(No Model.) 3 Sheets—Sheet 1

J. WENSTRÖM.

ELECTRO MAGNETIC ORE SEPARATOR.

No. 455,808. Patented July 14, 1891.

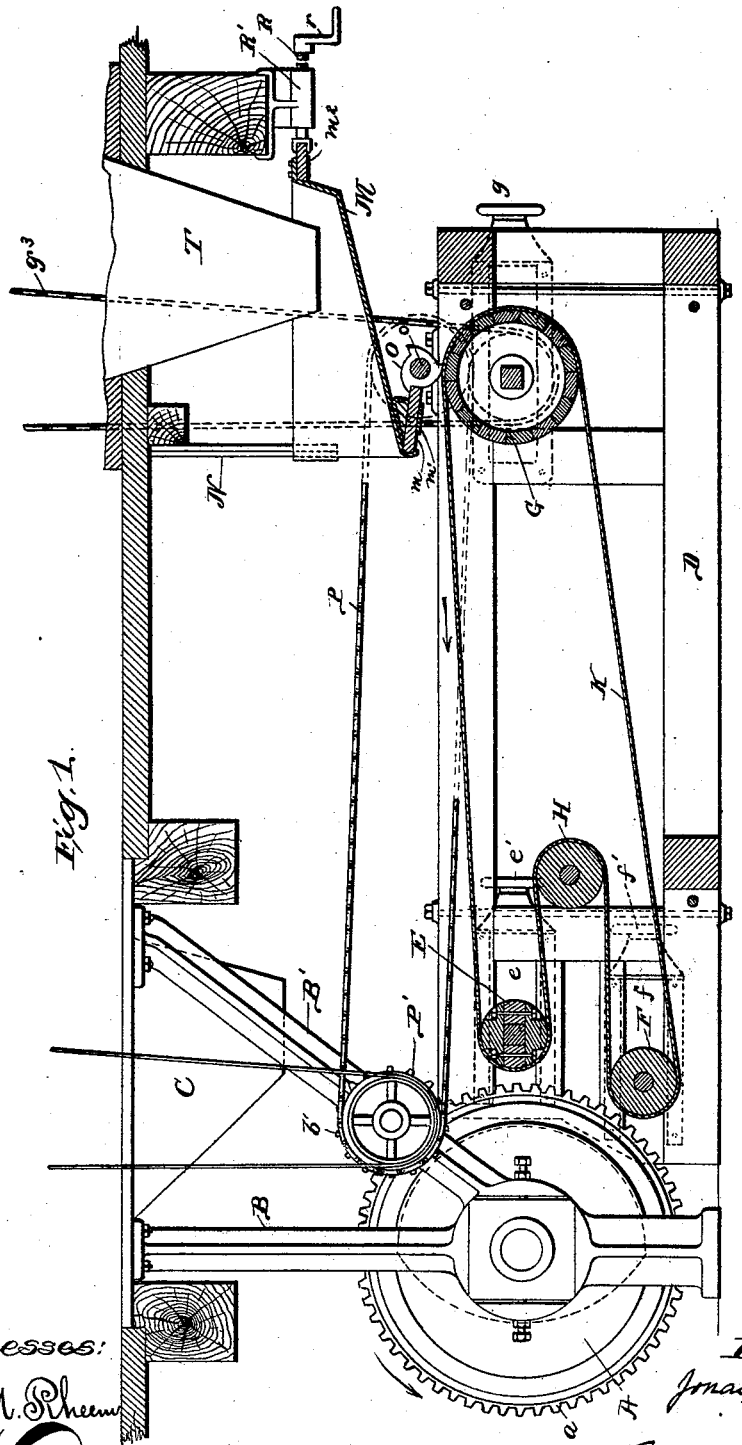

Fig. 1.

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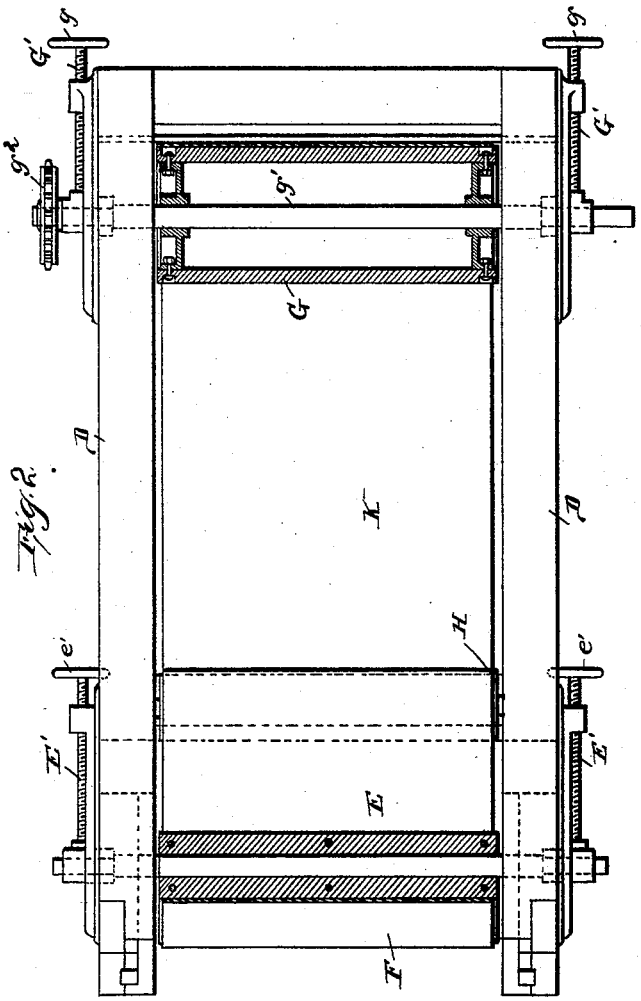

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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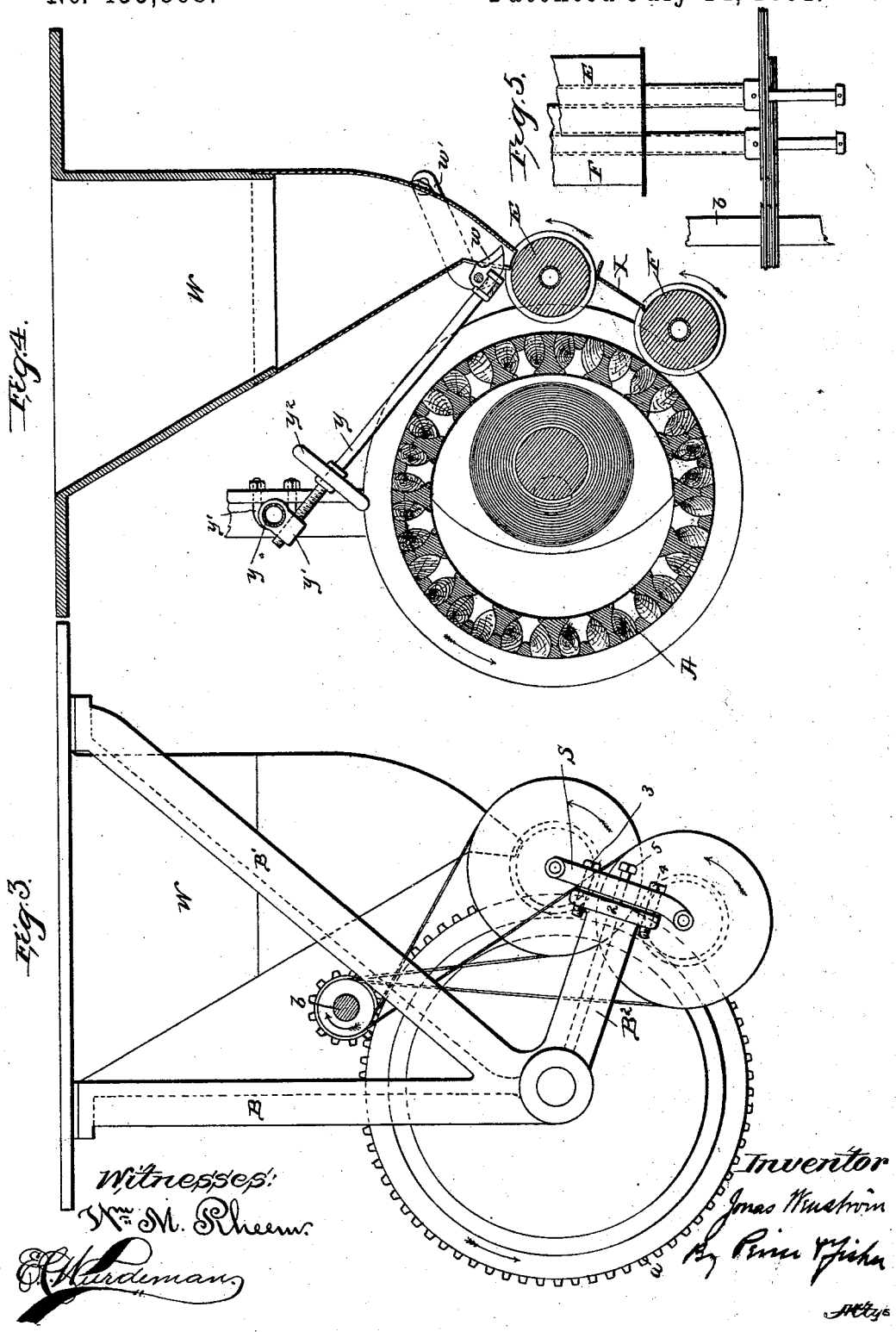

UNITED STATES PATENT OFFICE.

JONAS WENSTRÖM, OF ÖREBRO, SWEDEN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF TWO-THIRDS TO OLOF WENSTRÖM AND WILLIAM W. MANNING, OF MARQUETTE, MICHIGAN.

ELECTRO-MAGNETIC ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 455,808, dated July 14, 1891.

Application filed December 24, 1890. Serial No. 375,752. (No model.)

To all whom it may concern:

Be it known that I, JONAS WENSTRÖM, a citizen of Sweden, and a resident of Örebro, in the Kingdom of Sweden, have invented certain new and useful Improvements in Apparatus for Feeding Ore to Magnetic Separators, of which the following is hereby declared to be a full, clear, and exact description, sufficient to enable others skilled in the art to which such invention appertains to make and use the same.

My present invention relates to separators more especially adapted for separating the magnetic from the non-magnetic parts of mixed material—such as iron ore, slag, brass filings, &c.—an example of this type of machine being set forth in my Letters Patent No. 373,211, November 15, 1887.

My invention consists in certain novel features hereinafter described, and particularly pointed out in the claims at the end of this specification.

Figure 1 is a view partly in side elevation and partly in vertical longitudinal section through a magnetic separator embodying my invention. Fig. 2 is a view in horizontal section through my improved feed mechanism, parts being shown in plan. Fig. 3 is a view in side elevation of a modified embodiment of my invention. Fig. 4 is a view in central vertical section through the construction shown in Fig. 3. Fig. 5 is a fractional view in plan, showing the gearing for operating the feed-rolls illustrated in Figs. 3 and 4.

Referring more particularly to the constructions seen in Figs. 1 and 2 of the drawings, A designates the armature-barrel of the separator, this armature-barrel being similar in construction to that set out in Letters Patent No. 373,211, hereinbefore referred to, and its construction being in part illustrated more fully in Fig. 4 of the accompanying drawings. The precise construction of this armature-barrel and of the magnet contained therein is fully set forth in an application filed by me in the United States Patent Office of even date herewith, Serial No. 375,753, and, as it is not intended to claim the armature-barrel or the magnet in the present application, further description of this barrel and the inclosed magnet need not be given here, reference being made to the above-mentioned patent and application for more particular description thereof. It will be understood, however, that the feeding mechanism hereinafter described may be used not only in conjunction with the particular form of magnetizer comprising the armature-barrel illustrated in the accompanying drawings, but is applicable also for purpose of feeding ore or other material to be operated upon to other forms of magnetic separators. The armature-barrel A is suitably sustained by the standards B of the main frame, and rotation is imparted to this barrel through the medium of a pinion upon the drive-shaft *b*, this pinion engaging with a circular rack-bar *a*, suitably connected to the barrel. The drive-shaft *b* is preferably journaled within the arms B′, projecting from the uprights or standards B, and to the tops of these arms may be secured a supplemental delivery-hopper C.

Within a sustaining-frame D are mounted the adjustable presenting-rolls E F and drum G and the stationary pulley or roll H, over which several rolls passes a carrier feed-belt K, of rubber or other non-magnetic material. The rolls E and F are mounted within adjustable journal bearings or blocks *e* and *f*, so that the position of these rolls may be varied with respect to the periphery of the armature-barrel A, and the adjustment of the rolls E and F is preferably effected by means of set-screws E′ E′ and F′ F′, controlled by the hand-wheels *e′* and *f′*, these set-screws serving to move the bearing-blocks to any desired position. So, also, the drum or pulley G is mounted in adjustable bearings or journal-blocks controlled by an adjusting-screw G′ and hand-wheel *g* to shift the bearings of the pulley or drum G back and forth, as desired. The carrier feed-belt K is trained over the rolls E F, pulley H, and drum G, preferably in the manner shown, and the belt will be driven by the pulley or drum G, that receives rotation from a shaft *g′*, to the end of which is attached a sprocket-wheel g^2, that is driven by means of a sprocket-chain g^3, conveniently connected with the source of power. It will thus be seen that when it is

desired to vary the position of the presenting-rolls E and F with respect to the armature-barrel A it is only necessary to turn the hand-wheel *g* and move inward the drum or pulley G, so as to slacken the feed-belt K, after which, by means of their respective adjusting-screws, the presenting-rolls E and F can be moved to any desired position with respect to the armature-barrel A. The drum or pulley G will then be readjusted to give the proper tension to the feed-belt K.

The material to be worked will be delivered onto the feed-belt K preferably by means of a feed-pan M, sustained by suitable elastic bars N, a vibrating or shaking motion being imparted to this feed-pan through the medium of a tappet-wheel O, that is mounted upon the shaft *o*, this shaft being provided at one end with a sprocket-wheel that receives motion through the medium of the sprocket-chain P from the sprocket-wheel P′ and the drive-shaft *b*. The feed-pan M is provided upon its under side with a wooden block *m*, conveniently attached thereto by a metal strap *m*′, against the rear edge of which feed-block the tappet-wheel O will operate to effect the vibratory movement of the feed-pan. To the rear edge of the feed-pan M is also attached a buffer m^2, adapted to contact with the inner end of the adjusting-screw R, provided with the crank *r* and journaled within a suitable threaded bearing R′, this set-screw serving to determine the extent of movement of the feed-pan M. The construction of feed-pan is more particularly set out in my application for Letters Patent filed in the United States Patent Office December 24, 1890, Serial No. 375,753. The ore is delivered upon the feed-pan O from the hopper T, sustained above it.

From the foregoing description it will be seen that when the material to be separated is delivered from the hopper T onto the feed-pan M the shaking motion of this pan incident to the operation of the tappet-wheel O upon the block *n* will cause the material to be delivered upon the feed-carrier belt K, and by this belt it will be carried forward over the presenting-roll E and in proximity to the periphery of the armature-barrel A. As the fixed magnet within the armature-barrel is located upon that side of the armature-barrel next to the presenting-roll, as seen by dotted lines in Fig. 1, the magnetic portions will in great part be attracted by the armatures of the barrel A and will be carried upward thereby until they pass from out the field of influence of the magnet, when they will drop into a suitable receptacle provided for the purpose, and at the same time such portions as have not been attracted by the armatures of the barrel A will fall by gravity onto that part of the carrier-belt K above the presenting-roll F to be again presented to the action of the armature-barrel. It will be observed that the presenting-roll F is nearer to the armature-barrel than is the upper presenting-roll E, and consequently the smaller portions of the supply, which have escaped the action of the armatures, will be now attracted by reason of their closer presentation to the armatures and by reason of the fact that a large portion of the body of the material has been already carried upward by the armatures. The portion not attracted by the armature-barrel will fall by gravity from the carrier-belt after passing off the presenting-roll F into a suitable receptacle. It will be observed that the body of the material is presented to the armature-barrel A in a direction opposite to the travel of the barrel, as practice has demonstrated that by such feeding an effective separation can be secured and successive presentations to the separator or magnetizer during the continuous passage of the material through the machine be made possible. When very coarse stuff is being operated upon, the supplemental hopper C may be employed instead of the hopper T. The adjustment of the presenting-rolls E and F enables these rolls to be brought into desired proximity with respect to the armature-barrel, according to the size to which the material has been crushed.

The feature of repeatedly exposing the body of the material to the action of the separator is of importance, as it avoids the necessity of running it a second time through the machine to effect the separation of such magnetic portions as may have escaped the influence of the armature-barrel during the first passage, and the advantage of thus repeatedly presenting the material to the separator or magnetizer is materially increased by making these presentations at different distances and by passing the stuff through the machine in a direction opposite to that in which the separated portions are removed.

The details of construction above set out may be varied within wide limits without departing from the spirit of my invention, which, broadly considered, is not restricted to the precise form of presenting mechanism shown.

In the form of my invention illustrated in Figs. 3, 4, and 5 the armature-barrel A and magnet are similar in construction to those set forth in my Letters Patent No. 373,211 and in my application for Letters Patent filed of even date herewith, the armature-barrel and magnet being sustained by means of a frame comprising the uprights B and extensions B′, these uprights serving also to sustain the hopper W, the flanged portions of which rest upon the upper ends of the uprights. The hopper W, by its connection to the uprights B and B′, serves also as a consolidating frame for the machine. Beneath the discharge end of the hopper W are the feeding-rolls E and F, these rolls being journaled at opposite ends of the cross-bars S, that are adjustably connected to the flanged ends 2 of the arms B^2, that project from the lower portions of the uprights B. The cross-bars S are connected to the projecting arms B^2 by the set-screws 3 and 4, that pass through the bars and through

threaded holes in the flanges 2 of the projecting arms B, and through each of these cross-bars S extends also a set-screw 5. By this provision it is plain that the cross-bars may be tilted to some extent and may be set farther from or closer to the flanged ends 2 of the arms B^2, so that the rolls can be adjusted as to their distance from the armature-barrel. The shafts of the rolls E and F are provided with pulleys, over which pass cords or belts leading to suitable pulleys upon the drive-shaft *b*, this drive-shaft being furnished also with a pinion *b'*, that engages with the circular rack-bar *a* of the armature-barrel. Between the feed-rolls or presenting-rolls E and F extends an apron X to insure the delivery upon the lower feed-roll of such portions as may pass from the upper roll E. The discharge end of the hopper W is closed by a gate *w*, sustained from the hopper by means of the pivoted arms *w'*, the position of this gate *w* being controlled by an adjusting-rod *y*, the inner end of which is connected in a manner free to turn with the gate *w*, and its outer threaded end passes through a correspondingly-threaded swivel-socket *y'*, that is mounted upon a shaft Y, held within suitable straps or bearings Y', attached to the uprights B. Upon this adjusting-rod *y* is fixed a hand-wheel y^2, whereby the turning of the rod is effected to open and close the gate *w* of the hopper.

From the foregoing description it will be seen that as the material passes from the hopper W onto the upper feed or presenting roll E it will be delivered by said roll to the surface of the armature-barrel A, and as this part of the armature-barrel is within the field of the electro-magnet the magnetic portions will be carried upward by the armatures as the barrel revolves, while that portion not attracted by the armatures will fall onto the apron X and lower roll F, by which roll it will be again presented to the armature-barrel. By this second presentation to the armature-barrel those magnetic portions not previously removed by the armatures will be attracted and will be carried upward, while the non-magnetic portion will fall by gravity from the roll F. By thus repeatedly presenting the material to the action of the armature-barrel and in a direction opposite to the direction of the travel of the barrel, as I prefer to do, an effective separation of the magnetic from the non-magnetic portions will be secured. So, also, by mounting the lower roll F in closer proximity to the separator than the upper roll the magnetic portions remaining after the first presentation will be subjected to a stronger influence of the magnetized armatures, and will therefore be more certainly attracted and carried upward by the armature-barrel. The rolls E and F are made of non-magnetic material, as is the case also with all parts of the structure adjacent the barrel upon the delivery side of the machine.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A feed mechanism for magnetic separators, provided with devices for repeatedly presenting material to the same magnetizer during its passage through the machine, substantially as described.

2. A feed mechanism for magnetic separators, provided with devices for repeatedly presenting the material to the same magnetizer, the presenting devices being arranged at different distances from the magnetizer, substantially as described.

3. A feed mechanism for magnetic separators, provided with a series of presenting-rolls for repeatedly presenting the material to the same magnetizer during its passage through the machine, substantially as described.

4. A feed mechanism for magnetic separators, provided with presenting-rolls arranged at different distances from the same magnetizer, substantially as described.

5. A feed mechanism for magnetic separators, provided with presenting-rolls arranged at different distances from the same magnetizer, and a carrier-belt passing over said rolls, substantially as described.

6. A feed mechanism for magnetic separators, provided with presenting-rolls, a pulley intermediate said presenting-rolls, a drum, and a carrier-belt passing around said presenting-rolls, said intermediate pulley, and said drum, substantially as described.

7. A feed mechanism for magnetic separators, provided with a series of presenting-rolls adjustable with respect to the magnetizer, substantially as described.

8. A feed mechanism for magnetic separators, provided with a series of adjustable presenting-rolls, a carrier-belt, and an adjustable drum over which said carrier-belt passes, substantially as described.

9. A feed mechanism for magnetic separators, provided with presenting-rolls, adjustable journal-bearings for said presenting-rolls, a drum and adjustable bearings for said drum, screw-shafts for adjusting said bearings, and a carrier-belt passing over said rolls and said drum, substantially as described.

JONAS WENSTRÖM.

Witnesses:
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ERLAND BOGREN.