No. 780,716. PATENTED JAN. 24, 1905.

E. GATES.

METHOD OF AGGLOMERATING MAGNETIC ORE.

APPLICATION FILED JAN. 14, 1901. RENEWED NOV. 5, 1902.

Fig. 1.

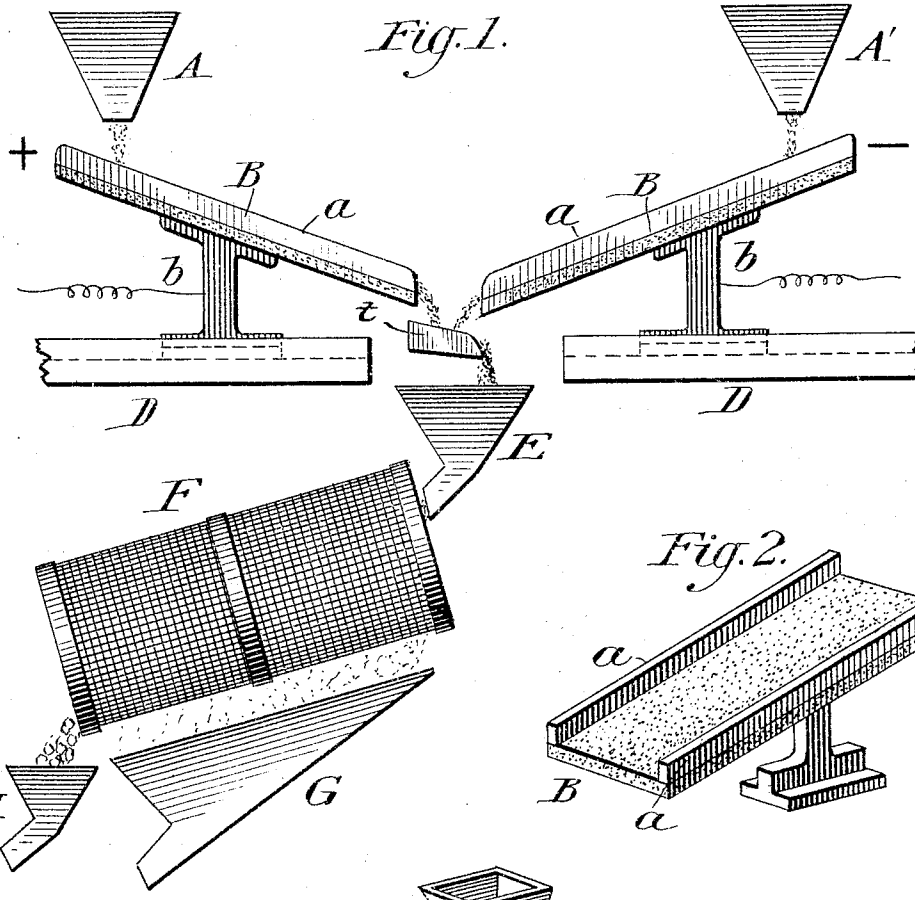
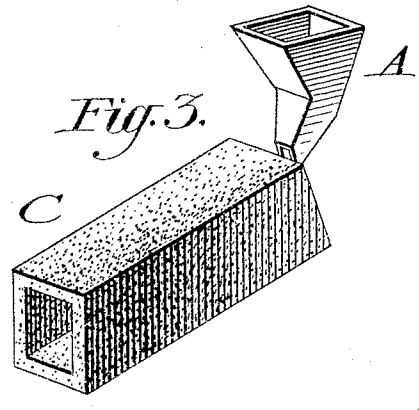


Fig. 2.

Fig. 3.



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No. 780,716. Patented January 24, 1905.

UNITED STATES PATENT OFFICE.

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METHOD OF AGGLOMERATING MAGNETIC ORE.

SPECIFICATION forming part of Letters Patent No. 780,716, dated January 24, 1905.

Application filed January 14, 1901. Renewed November 5, 1902. Serial No. 130,154.

To all whom it may concern:

Be it known that I, ELMER GATES, a citizen of the United States, residing at Chevy Chase, county of Montgomery, State of Maryland, have invented certain new and useful Improvements in Methods of Agglomerating Magnetic Ore; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the treatment of magnetic iron ore (commonly termed "magnetic sand") for the purpose of causing the incipient fusion and union of the particles into lumps or nugget-like particles of larger size adapted for more advantageous use in the final-reduction furnace. To this end I establish an electric arc between the ends of two oppositely-located feed-troughs or guiding-surfaces, and into said arc I feed the magnetic sand from opposite directions, whereupon the electric arc will pass from one body of the falling sand to the other and effect the fusion of the particles into small lumps of a size varying from that of a wheat-grain to that of an ordinary bean. By reason of the fact that during the operation the arcing takes place between the two streams of falling sand a corresponding economy in current employed is obtained. Moreover, I feed the magnetic sand with such rapidity that all of it is not lumped. This is a feature of economy, for the reason that enough sand is always passing to fully utilize the current, none of the current being allowed to pass without doing its maximum amount of lumping. Furthermore, I allow the fused material to accumulate immediately below the point of fusion before passing into the hopper, so that the fused particles following are allowed to drop onto those previously fused and partially cooled, but still hot, whereby the fused lumps will adhere to and agglomerate an additional amount of the unfused magnetite and form lumps of increased size. This is a further feature of economy in the practice of the process.

In the accompanying drawings, Figure 1 represents in side elevation an apparatus adapted for the practice of my invention. Fig. 2 represents a perspective view of one of the feed or guide troughs. Fig. 3 represents a perspective view of a modification thereof.

Similar letters of reference indicate similar parts through the several views.

Referring to the drawings, A A′ indicate hoppers for supplying the magnetic sand to inclined feed-troughs—as, for instance, the flat plates B, Figs. 1 and 2, having the side pieces *a* or the hollow conduit C, Fig. 3. In either event the feed-trough is mounted upon a standard *b* of conducting material, preferably carbon, and is itself of conducting material, so that when two opposite troughs, as in Fig. 1, are located opposite each other and are then brought together and included in an electric circuit the subsequent separation of the meeting ends of the trough will cause an electric arc to span the interval between them. As indicated in said figure, the opposite terminals of the electric circuit may be conveniently connected to the standards *b*, and the standards are movable toward and from each other upon the supports D.

Beneath the discharge ends of the troughs is located a tray *t*, into which the streams of fused particles fall and are temporarily accumulated. From this tray the particles drop into a hopper E, discharging into a rotatory screen F, and below the rotatory screen F are located the hoppers G and H.

The operation of the invention is as follows: The opposing ends of the inclined troughs B are brought together, so as to establish continuity of the electric circuit in which they are included. The troughs are then drawn apart, thereby causing an electric arc to span the interval between said ends, whereupon the magnetic sand is fed to the troughs from the hoppers A A′ and descends the inclines. In passing the ends of the troughs the falling streams approach each other, and the electric arc, seeking the path of least resistance, passes between the falling streams, thereby decreasing in length by reason of the decreased resistance offered by the shorter interval spanned by it. Care is taken to feed the magnetic

sand at a speed in excess of that necessary for the utilization of all of the energy of the current, and as a consequence the current is fully utilized, since it always finds in its path material upon which to act. The effect of the passage of the current is to fuse or agglomerate the magnetic sand into the condition of small lumps varying in size from a wheat-grain to the size of a bean. The passage of these lumps into the hopper is momentarily checked or retarded by their accumulation in the tray *t*, where they are partially cooled, but from which they overflow and drop while still hot into the hopper. Thus the fused particles of magnetite are brought into contact with the particles previously deposited in the tray and which have passed the state of fusion, the result being that the fused particles adhere to and agglomerate with the previously-fused but now partially-cooled particles in the tray and form lumps of magnetite of increased size. These lumps, together with the attendant excess of unfused sand, are received in the rotatory screen F, and in passing through the screen the fused lumps are received in the hopper H, and the sand is received in the hopper G, from which it may be again passed through the hoppers A A'.

Having thus described my invention, what I claim is—

1. The method of agglomerating magnetic sand, which consists in establishing an electric arc between opposing surfaces, feeding opposing streams of sand over said surfaces, and causing said streams of sand to fall freely from said surfaces so as to break the arc originally formed and establish arcing from one of the falling streams to the other, thereby fusing and agglomerating the sand into small lumps of a size varying substantially from that of a wheat-grain to that of a bean.

2. The method of agglomerating magnetic sand, which consists in establishing an electric arc between opposing surfaces, and feeding opposing streams of sand over said surfaces at a rate in excess of the fusing capacity of the arc, and so that the arc shall pass from one stream to the other, and, in its passage, shall fuse and agglomerate the sand into small lumps of a size varying substantially from that of a wheat-grain to that of a bean, with the maximum utility of the fusing capacity of the current; substantially as described.

3. The method of agglomerating magnetic sand, which consists in establishing an electric arc between opposing surfaces, and feeding opposing streams of sand over said surfaces, so that the arc shall pass from one stream to the other and fuse and agglomerate the sand into small lumps of a size varying substantially from that of a wheat-grain to that of a bean, and delivering said fused particles onto an accumulation of previously-fused and partially-cooled particles, whereby said fused particles agglomerate additional unfused particles and form lumps of increased size.

In testimony whereof I affix my signature in presence of two witnesses.

ELMER GATES.

Witnesses:

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