCESS OF SEPARATING METALLIC FROM ROCKY CONSTITUENTS OF ORES.

SPECIFICATION forming part of Letters Patent No. 676,679, dated June 18, 1901.

Application filed April 10, 1899. Serial No. 712,454. (No specimens.)

To all whom it may concern:

Be it known that I, FRANCIS EDWARD ELMORE, electrometallurgist, a citizen of England, residing at Pontefract road, Hunslet, Leeds, in the county of York, England, have invented certain new and useful Improvements in Processes of Separating Metallic from Rocky Constituents of Ores, (for which I have applied for a patent in Great Britain, dated October 18, 1898, No. 21,948,) of which the following is a specification.

My invention relates to a method of separating metallic constituents of ore from rocky and other impurities, which is distinguished from the usual amalgamation processes in which the ore forms an amalgam with mercury.

It consists in mixing the crushed ore with water and mixing with the ore and water a substance other than mercury which has the power of causing the metallic portions of the ore only to adhere to it, while the water and rock or other impurities of the ore remain unaffected and may be drawn off. The metallic constituents of the ore are then recovered from the substance in which they are entrapped. I have found that the heavier oils are efficacious for this purpose and particularly that kind of oil known as the "residuum" of mineral oil after the more volatile elements have been distilled off.

In carrying out my process I prefer to mix the ore with water—as, for instance, by the wet crushing method in common use—using a sufficient quantity of water to make a freely-flowing mixture, the fineness of the ore depending upon the particular kind of ore treated. I then place the ore and water in a suitable vessel, add a quantity of the oil depending upon the particular kind of ore under treatment, and then agitate the mixture without breaking up the oil into small globules. The metallic particles will adhere to the oil and be buoyed up and floated by it, while the other constituents of the ore will remain in the water. The water and attendant impurities are then drawn off, leaving the oil and metallic particles. The metallic particles are easily separated from the oil by mechanical or other means.

In the accompanying drawings, Figure 1 is a vertical sectional view of an apparatus suitable for carrying my invention into practice, omitting the elevated cistern; and Fig. 2 is a side elevation of the apparatus, showing the elevated cistern.

In order to enable those skilled in the art to practice my invention, I will now describe the same in detail, with reference to the drawings.

The mixture of pulverized ore and water supplied by pipe *a* and also the oil supplied by pipe *b* flow into one end of a drum *c*, which slowly revolves on a horizontal axis. At each end of the drum there is a circular opening, and within the drum annular helical ribs *d* extend from end to end, the spaces between these ribs being divided into cells by a number of equidistant blades. The ore and water and the oil, which are thus mingled without being broken up so as to form a uniform mixture, are carried from the end of the drum where they entered to the opposite end, whence they are discharged into a vessel *e*, in which the water and rocky constituents mostly subside, while the oil, with the metallic constituents, floats above. The lowest layer is drawn away as tailings, which may be again treated with oil by leading them by a pipe *f* to a second drum *g*, where they are again mixed with oil supplied by a pipe *h*, the mixture being discharged into a second subsidence vessel *k*. This may be again repeated until little or none of the metallic constituents remain in the tailings. The upper layer from the subsidence vessels is led by pipes *l* into a centrifugal drum *m*, containing a little water. As the drum rapidly revolves the metallic particles are caused by centrifugal force to pass from the oil to the water, which forms a layer next the circumference of the drum, the side of which is closed, while the oil, being lighter, flows over an inwardly-projecting lip *n* into the casing *h'* of the drum, whence it is removed by a pipe *q* to be used over again. When the layer of particles and water in the centrifugal drum attains a certain thickness, the drum is stopped, the layer is removed, and the drum receives a fresh charge of water and is again worked.

The oil may be pumped up through pipe *q* to an elevated cistern *o* to supply the drums *c* and *g*; but in order to clear the oil from

air-bubbles I prefer to draw the oil up to the cistern by creating a partial vacuum in the cistern through the medium of any suitable means, such as a vacuum-pump p'.

In carrying out my invention I do not employ an oil mixture. The thick oil of the kind before set forth, with the metallic ingredients entrapped in it, floats over the water, which holds in suspension the earthy ingredients which have no oil whatever adhering to them.

Instead of employing centrifugal force to separate the oil from the metallic matters mixed with it the mixture may be thinned by heating it or mingling it with solvents of the oil, such as benzolin, and left for subsidence or subjected to filter-pressing, so that the greatest portion of the oil can be recovered for subsequent use.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. The process of separating the metallic from other constituents of ore, which consists in mixing with crushed ore to which sufficient water has been added to make a flowing mixture a substance other than mercury to which the metallic particles only will adhere, and then recovering the metallic particles from such substance, substantially as described.

2. The process of separating the metallic constituents of ore from the rocky or other impurities, which consists in mixing crushed ore with a sufficient quantity of water to make a flowing mixture, mixing with the ore and water a quantity of oil, and recovering the metallic particles from the oil, substantially as described.

3. A process of separating the metallic from the other constituents of ore, which consists in mixing crushed ore and water to form a flowing mixture, mixing with the ore and water a substance other than mercury to which the metallic particles only will adhere, separating the water and impurities from the substance containing the metal, and recovering the metal from such substance, substantially as described.

4. The method of separating the metallic from other constituents of ore which consists of commingling pulverized ore to which sufficient water has been added to make a flowing mixture with oil, separating the oil and metallic constituents contained therein from the water and impurities, and separating the metallic constituents from the oil, substantially as described.

5. A process for separating metallic from rocky constituents of ore by mixing the pulverized ore with water and mixing the ore and water with oil, allowing the water carrying rocky materials to subside, while the oil carrying metallic constituents floats above, and separating the oil from these constituents substantially as described.

6. The improved process for separating metallic from rocky constituents of ore which consists in mixing the pulverized ore with water, flowing the same into contact and admixture with flowing oil, subjecting the mixture of ore, water and oil to subsidence, and then separating the oil from the rocky constituents and water, substantially as described.

7. The herein-described process for separating the metallic from the rocky constituents of ore, which consists in first mixing pulverized ore with a large quantity of water to maintain the mixture in a freely-flowing condition, then adding to this mixture of water and ore a thick oil of the character set forth, which oil will adhere to the metallic constituents but not to the wet rocky constituents, then subsiding the water and rocky material and causing the oil carrying the metallic constituents to float off over the body of water and finally separating said oil from said metallic constituents, substantially as specified.

8. The herein-described process for separating the metallic from the rocky constituents of ore, which consists in first mixing pulverized ore with a large quantity of water to maintain the mixture in a freely-flowing condition, then adding to this mixture of water and ore a thick oil of the character set forth, which oil will adhere to the metallic constituents but not to the wet rocky constituents, then subsiding the water and rocky material and causing the oil carrying the metallic constituents to float off over the body of water and finally separating said oil from said metallic constituents by centrifugal action, substantially as specified.

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

FRANCIS EDWARD ELMORE.

Witnesses:

THOMAS BROWN,

THOBIAS HENRY BUTT.