No. 670,440. Patented Mar. 26, 1901.

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

ELECTRIC ORE CONCENTRATOR.

(Application filed July 18, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

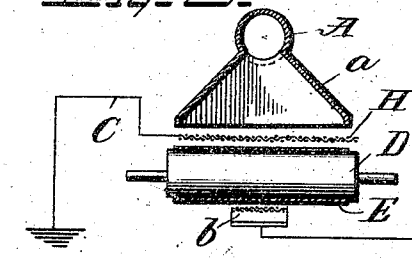
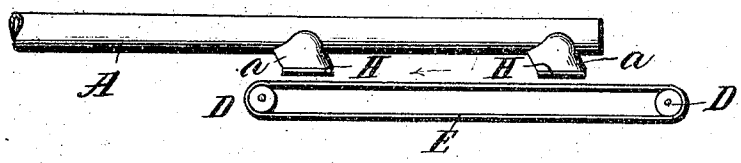
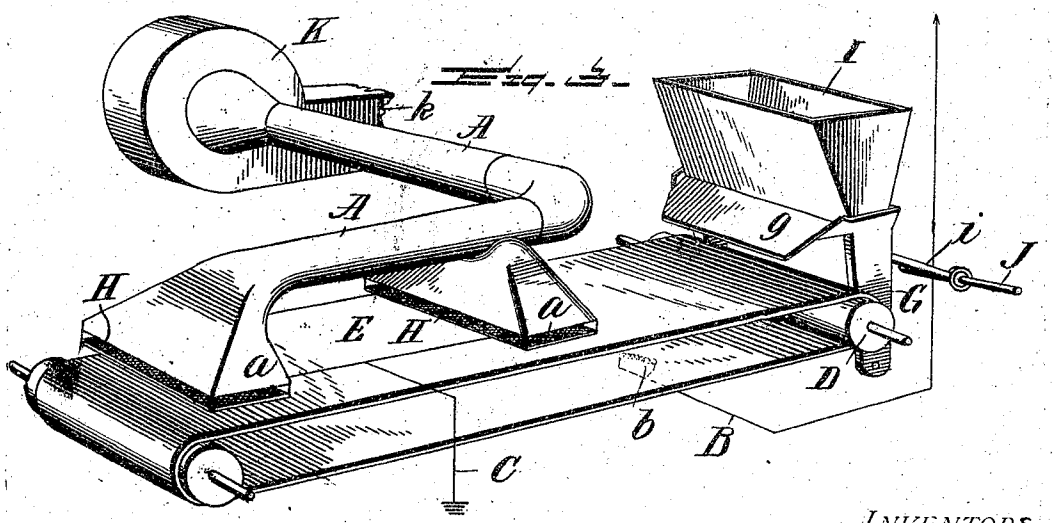


Fig. 1.

Fig. 4.





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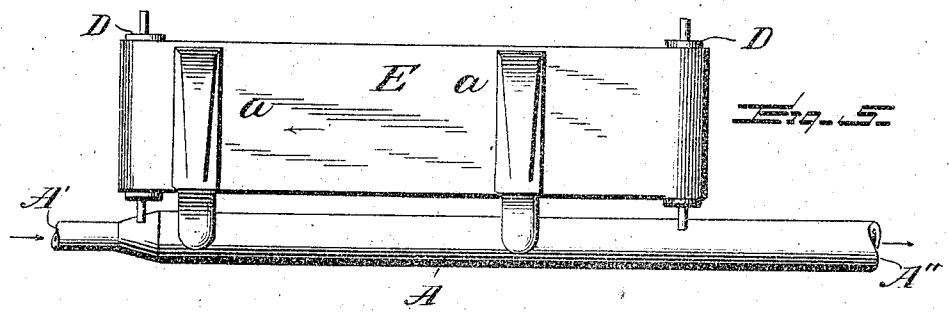


Fig. 5.

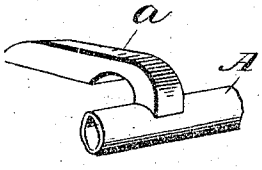


Fig. 6.

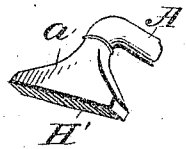


Fig. 7.

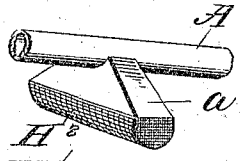


Fig. 8.

Fig. 9.

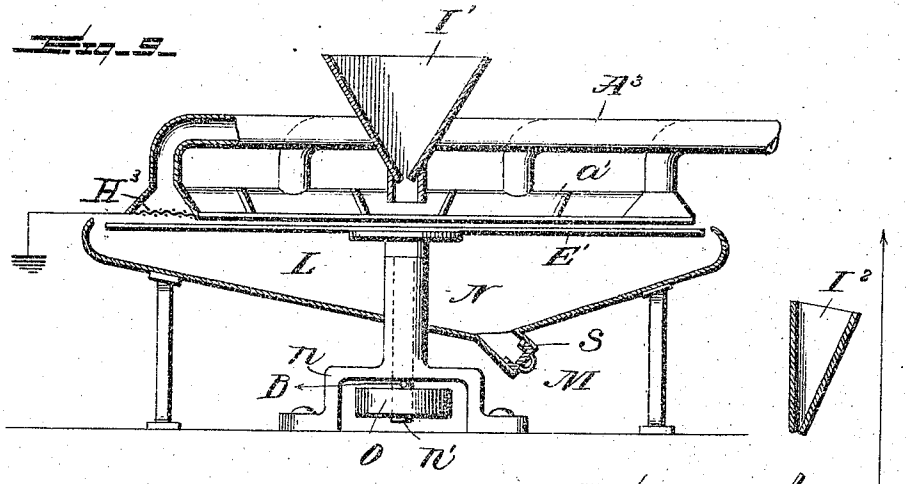


Fig. 10.

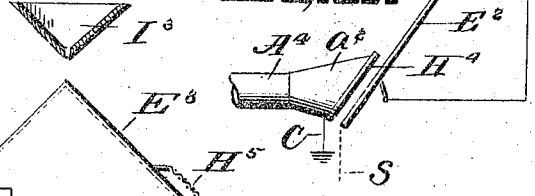
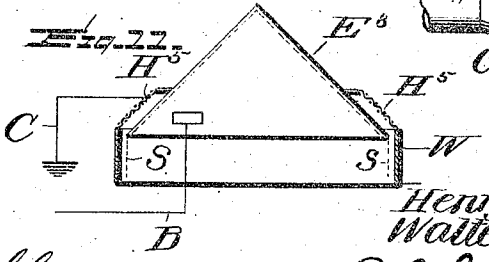


Fig. 11.



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UNITED STATES PATENT OFFICE.

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

ELECTRIC ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 670,440, dated March 26, 1901.

Application filed July 18, 1900. Serial No. 24,063. (No model.)

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 Electric Ore-Concentrators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an electric ore-concentrator, and particularly to an apparatus wherein a dry separation is effected by electrifying particles of ore.

One object of the invention is to provide an improved method and means for electrically concentrating and separating various metallic substances from their respective ores or the substances within which they may be contained by means of a surface charged with static electricity in connection with suitable means for separating the waste or refuse material from the ore. Heretofore in this art static 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 toward any solid substance used to effect the separation of the metallic from the non-metallic particles, and the result is a general scattering of the metallic ore without an effective separation. In the prior art it has also been common to use air to effect a mechanical agitation of the ore; but in this method the smaller particles of the valuable metallic substances are either blown away with the non-metallic particles or are mixed therewith, so that a thorough concentration cannot be effected. The objections thus found to the devices now in use are overcome by means of the structure herewith presented in which an electrically-repulsive screen is placed adjacent to the electrified belt on which the ore lies in a pulverulent condition, and the suction-pipe or other device may be used for the removal of the non-metallic particles.

A further object of the invention is to provide an apparatus embracing means by which the ore will be fed in a thin layer to an electrified surface, from which the metallic substances will be discharged to a proper receptacle, and means for discharging the non-metallic particles at an independent point.

Other objects and advantages of the invention will hereinafter appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal section through one form of the invention. Fig. 2 is a vertical cross-section on the line 2 2 of Fig. 1. Fig. 3 is a perspective of this form of the invention, showing a slightly-modified application of the exhaust-fan. Fig. 4 is an elevation of a further modification of the exhaust or suction pipe. Fig. 5 is a plan showing an arrangement of exhaust-pipe adapted for operation by either a blowing or suction device. Figs. 6, 7, and 8 are detail perspectives of different forms of screen-hoods adapted to operate in connection with an electrified surface. Fig. 9 is a modified form of the invention embodying a rotating electrified surface. Fig. 10 is a further modification employing an inclined electrically-charged surface, and Fig. 11 is a modification embodying a conical electrified surface.

Like letters of reference indicate like parts throughout the several figures of the drawings.

In describing the several applications and modifications of this invention it may here be stated that the specific structure employed may be varied to a large extent. Although the form shown produces the most satisfactory results, still the essential principles involved are an electrified surface either stationary or movable and an electrically-repulsive screen or surface located adjacent to the electrified surface to permit the passage of the non-metallic particles through the screen, while the metallic particles will be repelled therefrom and returned to the surface.

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 fan K, having a discharge *k*, Fig. 3, or other 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 shakers 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 in any suitable receptacle—for instance, as shown at F.

In Fig. 3 a fan K has been shown at one side of the exhaust or suction pipe A, while the driving-shaft J is shown eccentrically connected to the bar *i* for the purpose of reciprocating the same and rocking the shaker G.

In Fig. 4 the suction-pipe A is extended beyond the delivery end of the belt E and the screens H permanently and directly attached to the open ends of the hoods *a*.

In Fig. 5 a form of suction or exhaust pipe is provided by means of which a blowing-fan may be applied at the end A′ of the pipe or a suction fan or device at the end A″, while the hoods *a* extend laterally from the pipe A and over the belt E, as in the former instances. This form of hood is shown in detail in Fig. 6, while in Fig. 7 the hood is provided with a screen H′, composed of a series of rods extending across the open end of the hood and electrically connected with a ground-line.

In Fig. 8 the hood *a* is provided with a curved or segmental screen H^2, similarly connected to constitute an electric conductor.

A modified form of the invention is illustrated in Fig. 9, 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. 10, 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 a 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 non-metallic 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. 11, 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 of 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 description of the construction of the apparatus employed in this invention the operation thereof 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-metallic particles will pass through the screen while the metallic particles are repelled from the screen and retained between the same and the electrified surface until they are discharged into a suitable receptacle. From the foregoing it will also be seen that the use of a conveyer for the non-

metallic particles is not an essential element in the operation of the invention, save when the structure and location of the parts are such that the movement of the non-metallic particles must be assisted after they have passed to such a distance that they are not affected by the electrified condition of the surface from which they are repelled or such electricity has been removed by contact with any other surface. The successful operation of the invention is due to the fact that metallic substances lose their charge of electricity much more readily when brought into the vicinity of conducting substances or an electrically-repulsive surface than non-metallic or non-conducting substances—such, for instance, as the waste or refuse portion of the ore in its relation to the metallic portion which it is desired to retain as the valuable element of the concentration process.

The screen located above the electrified surface may be of any desired material or character and may be connected with a grounded wire, Figs. 1, 2, and 3, or charged with an opposite potential to the electrified surface, Fig. 11, it being apparent that the surface of the screen should be electrically repulsive. It may also be stated that the scope of the invention contemplates the use of a screen which is neither grounded nor connected with a generator, (see Fig. 9,) as in the use of static electricity when the electrified material approaches the screen the latter becomes charged with electricity of the same potential as the metallic particles. This causes a repulsive action between the screen and the particle, as is well known in electrical arts. The term "electrically-repulsive screen" herein used is intended to embrace any form of surface by which the charge may be removed from the metallic particle or so changed in character or potential as to repel the particle from the screen or surface, while the non-metallic particle which has not been so quickly affected will continue its movement through the screen and there be acted upon by an extraneous force.

It will be obvious from the foregoing description and illustration that various changes may be made in the details of construction and configuration of the apparatus embodying this invention without departing from the spirit of the same as defined by the appended claims.

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

1. In an ore-concentrator, the combination with an electrified surface, of a screening device capable of electrical repulsive action disposed adjacent thereto; substantially as specified.

2. In an ore-concentrator, the combination with an electrified surface, of a screening device capable of electrical repulsive action disposed adjacent thereto, and means for conducting non-metallic particles which may pass through said screen; substantially as specified.

3. In an ore-concentrator, the combination with an electrified surface, of a screening device capable of electrical repulsive action disposed adjacent thereto, means for conducting non-metallic particles which may pass through said screen, and hoods extending from said conducting means and disposed adjacent to said screen; substantially as specified.

4. In an ore-concentrator, the combination with an electrified surface, of a screening device capable of electrical repulsive action disposed adjacent thereto, means for conducting non-metallic particles which may pass through said screen, hoods extending from said conducting means and disposed adjacent to said screen, and a feeding device adapted to discharge upon said surface; substantially as specified.

5. In an ore-concentrator, the combination with a moving ore-conveying surface, of means for electrically charging the same, an exhaust device provided with hoods disposed above said surface, and electrically-repulsive screens disposed between said surface and hoods; substantially as specified.

6. In an ore-concentrator, the combination with a moving ore-conveying surface, of means for electrically charging the same, an exhaust device provided with hoods disposed above said surface, electrically-repulsive screens disposed between said surface and hoods, and a feed-hopper adapted to discharge upon said moving surface; substantially as specified.

7. In an ore-concentrator, the combination with a moving ore-conveying surface, of means for electrically charging the same, an exhaust device provided with hoods disposed above said surface, electrically-repulsive screens disposed between said surface and hoods, a feed-hopper adapted to discharge upon said moving surface, a rocking shaker disposed between said hopper and moving surface, and a receptacle to receive material discharged from said surface; substantially as specified.

8. In an ore-concentrator, the combination with an electrified surface, of an electrically-repulsive device disposed adjacent to said surface and provided with apertures through which non-metallic particles may pass while metallic particles will be repelled by said device; substantially as specified.

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

HENRY M. SUTTON.
WALTER L. STEELE.

Witnesses:
E. S. LAUDERDALE,
HARRY L. SEAY.