No. 679,901. Patented Aug. 6, 1901.

T. J. LOVETT.

PROCESS OF TREATING METAL BEARING ROCK.

(Application filed Oct. 29, 1900.)

(No Model.)

Fig. 1.

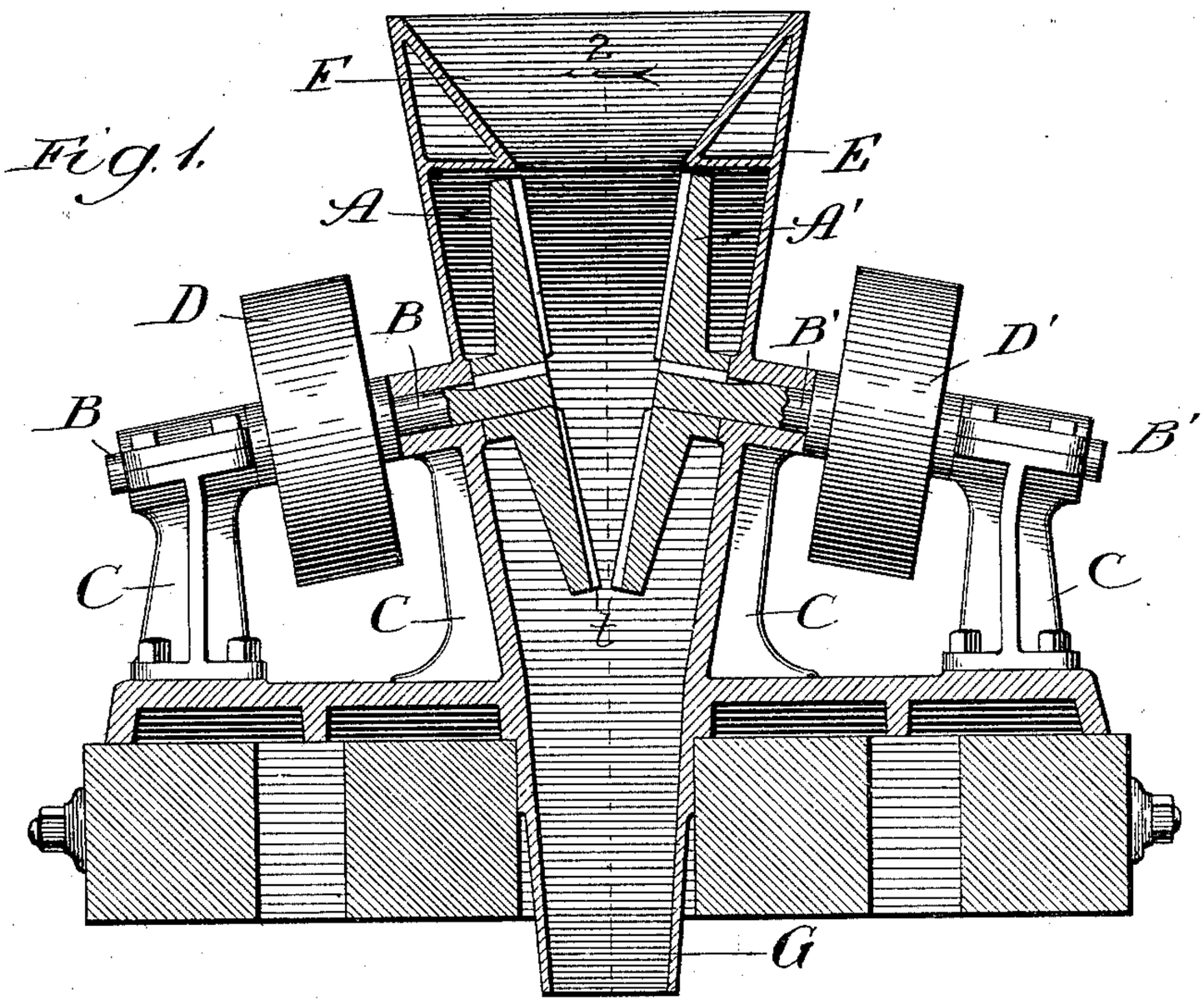
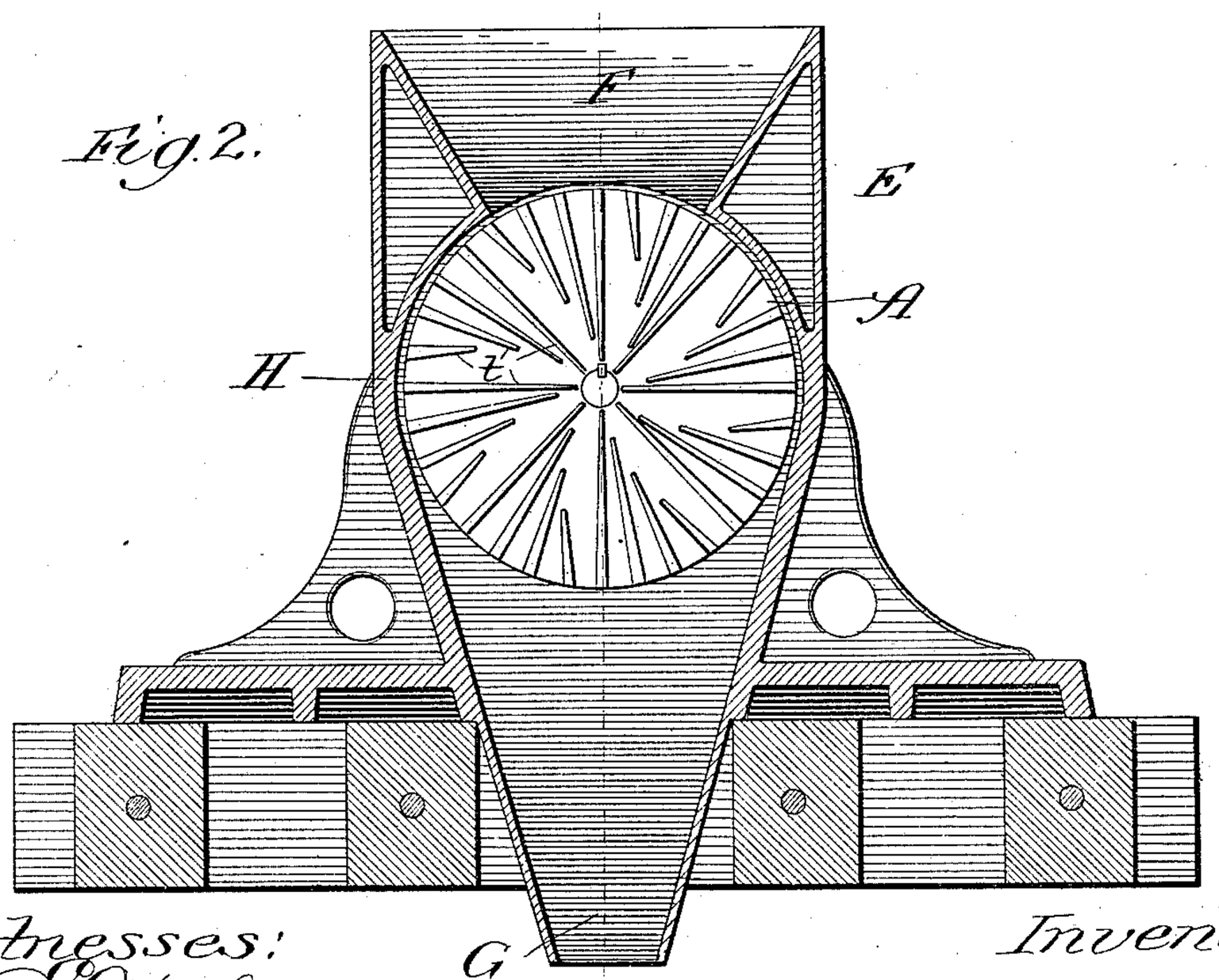


Fig. 2.



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UNITED STATES PATENT OFFICE.

THOMAS JEFFERSON LOVETT, OF CHICAGO, ILLINOIS.

PROCESS OF TREATING METAL-BEARING ROCK.

SPECIFICATION forming part of Letters Patent No. 679,901, dated August 6, 1901.

Application filed October 29, 1900. Serial No. 34,697. (No specimens.)

To all whom it may concern:

Be it known that I, THOMAS JEFFERSON LOVETT, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Processes of Treating Copper-Bearing Rock, of which the following is a specification.

My invention relates to an improved process of treating copper-bearing rock for the purpose of permitting the separation of the metal therefrom with economy.

The invention is particularly applicable to that class of copper-bearing ore in which the metal is found in scales of varying dimensions, but usually very thin, frequently lying between laminations of the rock.

As a general statement it may be said that in certain regions of the United States where the copper deposit is of great richness the conversion of the ore into a commercial product is rendered unprofitable by the difficulty attending the separation of the metal from the gangue. The common methods of preparing the rock for the separation of the metal therefrom are that employing concussion or that employing abrasion, the former, which involves the use of the stamp-mill, being much the more common. It is found in the treatment of the copper-bearing ore or rock, in which the native copper lies in scales in the rock, that the method of breaking up the non-metallic substance by concussion, as in the stamp-mill, reduces the thin particles of copper to a dimension where they float off in the subsequent washing operation as freely as the non-metallic material, so that after the washing operation has been performed the deposited copper presents so small a proportion to the mass of the metal and the amount carried off in the tailings is such a large percentage of the mass that the operation of separation is wholly unprofitable. Abrasion when employed as a means for separating the metal from the non-metallic gangue or ore is an operation too slow for successful application in the treatment of a metal having the low commercial value of copper, and it is therefore not used, so far as I am aware. The stamp-mill may be and is successfully used in the treatment of copper-bearing ore or rock in which the metal is not in a position itself to be broken into fine particles by the stamp-mill, and with metal-bearing rock of this character my process, while useful, presents fewer elements of advantage than with metal-bearing rock in which the copper is found in thin scales of variable dimensions.

My invention has for its object the alteration of the form or shape of the copper, whereby in its new shape or configuration it more readily separates by gravity from the triturated gangue or rock during the common washing operation or any usual substitute therefor.

A further object of my invention is to enable this change in the shape of the copper to be effected economically and as an incident to the operation of triturating the non-metallic body associated with the metal.

To these ends my invention consists in subjecting the particles of ore or rock with which the copper is associated, when the copper is in the form of native copper, to a simultaneous triturating and torsional impact action, whereby the non-metallic element is reduced to a finely-divided condition or to a condition reasonably approaching this, and the copper particles are twisted or massed into pellets, slugs, or the like condition.

My invention further consists in the details of operation, all as hereinafter more fully set forth.

In the drawings, Figure 1 is a sectional view on line 1 of Fig. 2 of a mill adapted to carry my invention into effect; and Fig. 2 is a vertical transverse section on the line 2, Fig. 1, viewed in the direction of the arrow.

It should be stated that the apparatus illustrated in the drawings and hereinafter described is only one form of apparatus capable of carrying my invention into effect and is used for purposes of illustration mainly, because it is the simplest form known to me by which the advantages of my invention may be obtained.

A A′ represent two disks each having burs or strikers *t*, each disk mounted at the end of a shaft B B′, suitably supported, as in the standards C, and each shaft B B′ is arranged to be driven at a high rate of speed through the pulleys D D′, which pulleys are operated to rotate in opposite directions, thereby giving opposite rotation to the disks

A A'. The disks are oppositely inclined, whereby the space between them is less at the lower than the upper end, as shown in the drawings. Surrounding the disks A A' is a casing E, the upper end of which forms the hopper F, the lower end the discharge-outlet G, and the sides H of which approach so closely to the edges of the disks A A' as to prevent the material between the disks from clogging the apparatus.

The operation is as follows: The ore, rock, or it may be the gangue, broken into irregular lumps, preferably of small dimensions, is placed in the hopper and caused to enter the space between the disks. As these disks rotate in opposite directions they serve to impel and grind the lumps of ore or rock against each other, causing a rotary movement of the rocky particles in opposite directions and simultaneously a torsional impact of the rocky particles against each other. This combination of impact with torsional action produces the trituration of the rock and the rolling, twisting, or massing of the thin scales of native copper into more compact forms, resembling slugs, pellets, or the like. Where the particles of copper are rubbed against each other by this process of attrition, it may happen that certain of the particles become twisted or otherwise massed together into a single pellet or slug, and where the metallic scale receives a torsional attrition from non-metallic rock the effect is to twist it into slug, pellet, or similar shape, in which it is capable of ready separation from the non-metallic surroundings. The mass of triturated non-metallic material and twisted or otherwise altered metallic material may then be subjected to the ordinary washing operation or other means of concentration, under which the non-metallic substance is floated off, while the metallic element deposits by gravity. It will be obvious that the changed form of the copper enables it to precipitate by gravity much more readily than when it is in the form of a thin scale, and by this process I have succeeded in recovering a very large percentage of native copper held in its rocky environment, where by the other processes of concussion or abrasion applied to the same physical conditions I have succeeded in recovering at the utmost only a very small and unprofitable percentage. It will be observed that concussion of a character which would tend still further to flatten the copper is entirely avoided in carrying out my process. On the contrary, the tendency is not to subdivide the copper, but to increase the bulk of each particle by adding to it adjacent particles which become twisted or otherwise agglomerated therewith under the process of attrition. It is one of the advantages of my process that it is equally effective whether the metal be in large or small scales and whether of uniform or variable thickness.

The essential characteristic of the invention is that it takes advantage of the pliable nature of the native copper and the friable nature of the non-metallic surroundings, and by a method of attrition involving impact pressure and torsional action simultaneously breaks up the friable mass and rolls up or masses together the pliable substance. This, so far as I am aware, has never before been done in connection with the separation of native metal from its ore or rock.

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

1. The process of treating native copper-carrying rock or ore, which consists in subjecting it to simultaneous triturating and torsional impacts, whereby the non-metallic part is broken up and the copper part is formed into lumps of slug, pellet or similar shape, as described.

2. The process of treating a native copper-bearing ore or rock to render the metal more easily separable from its rocky environment, which consists in subjecting a mass of the broken ore or rock to simultaneous triturating and torsional impacts, whereby each particle of the rock grinds upon its neighbor producing the trituration of the non-metallic element and the forming of the copper into lumps of slug, pellet or similar shape, substantially as described.

3. The method of treating native copper-bearing ore or rock, in which the metal is presented in the form of scale, which consists in subjecting a mass of broken ore or rock to a grinding impact action and a simultaneous torsional action, whereby the non-metallic ore or rock is broken and the copper scale is twisted into a compact form, substantially as described.

4. The process of treating native copper-bearing ore or rock, which consists in subjecting a mass of the broken ore or rock to a grinding impact action operating in different directions on opposite sides of the mass, whereby attrition between all the particles of rock is effected, and the non-metallic element is crushed into smaller particles while the native copper is twisted, rolled or massed into pellet, slug, or similar shape, substantially as described.

THOMAS JEFFERSON LOVETT.

In presence of—
D. W. LEE,
ALBERT D. BACCI.