

No. 629,593.

Patented July 25, 1899.

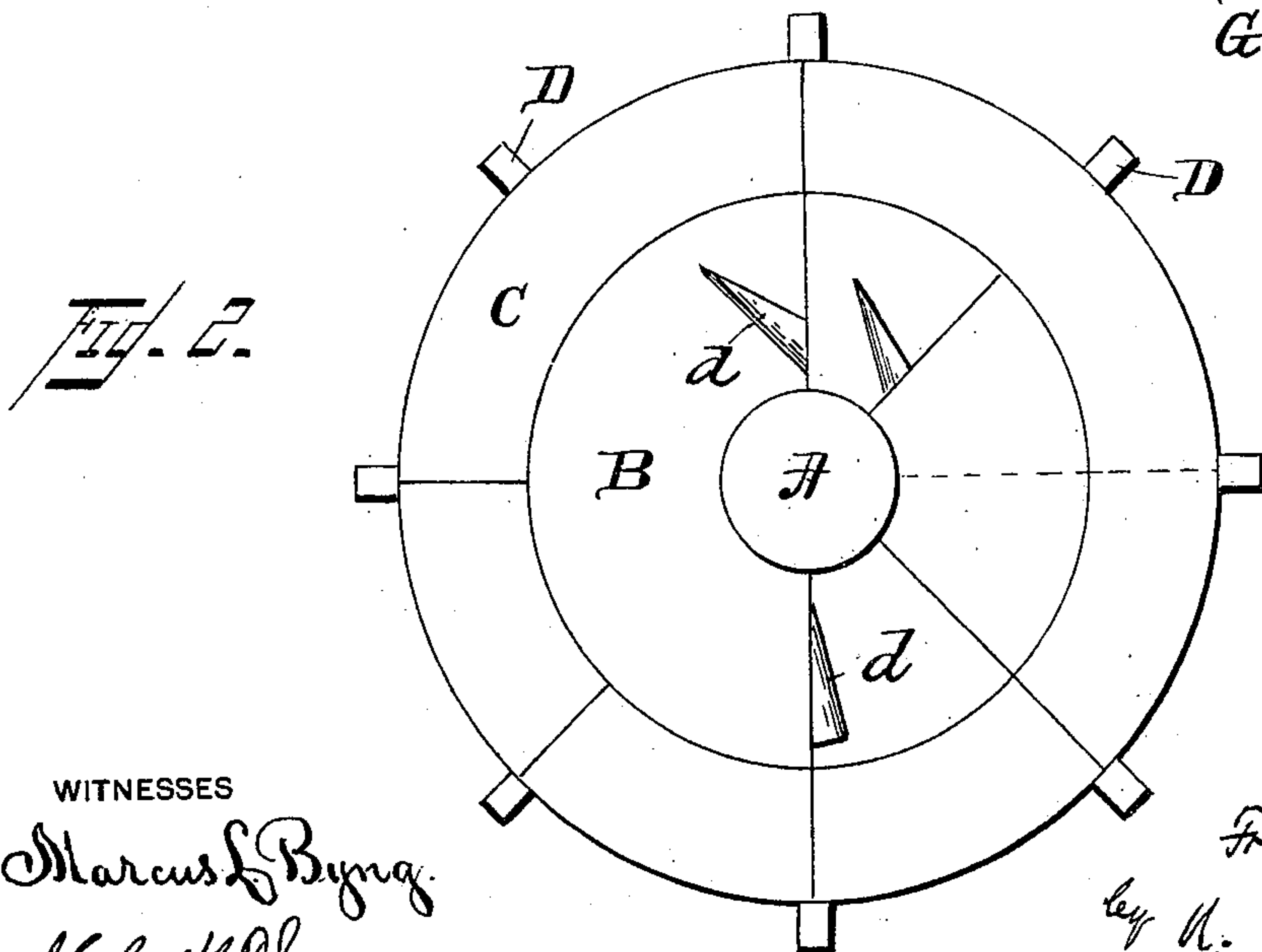
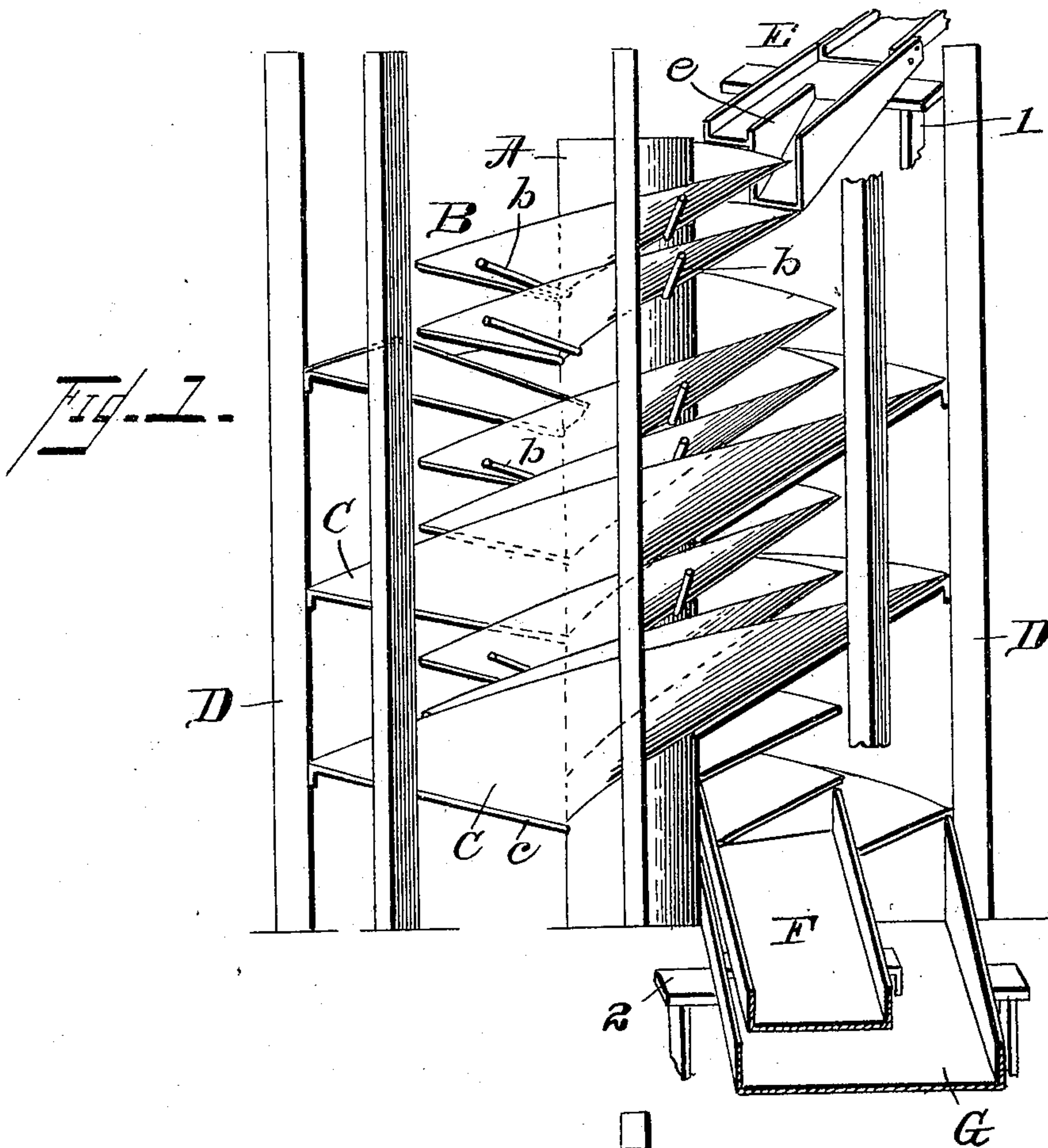
F. PARDEE.

SEPARATOR FOR ORE, COAL, &c.

(Application filed Nov. 18, 1898.)

(No Model.)

4 Sheets—Sheet 1.



WITNESSES
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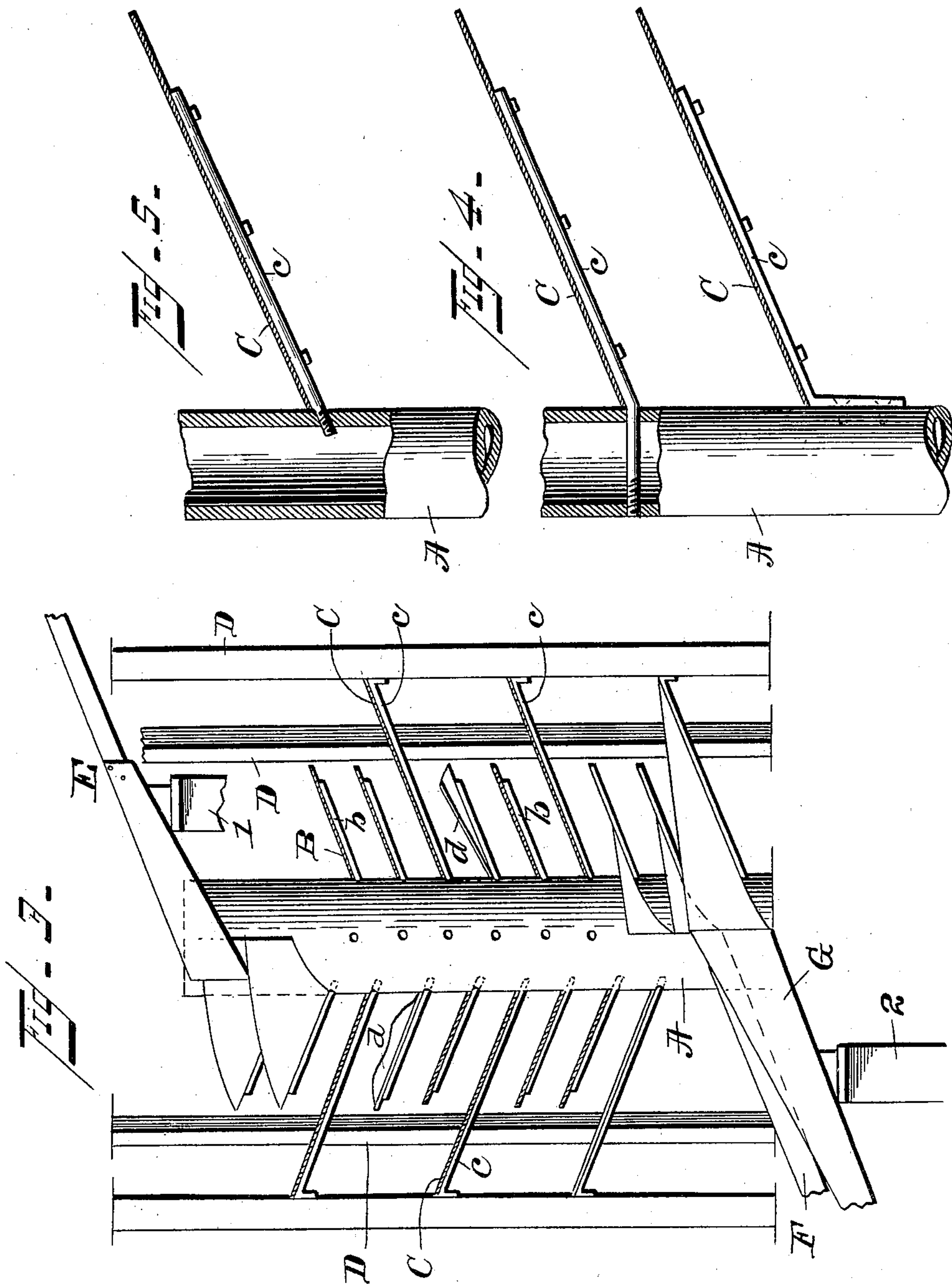
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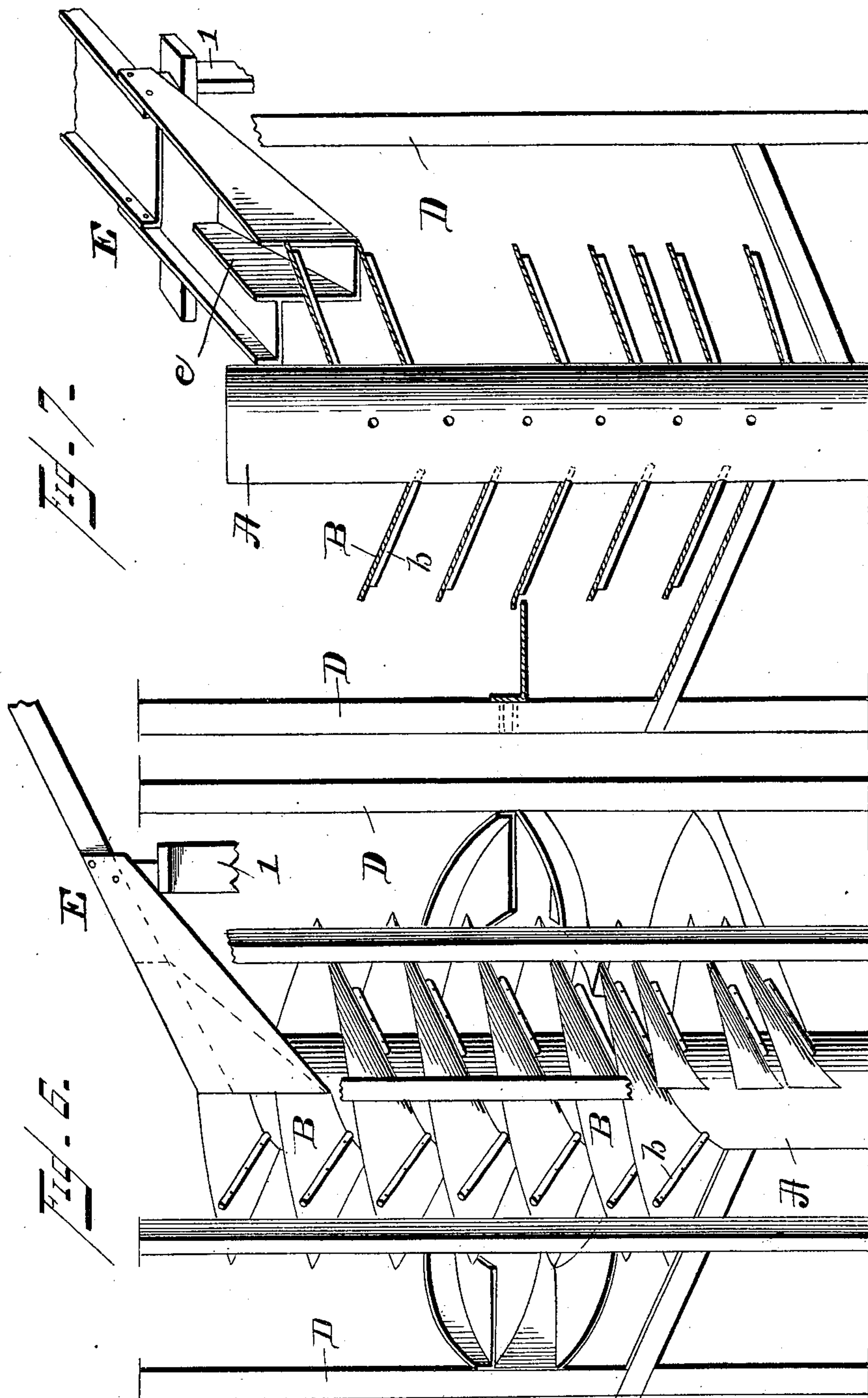
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4 Sheets—Sheet 3.



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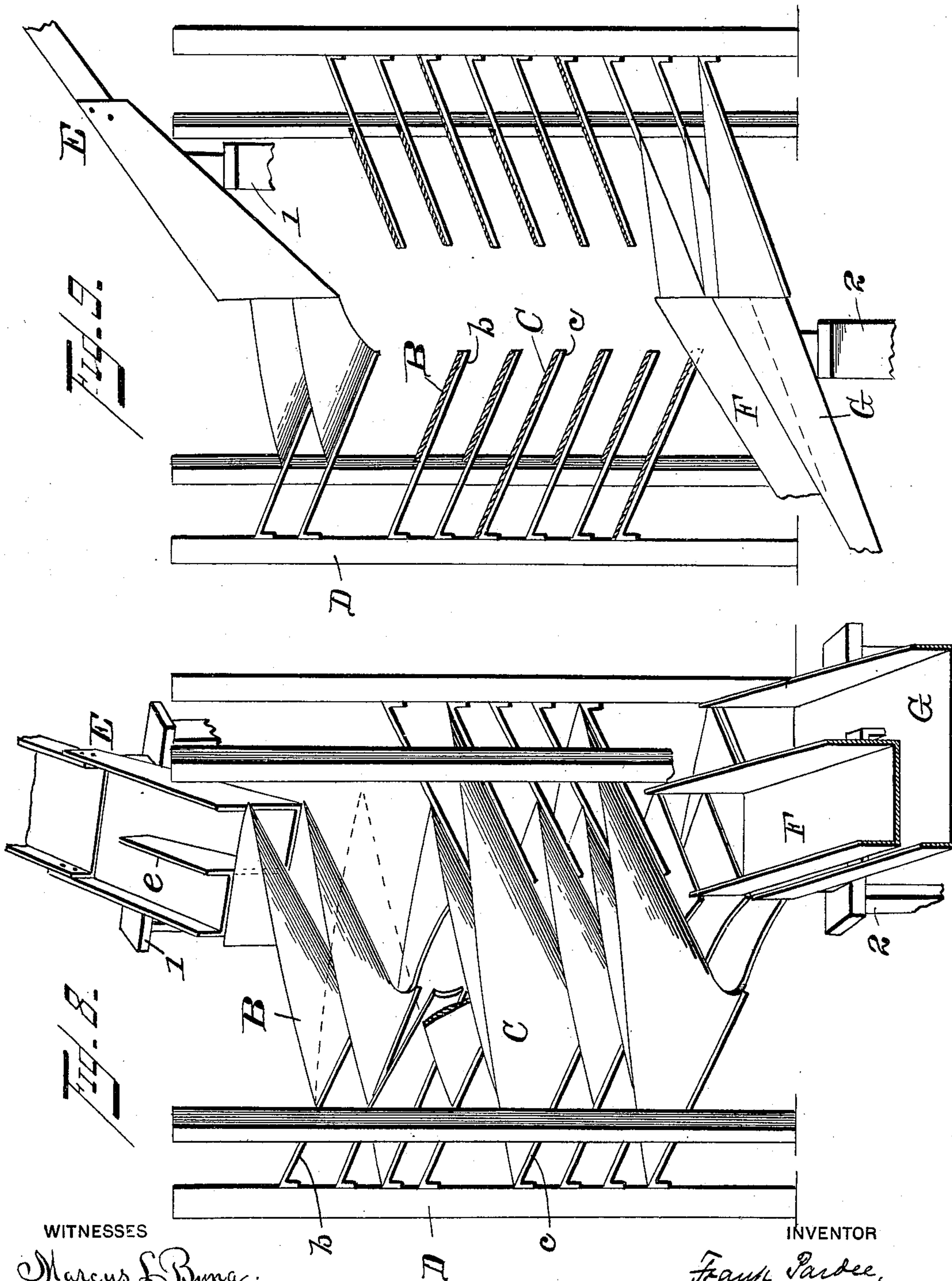
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4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

FRANK PARDEE, OF HAZLETON, PENNSYLVANIA.

SEPARATOR FOR ORE, COAL, &c.

SPECIFICATION forming part of Letters Patent No. 629,593, dated July 25, 1899.

Application filed November 18, 1898. Serial No. 696,763. (No model.)

To all whom it may concern:

Be it known that I, FRANK PARDEE, a citizen of the United States, and a resident of Hazleton, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Separators for Ore, Coal, &c., of which the following is a specification.

The improvements relate to machines for separating substances differing in specific gravity or frictional resistance and belong to that class of machines which operate by centrifugal action.

The object of the invention is to provide a cheaper and more perfectly-operating machine than those previously constructed for the automatic separation and assortment of such substances.

As the machines illustrated by the drawings are adapted to the separation of coal from slate and from "bone" or pieces of coal containing a kind of slate usually in thin layers, the invention will be described in that connection, although it is applicable to the separation of other substances.

When anthracite coal is taken from the mines, it is mixed with more or less rocky substances, usually designated as "slate," which contain silica or other gritty matter possessing a peculiar frictional resistance when moving over other solid substances. This resistance is such during the passage of the mixed substances along the spirals of a centrifugal separator as to cause the slate and bone to move slower than the pure coal apart from the difference in velocity due to the difference in the specific gravity. The coal gliding with more rapidity and meeting with less resistance from the surface over which the several substances are made to travel passes to the outer edge of the spirals, the bone being next and the slate nearest the center. The difference in the nature and action of the substances makes centrifugal force available for purposes of separation; but that force is not wholly to be relied upon. The substances must necessarily adjust themselves to their relative positions, which requires some to cross the course of others and occasions more or less knocking of the pieces against one another. So, also, the slate or

rock, as well as the bone, at times receive an impact from the substances behind them, which, or the knocking already mentioned, gives to pieces of slate or bone a greater impetus than they would have from the mere force of gravity or of centrifugal action, and unless prevented from so doing such pieces are liable to pass outwardly beyond the intended limits and become mixed with the coal; but the peculiar frictional resistance which operates against the speed of the slate and bone when moving over another solid surface may be taken advantage of by mechanical means for overcoming any extraordinary impetus which they may receive and which will change their course, so that such pieces will proceed nearer the center of a spiral way and come within proper limits before emerging from the machine.

My application Serial No. 680,987, filed May 17, 1898, shows a centrifugal separator having an axial support and a spiral way, forming a floor between the same and an outer abutment or wall, within which the material is confined while passing through the machine. The invention claimed in that application was described more particularly in connection with that form of machine, which, however, is expensive to construct, and unless the diameter of the spiral way is large enough to prevent coal from striking against the outer abutment liability exists that the rebound will be such as to cause them to pass so far inward that they will be unable to regain their proper place in sufficient time to emerge from the machine separately from the slate.

In order to attain the object already stated by utilizing the different properties of the substances to be separated and overcoming conditions which would otherwise be a hindrance, the invention consists in the construction of a machine with two or more suitably-supported spiral ways of different width, the larger spirals being arranged and adapted to catch and conduct the substances thrown from the smaller ones during the passage of the same through the machine; and, further, in the construction and arrangement of the parts, as hereinafter more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation of a separator embodying the invention. Fig. 2 is a plan view of the same. Fig. 3 is an elevation, partly in section, showing a central and some of the outer supporting-columns in full, also the inlet-chute and a portion of the smaller spiral in full, the continuation of the latter being shown in section, as is the larger spiral, while the outlet-chutes are shown in full. Figs. 4 and 5 are details of a central supporting-column with inclined arms or brackets for supporting the spirals and show several ways in which these arms may be secured to the supporting post or column. Figs. 6 and 7 are respectively an elevation and a vertical sectional view showing a modified arrangement or construction of the spirals, while Figs. 8 and 9 are similar views of another modification having no central supporting-column.

In Figs. 1 to 7 of the drawings, A represents a central supporting column, post, or shaft, which may be of wood, iron, or other suitable material. A double series of spirals forming ways B and C of different size or width are shown in these figures as being built around the supporting-column; but, if desired, more than two such spiral ways may be embodied in the construction.

The spiral ways B and C may be of plain or perforated metal, of glass, or of any other suitable material secured solidly to the supporting-column by brackets or arms *b* and *c*, three modes of securing them being shown in Figs. 4 and 5, one of which is screwed into the post A, another passed through a hole made for it, while the third is bolted to the side of it. These brackets or arms incline upward, so that when the material forming the spiral ways is secured thereto by bolts and nuts, as shown, or otherwise it will form an inclined surface and curve around the central support from top to bottom or along so much thereof as it may be desirable to extend it.

The arms or brackets to which the larger spirals C are secured may be supported at their outer ends by a framework or by columns D, as shown in several of the figures. These outer columns or posts also serve to prevent any serious vibration of the spiral ways when filled with coal and slate or other substances requiring separation.

A chute E admits the mixed substances—say coal and slate as it comes from the mine—to the spirals B and C, and this chute is preferably divided by a partition *e*, which causes the substances to part into streams, which pass along the spirals in a whirl around the central post. The centrifugal force thus created increases during the passage of the substances through the machine and causes the less frictional substance, such as the coal, to be thrown outward over the edge of the smaller spiral and onto the larger ones, while the material having greater weight or more frictional resistance, such as the slate, will gravitate or

be forced toward the central column or shaft and the bone will be carried along the outer edge of the smaller spirals.

The machine may connect with a proper outlet-chute, as F, connecting with the smaller spirals to receive the slate and bone, respectively, and shown in an upright machine as being below the spirals, while the chute G receives the clean coal from the larger spiral, and by this means the several materials are led to separate piles or heaps at any convenient place for receiving them. The respective upper and lower chutes may be supported by any suitable means, as by benches 1 and 2, as indicated in the drawings.

In Figs. 6 and 7 the outer or larger spiral C is shown as not being continuous, but with one section arranged beneath another, so that the substances running over the edge of the smaller spiral drop onto a section of the larger spiral and from that to the section next below, the different sections being connected by an outer rim or flange secured to the outer posts D, as shown.

It is not essential that the spirals should be supported by a central column, shaft, or post, though I prefer to so construct the machine. The spirals may, however, be supported by a framework or outer columns D D, as shown in Figs. 8 and 9, or otherwise, as desired. Where there is no central support and the machine is constructed as indicated by these figures, the centrifugal action and difference in frictional resistance will cause the slate to run into the central opening and drop down to the chute F for receiving it, while the bone and coal will remain on the spirals and reach their chutes as if the central column were present.

If desired, the machine may be arranged so that both spirals are fed by separate chutes and arranged to operate separately from each other. In such case or where for any reason it is desired to make a separation on each of the spiral ways the spirals are preferably provided with humps, ridges, corrugations, or other forms of undulating surfaces—as, for example, those shown at *d d* on the smaller spirals in several of the figures—but neither the form of the spirals, nor the manner in which they are constructed, nor the materials of which they are made, nor the way in which they are secured are essential to this invention, except when and as specified in the claims.

The operation of the machine will be understood from the description already given, and its advantages over the constructions heretofore devised for like purposes, and more especially as a separator for coal from slate and other foreign matter, will be apparent to those who are familiar with the use of such machines.

I do not herein claim the features of construction of spiral separators which are made the subject-matter of the application filed by me on May 17, 1898, Serial No. 680,987, nor do I herein claim the features of such a ma-

chine which form the subjects-matter of the several applications filed by me on November 18, 1898, Serial Nos. 696,761, 696,762, 696,764, 696,765, 696,766, and 696,767, respectively, to which reference is hereby made.

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

1. A machine for separating ore, coal, &c., by gravitation, centrifugal action and frictional resistance, comprising suitably-supported spiral ways of different width, the larger spirals being arranged and adapted to catch and conduct the substances thrown from the smaller ones during the passage of the same through the machine.

2. A machine for separating ore, coal, &c., by gravitation, centrifugal action and frictional resistance, comprising a central support, spiral ways of different width curved around said support, the larger spirals being arranged and adapted to catch and conduct the substances thrown from the smaller ones during the passage of the same through the machine.

3. A machine for separating ore, coal, &c., by gravitation, centrifugal action and frictional resistance, comprising a central sup-

port, inclined arms secured thereto and projecting therefrom and spiral ways of different width formed on said arms around said support, substantially as described.

4. A machine for separating ore, coal, &c., by gravitation, centrifugal action and frictional resistance, comprising suitably-supported spiral ways of different width, the larger spirals being arranged and adapted to catch and conduct the substances thrown from the smaller ones and a chute for admitting the substances to be separated to said machine.

5. A machine for separating ore, coal, &c., by gravitation, centrifugal action and frictional resistance, comprising suitably-supported spiral ways, of different width, the smaller spiral being adapted to receive the substances to be separated, and the larger one to receive the substances forced from the smaller spiral, and chutes forming outlets for the different substances when passed through the machine.

FRANK PARDEE.

Witnesses:

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GUST. FISCHER.