No. 670,441. Patented Mar. 26, 1901.

H. M. SUTTON & W. L. STEELE.

PROCESS OF CONCENTRATION.

(Application filed Aug. 23, 1900.)

(No Model.)

Fig. 1.

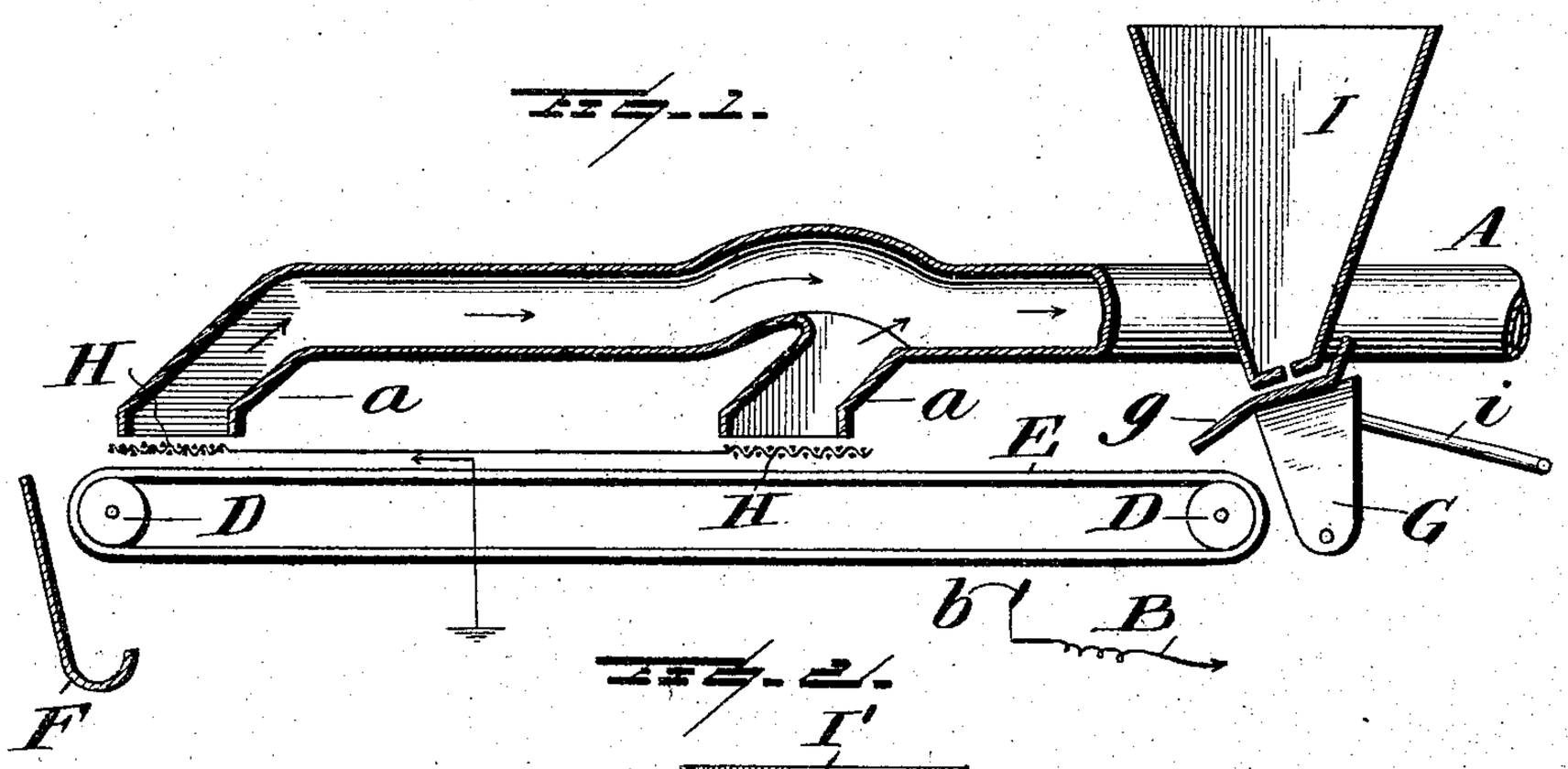


Fig. 2.

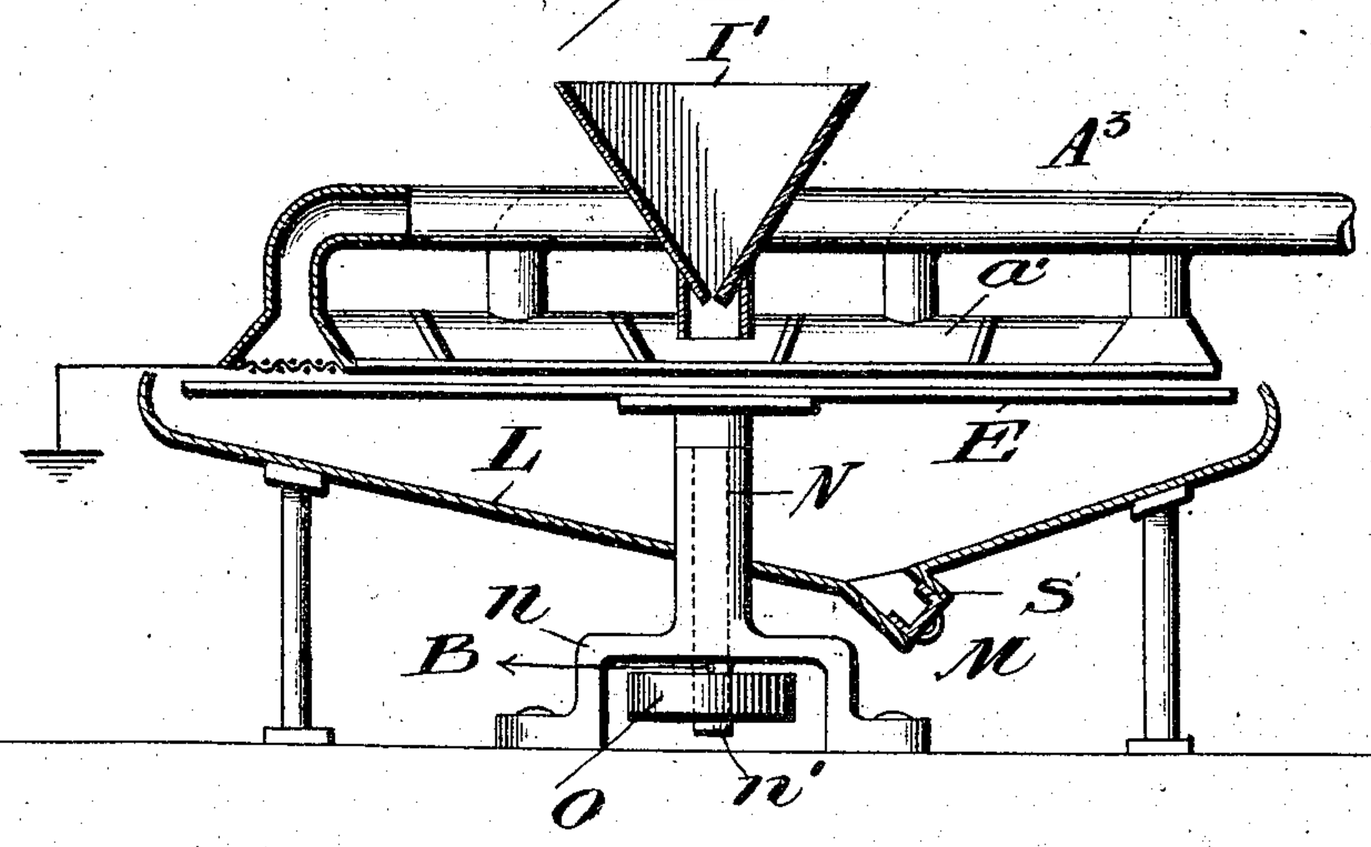


Fig. 3.

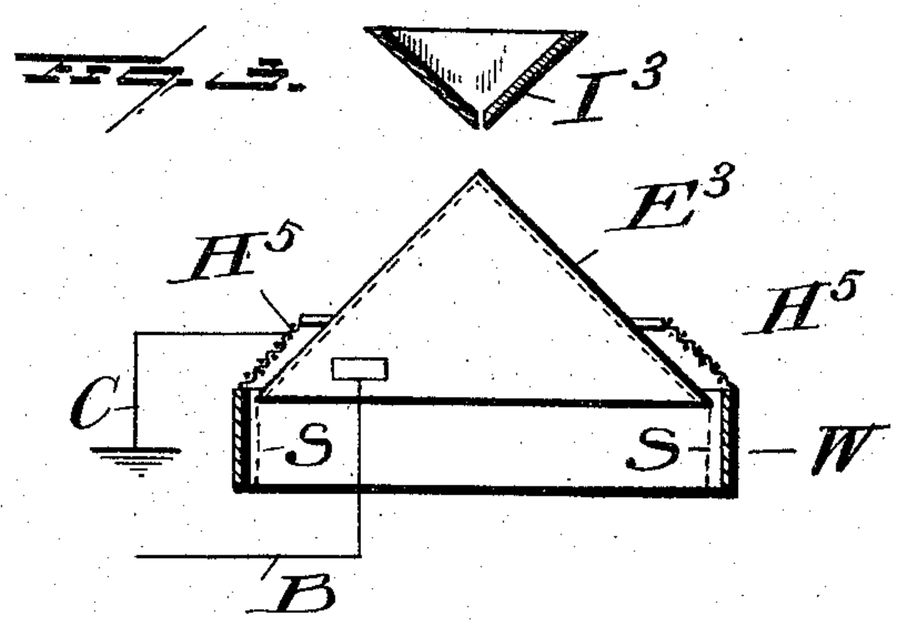
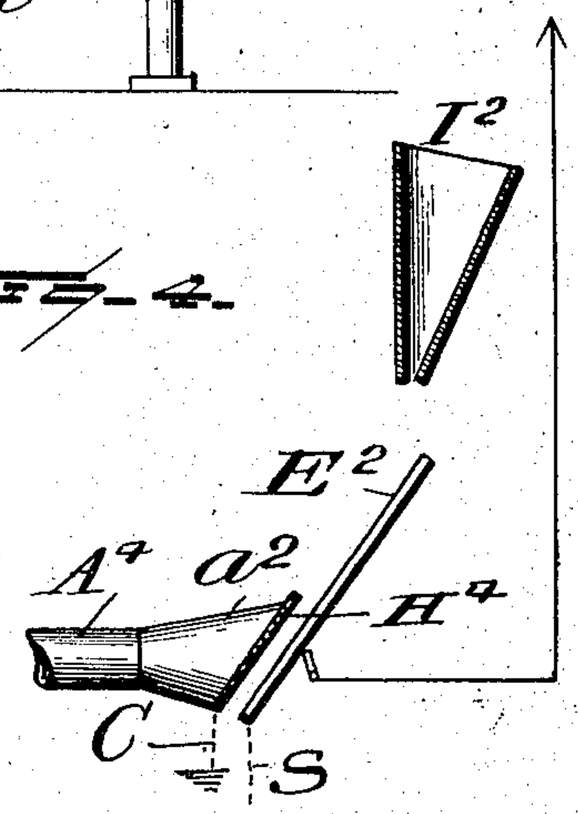


Fig. 4.



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UNITED STATES PATENT OFFICE.

HENRY M. SUTTON AND WALTER L. STEELE, OF DALLAS, TEXAS.

PROCESS OF CONCENTRATION.

SPECIFICATION forming part of Letters Patent No. 670,441, dated March 26, 1901.

Original application filed July 18, 1900, Serial No. 24,063. Divided and this application filed August 23, 1900. Serial No. 27,850. (No specimens.)

To all whom it may concern:

Be it known that we, HENRY M. SUTTON and WALTER L. STEELE, citizens of the United States, residing at Dallas, in the county of Dallas, State of Texas, have invented certain new and useful Improvements in Processes of Concentration, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a process of separating a conductive substance from a non-conductive substance, and more particularly to the separation by means of electrifying the conducting particles and repelling said particles, while the non-conductive substances are not so repelled.

The object of the invention is to provide an improved method or process for electrically concentrating and separating various conductive or metallic substances from the non-conductive substances with which they may be associated or mixed, and comprises the use of a screening member capable of electrical repulsive action upon the conductive substances and permitting the passage therethrough of the non-conductive substances.

Heretofore in the art of electrical ore separation statical or frictional electricity has been used for concentrating ores by electrifying the particles thereof; but difficulty has been experienced in controlling the electrified particles, as they not only mutually repel each other, but are alternately attracted and repelled from any solid substance used to effect the separation of the conducting from the non-conducting particles, and the result is a general scattering of the metallic or other conductive particles without an effective separation. It has also been common to use air or other extraneous forces to effect a mechanical agitation of the ore; but in this method or process the smaller particles of the valuable conducting substances are either blown away with the non-metallic or non-conductive particles or mixed therewith, so that a thorough concentration cannot be effected. The difficulties thus found to exist in the proper operation of devices in the prior art are overcome by means of the process in which an electrically-repulsive screening member is supported adjacent to an electrified surface upon which the ore or conducting substances lie in a pulverulent condition, whereby the screen repels the conducting substance and permits the passage therethrough of the non-conducting substances.

In the process presented herewith the ore is supported upon or travels over an electrically-charged surface, above which a screening member is supported and capable of electrical repulsive action upon the conducting particles, while the non-conducting particles which pass through the screen may be removed by any extraneous force which does not affect the repulsive action of the screening member.

In our application for patent for an electrical ore-concentrator filed July 18, 1900, serially numbered 24,063, of which this case is a division, several different forms of apparatus have been disclosed which accomplish the objects and functions of the process hereinbefore described. It is obvious that the apparatus for accomplishing the process is not confined to any particular form of device disclosed in said application.

For the purpose of illustrating several of the forms of apparatus just referred to we have shown in Figure 1 of the accompanying drawings a longitudinal section through one form of concentrator; in Fig. 2, a similar view of another form of apparatus employing a rotating surface; in Fig. 3, a vertical section of a modified apparatus employing a conical electrically-charged surface, and in Fig. 4 a similar view of a modified form in which an inclined surface is used.

Referring to Fig. 1, the letter A designates an exhaust or suction pipe of any desired construction provided at points with hoods *a* and connected at its discharge end with a suitable device for creating a suction or exhaust therein. Beneath the hoods *a* of this suction device a belt E is suitably mounted upon pulleys or rollers D and is electrically charged, preferably by a static current, by means of a conductor B, from a generator and any suitable connections—such, for instance, as a brush *b*. Interposed between this belt and the suction device is a metallic screen H, constituting an electric conductor and connected with the earth by means of a ground-

line C, so as to return to the earth any current received by the screen through the metallic particles coming in contact therewith. The traveling belt E is provided with any desired form of feeding device—for instance, a hopper I—in which the ore is placed in a properly-pulverized condition and from which it is fed by a shaker G, pivoted at one end and provided with a pan *g* for discharging the ore in a thin layer upon the belt E. This rocking shaker is suitably operated by means of an eccentric bar *i*, carried by any suitable driving-shaft and connected to the shaker. It will be seen that the movement of the shaker G and the pan *g* will discharge upon the moving belt a thin layer of ore, from which the non-metallic particles will be removed through the hoods *a*, while the metallic particles will be retained upon the belt and discharged therefrom into any suitable receptacle—for instance, as shown at F.

A modified form of the invention is illustrated in Fig. 2, in which the electrically-charged surface consists of a revolving plate E′, suitably mounted in a standard N, having an apertured base *n*, within which a driving-pulley O may be located and connected to the shaft *n′*, extending downward from the plate E′. Surrounding the plate and extending beneath the same is a suitable hopper or receptacle L, provided with a discharge-spout S, which may be emptied by means of the removable cap or closure M. Above this revolving plate an annular hood *a′* is connected to a suitable suction or exhaust pipe A^3, while the plate E′ is similarly connected with an electric generator through the line B. Centrally above the plate E′ a hopper I′ is provided, from which the ore may be fed. It will be seen that the ore falling upon the center of the plate E′ is carried by the centrifugal force exerted in the rotary motion of the plate toward the edge thereof, where the non-metallic particles are drawn through the screen and suction-pipe to a suitable point of discharge, while the metallic particles are repelled from the screen and discharged at the edge of the plate E′ into the receptacle L.

A further modified application of the invention is shown in Fig. 4, where the ore passes from the hopper I^2 over an inclined plate E^2, electrically charged from any suitable generator, while the non-metallic particles are removed from said ore by means of suction-pipe A^4, provided with a hood a^2 and screen H^4, suitably connected with the earth by means of a ground-line C. The ore in its passage between the screen and plate is freed from the nonmetallic particles, which pass through the exhaust-pipe to a suitable point of discharge, while the metallic particles drop from the lower edge of said plate, as shown at S.

Another modified application of the same principle is illustrated in Fig. 3, where the ore is discharged from a hopper I^3 upon a conical plate or surface E^3, which is suitably charged by electricity from a generator-line B, while concentric with the lower portion of the cone a screen H^5, suitably connected with a ground-line C, is disposed. If the surface of the conical plate be sufficiently charged with electricity, particles of ore when similarly charged with electricity will be repelled therefrom to such a distance that the non-metallic particles will pass through the screen H^5, falling upon the outside of the partition W, while the metallic particles by their contact with the grounded screen are repelled therefrom and fall upon the inner surface of the partition, as shown at S. It will be seen that in this form of the invention the use of a suction or exhaust device is not necessary, nor would it be in any form or structure where the electrified plate or surface can repel the non-metallic particles for a sufficient distance therefrom that they may be deposited in a separate receptacle from the metallic particles, which are retained near the plate or surface by means of the grounded screen, which removes the electric charge from the metal.

From the foregoing statements the steps of the process will be clearly seen, particularly the essential feature of the electrically-repulsive screen located above or adjacent to an electrified surface, by means of which the non-conducting particles are electrified and passed through the screen, while the conducting particles or substances are repelled from the screen and retained between the same and the electrified surface until they are discharged into a suitable receptacle. As previously stated, an extraneous force may be used, if desired, to remove and convey the non-conducting particles which have passed through the repulsive screen. The successful operation of the process is due to the fact that the conductive substances, such as the metallic ores, change their polarity when brought into contact with other conducting substances or with an electrically-repulsive substance more readily than do the non-conducting or non-metallic substances—such, for instance, as the waste or refuse portion of the ore—by reason of their inferior conductivity as compared to that of the metallic portion, which it is desired to retain as the valuable element of the concentration process.

The term "electrically-repulsive screen" herein used is designed to embrace any form of surface by which the charge of electricity may be removed from the conducting substance or particles or so changed in character, polarity, or potential as to repel the particles from said surface or screen, while the non-conductive particles which have not been so quickly affected, will continue their movement through the screen and there be acted upon by the extraneous force unto a complete separation from conductive particles.

All substances are, in fact, conductors of electricity, some being so poor, however, as to be classed as insulators, non-conducting, or non-conductive, while others—notably the

metals, some oxids of metals, and metalloids—conduct electricity with so much freedom that they are classed as conductors or conductive. Now, bearing in mind that substances of superior conductivity lose their charge of electricity much more rapidly than substances that conduct with less freedom when they are brought in contact with any substance that will change their polarity, it will be seen that the repulsive action of the screen will be exerted first on those substances which will change their polarity the quickest, and consequently all that is necessary to separate substances of varying conductivity is simply a question of the adjustment of the repulsive screen to the electrically-charged surface and the strength of the electrification employed.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The process of separating a conductive substance from a non-conductive substance, or one of relatively inferior conductivity, which consists in electrically charging the mass and exposing the same to a screening member which is capable of electrical repulsive action; substantially as specified.

2. The process of separating a conductive substance from a non-conductive substance, or one of relatively inferior conductivity, which consists in electrically charging the mass and exposing the same to a screening member which is capable of electrical repulsive action upon the conductive substance and removing the non-conductive particles by an extraneous force; substantially as specified.

In testimony whereof we affix our signatures in presence of two witnesses.

HENRY M. SUTTON.
WALTER L. STEELE.

Witnesses:
HARRY L. SEAY,
WALTER F. SEAY.