No. 702,184. Patented June 10, 1902.

J. W. CARTER.

MAGNETIC ORE SEPARATOR.

(Application filed Nov. 29, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig: 1.

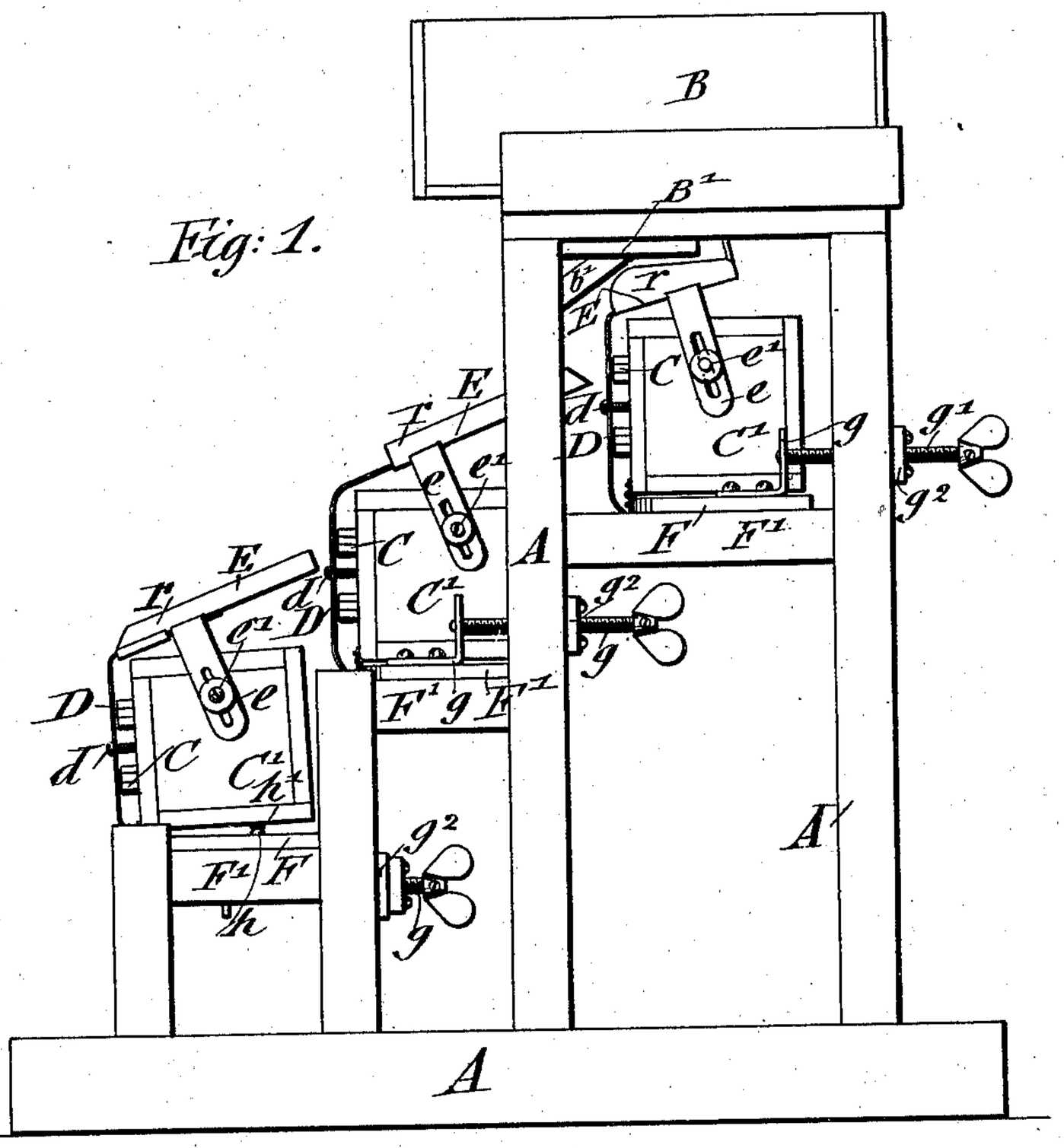

Fig: 2.

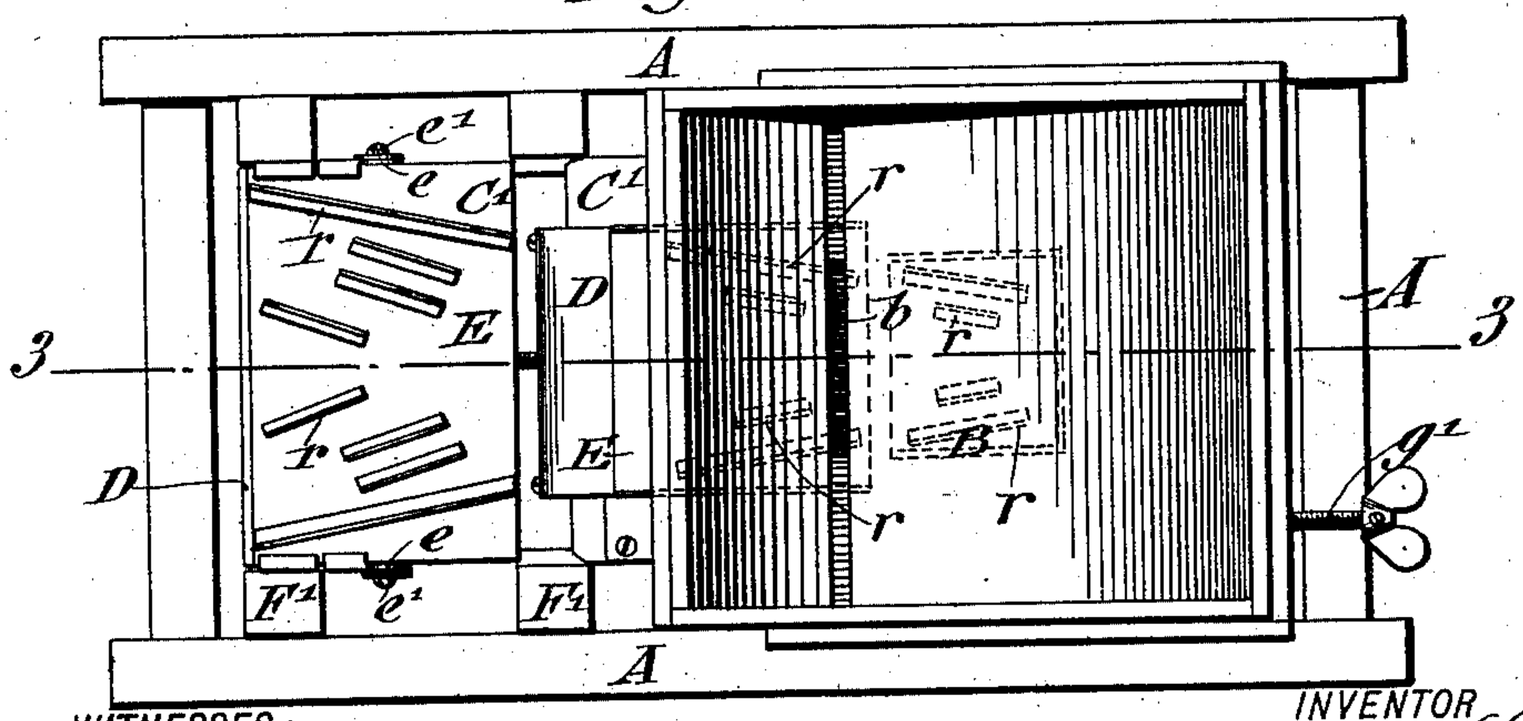

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Fig. 3.

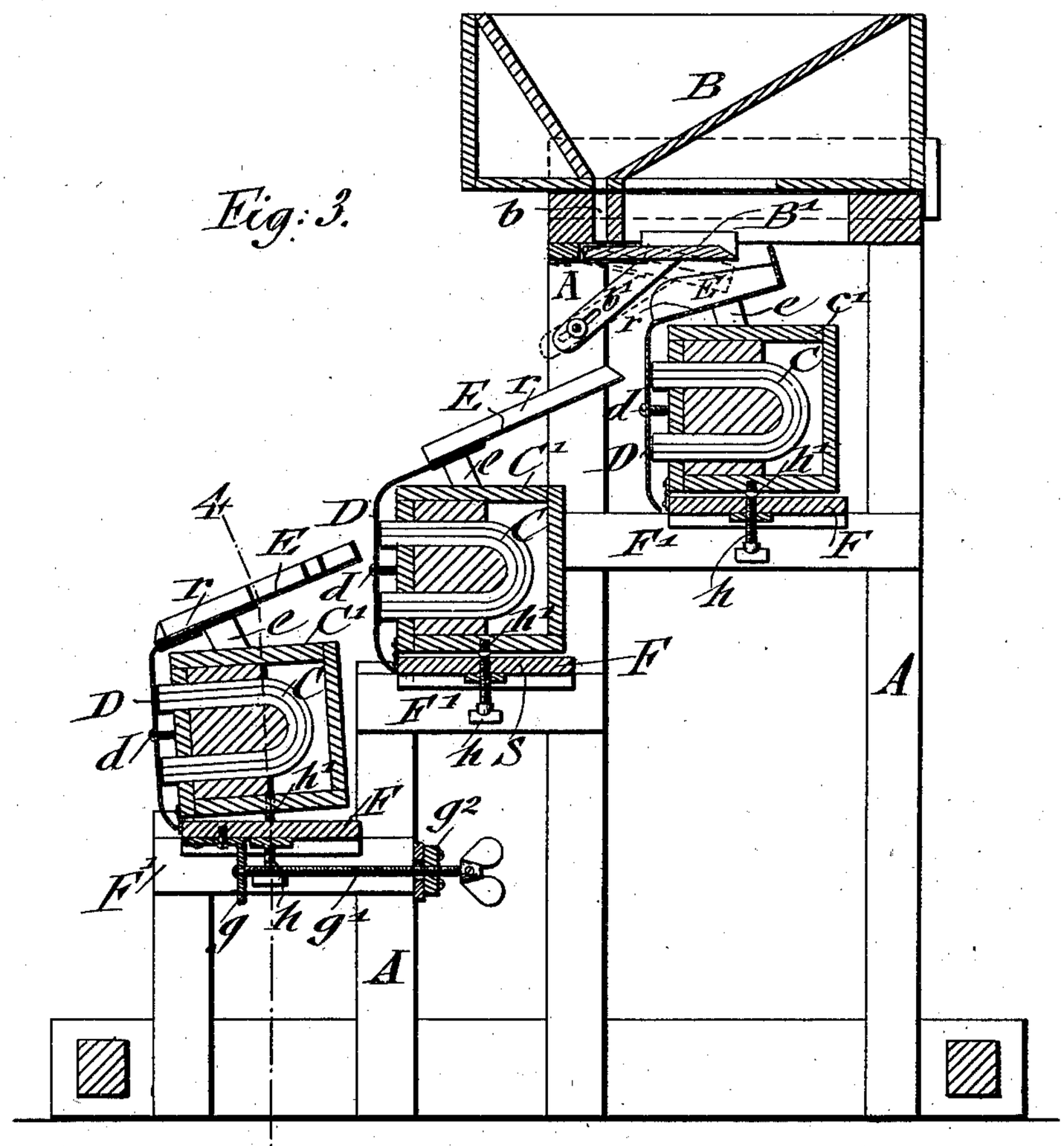
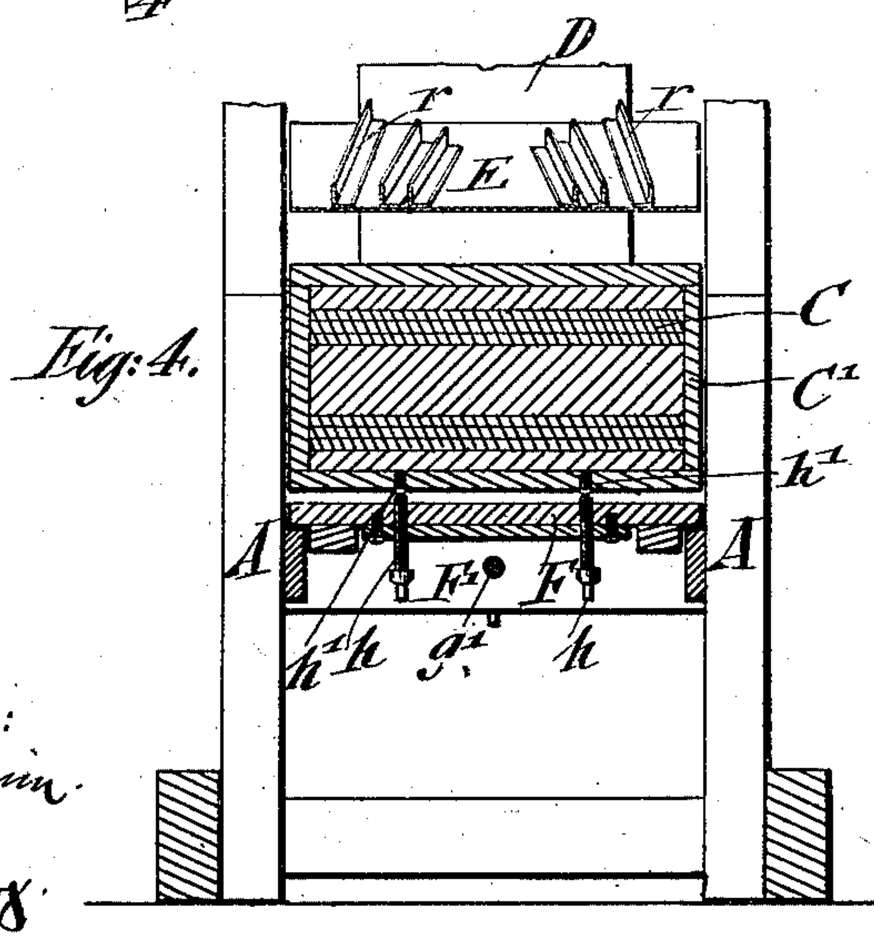


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MAGNETIC ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 702,184, dated June 10, 1902.

Application filed November 29, 1901. Serial No. 84,037. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. CARTER, a citizen of the United States, residing in Franklin, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Magnetic Ore-Separators, of which the following is a specification.

This invention relates to certain improvements in that class of machines known as "magnetic ore-separators," in which a number of gangs of magnets are arranged step-shaped—that is to say, one gang below and forward of another—said magnets being provided with suitable septa or shields over which the crushed or natural ore is passed by gravity, so that the magnetic particles of ore are separated from the non-magnetic particles in a quick and reliable manner. For this purpose the invention consists of a magnetic ore-separator comprising a series of gangs of magnets arranged below a supply-hopper in step shape—that is to say, one gang below and in front of another—said gangs being provided with covering septa or shields and inclined chutes above said shields. Each gang of magnets is capable of independent adjustment in forward or backward direction and also capable of being adjusted in tilted position for the purpose of imparting a greater velocity to the whole mass. The gangs of magnets and their septa are made wider from the upper toward the lowermost gang, the chutes for the septa being provided with diverging guide-ribs, so as to produce the spreading of the ore and tailings over the entire surface of the enlarged septa, as will be fully described hereinafter and finally pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of my improved magnetic ore-separator. Fig. 2 is a plan view of the same. Fig. 3 is a vertical longitudinal section on line 3 3, Fig. 2; and Fig. 4 is a vertical transverse section on line 4 4, Fig. 3.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the supporting-frame of my improved magnetic ore-separator, and B a supply-hopper that is arranged at the top of the frame A, in which hopper the crushed or natural ore is placed. Below the throat *b* of the supply-hopper is a spring-supported chute B′, that is secured to the frame in normally horizontal position and which is capable of adjustment to an inclined position, as shown in dotted lines in Fig. 3, by means of the straps *b′*, having suitable fastenings upon the frame A, so as to regulate the feed of ground ore from the hopper. The supporting-frame A is arranged step shape, as shown clearly in Figs. 1 and 3, so as to support on each step a gang of magnets C. Each gang of magnets C is arranged in a suitable box C′, so that a considerable part thereof is inclosed by non-magnetic material, while the pole ends project from the front of the inclosing box C′. The boxes are disposed in step arrangement and are spaced apart, so as to permit the magnetic ore particles to be attracted between the same by the magnets and to pass downward in vertical direction. The pole ends of each gang of magnets are covered by a septum or shield D, that may be made either of magnetic or non-magnetic material, but preferably of magnetic, that is supported close to the poles of the magnets by means of set-screws *d*, of non-magnetic material, such as brass. The upper ends of the septa D are bent in a backward direction to form chutes when the septa are made of non-magnetic material or may be attached to non-magnetic chutes E when made of magnetic material the inclination of the chutes being adjusted to greater or smaller angle toward the horizontal plane by means of set-straps *e* and clamping-screws *e′*, that are attached to the ends of the inclosing box C′, as shown in Fig. 1. The adjustment of the non-magnetic chutes E is accomplished against the spring tension of the upper inclined end of the septa D, said septa being made thin enough to have sufficient elasticity for permitting such adjustment. The chutes can be adjusted so that their upper ends are in proximity to and sufficiently separated from the adjacent septa by the adjustment of the boxes, as will be described hereinafter, so as to provide for the proper passage of the gangue from one chute to another and to permit the magnetic particles to pass between the upper edges of the chutes and adjacent septa. The lower ends of the septa are curved inwardly or backwardly below the lower poles of the magnets.

The upper surfaces of the inclined chutes E are preferably provided with diverging ribs *r*, so that the ore and tailings passing over the same are distributed over the entire surface of the septa. A larger number of diverging ribs are arranged at the lowermost and intermediate chutes than at the uppermost, for the reason that the width of the gangs of magnets is gradually increased from the upper to the lower gang, likewise the width of the septa and the width of the conveying-chutes. The chute B′ and the non-magnetic chutes E are all provided with side flanges, so as to prevent any dropping of the ore from the ends of the chutes.

The gangs of magnets and their inclosing boxes are supported on shelves F, that are again supported on the steps F′ of the frame A. Each inclosing box C′ is capable of being adjusted forwardly or backwardly as well as in tilted position, so as to impart different inclinations to the septa and to adjust the proper distance between the boxes as required for the proper conveying of the ore from one gang of magnets to the other, so that the magnetic particles of ore that are attracted on the septa by the influence of the magnets can freely drop into a receptacle at the lower part of the retaining-frame, while the tailings and non-attracted particles pass readily over the successive chutes and septa of the lower gangs of magnets. The adjustment of the gangs in a forward or backward direction is accomplished by means of angle-pieces *g*, that are attached to the shelves F, and screw-spindles *g′*, that are passed through tapped stationary plates g^2, said screw-spindles being provided with nuts, hand-wheels, or their equivalent at their rear ends. By this arrangement the distance between the boxes C′ is regulated, so as to permit the free dropping of the magnetic particles of ore that have accumulated on the surfaces of the septa and for the purpose of regulating the proper relative positions of the chutes in order to effectually separate the non-magnetic particles and the tailings from the magnetic particles as the ore passes down the chutes. The tilting adjustment of the gangs of magnets, with their boxes and septa, is accomplished by means of screw-spindles *h*, that pass through tapped plates on the under side of the shelves and impinge upon the studs *h′*, secured in the bottom of the boxes. The boxes are hinged to their respective shelves at the front lower edge, as shown in Figs. 1 and 3, so that by manipulating the screw-spindles *h* the tilting of the boxes on their hinged edge is accomplished. This tilting action places the septa of the gangs of magnets in inclination to a vertical plane and a greater inclination of the chutes, so as to produce a quicker motion of the ore and tailings passing over the same. This is necessary so as to adjust the separator to different qualities of ore, some of the ore being more magnetic and richer than other ore. By the tilting of the gangs of magnets and septa the quicker dropping off of the particles from the septa is also accomplished. The upper inclined portion of each septum that the chute is connected to being under the influence of the magnets serves to retard the magnetic particles of ore that pass over the same, while the non-attracted portions and tailings pass quickly at uniform speed over the septum onto the adjacent chute below. The attracted ore particles thus pass slowly on from the upper inclined to the main or vertical portion of the septum, being retained on the same by the stronger influence of the magnets, and gradually pass over the vertical to the lower backwardly-inclined portion, so that they are freely dropped off into the receptacle.

In the drawings three gangs of magnets are shown, step-shaped one below the other. It is obvious, however, that an increased number of gangs can be used, according to the character and quality of the ore to be separated. It is preferable to make the width of the gangs of magnets gradually increasing from the upper toward the lowermost gang, so as to diminish the thickness of the layer or sheet of ore and tailings that passes over the increased chutes and septa. A thicker layer is supplied to the chute and septum of the upper than is supplied to the lower gangs of magnets, the thinnest layer gliding over the chute of the lowermost gang of magnets, whereby the separation of the magnetic particles from the non-magnetic particles or tailings is accomplished in a more effective manner than if all the chutes and septa were made of a uniform width.

The operation of the magnetic ore-separator is as follows: The natural or crushed ore to be separated is conducted from the supply-hopper B over the chute B′ below the hopper onto the chute E of the uppermost gang of magnets. The ore glides over the chute and is attracted to the septum by the action of the magnets of the uppermost gang, the magnetic particles adhering to the surface of the septum and gliding gradually from the upper toward the lower part of the same until the septum is charged sufficiently, when the surplus particles gradually drop off into a collecting-receptacle at the bottom of the supporting-frame, while the non-attracted particles and the tailings pass onto the inclined chute of the next septum, being distributed by the diverging ribs into a thinner sheet, so as to be conducted to the surface of the septum of the second gang of magnets, where the same operation is repeated, while the non-magnetic particles and tailings are conducted to the chute of the third gang and distributed in a still thinner layer and conducted over the septum of the same, and so on. The magnetic particles attracted to the surfaces of the different septa accumulate gradually to such an extent as to form a continuous web or fleece-like body that gradually passes downwardly over its septum until they are dropped

off in the collecting-receptacle. This is repeated at each septum, until finally the magnetic particles are attracted from the tailings and the latter conducted off with an almost imperceptible percentage of ore particles remaining in the same. The action of the septa of the lowermost gangs of magnets is the same as in the first septum, all the septa being "charged," so to speak, with a coating of accumulating magnetic particles that move downwardly in sheet-like bodies, dropping off at their lower ends, where they pass beyond the field of magnetic attraction.

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

1. In a magnetic ore-separator, the combination, with a supply-hopper, of a plurality of gangs of magnets, each gang of magnets being arranged in suitable boxes and having their poles in approximately vertical planes, said boxes disposed in step arrangement with vertical spaces between the front and rear sides of adjacent boxes, septa secured to the front side of said boxes over the poles of said magnets, chutes supported on said boxes, means for horizontally adjusting and tilting said boxes, and means for independently adjusting said chutes in inclined position, substantially as set forth.

2. In a magnetic ore-separator, the combination of a gang of magnets inclosed in a suitable box having the poles of said magnets projecting from the front of the same, a vertically-disposed septum secured stationary to the front of said box and over the poles of said magnets, said septum having a resilient upper end extending rearwardly in oblique direction, a chute connected with and in the same plane as the upper end of said septum and supported on said box, and means for simultaneously adjusting said box and septum in forward-tilted position, substantially as set forth.

3. In a magnetic ore-separator, the combination of a gang of magnets inclosed in a suitable box having the poles of the magnets projecting from the front face thereof, a chute supported on said box having an upper inclined portion arranged over said box and a vertically-disposed lower portion arranged in front of the poles of said magnets, means for simultaneously adjusting said chute with said box, and set-straps adjustably connecting the inclined upper portion of said chute with said box, for independently adjusting same in inclined position, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

JOHN W. CARTER.

Witnesses:

PAUL GOEPEL,

HENRY SUHRBIER.