

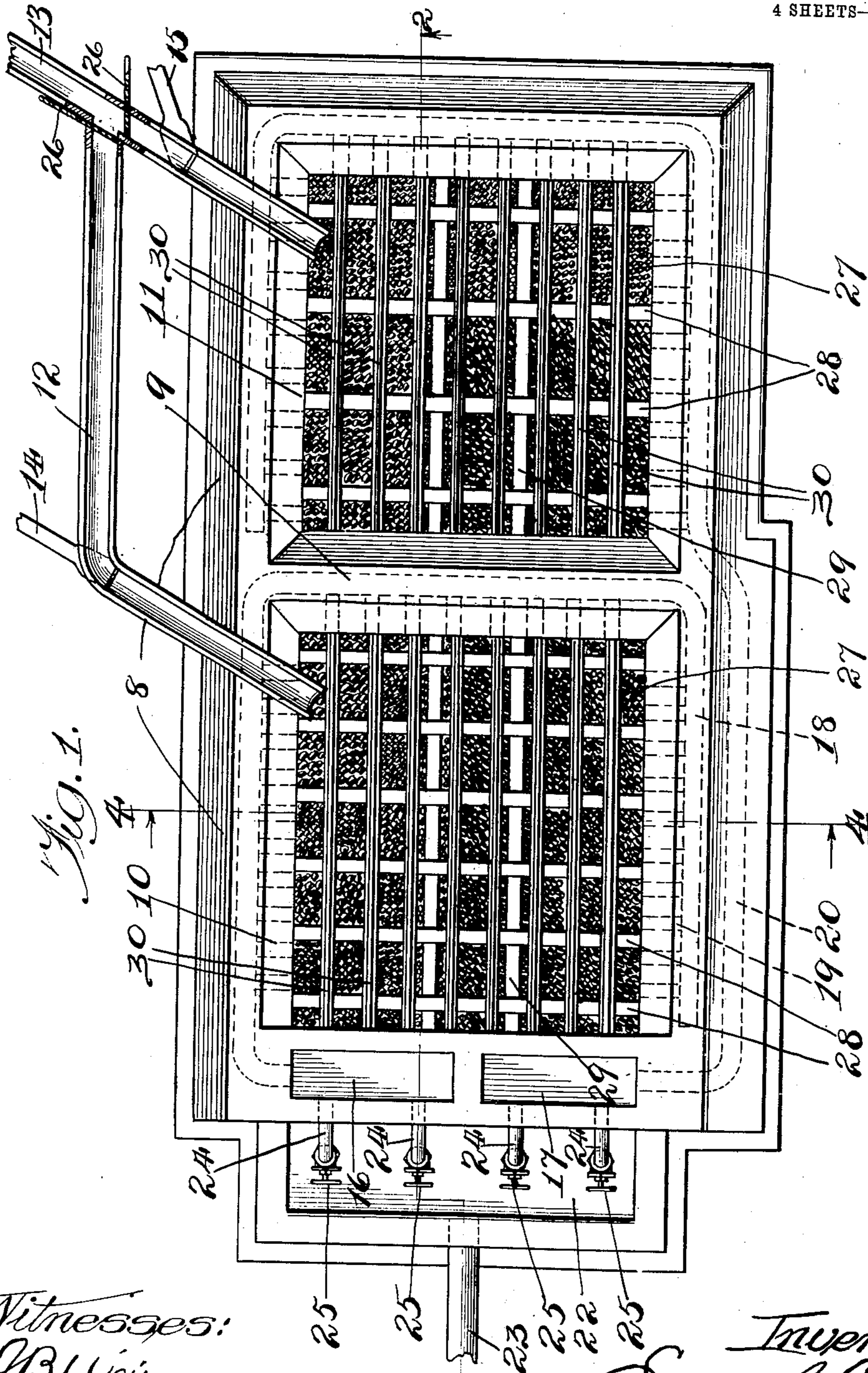
No. 824,340.

PATENTED JUNE 26, 1906.

E. B. CLARK.
SLAG GRANULATING APPARATUS.

APPLICATION FILED SEPT. 5, 1905.

4 SHEETS—SHEET 1.



Witnesses:
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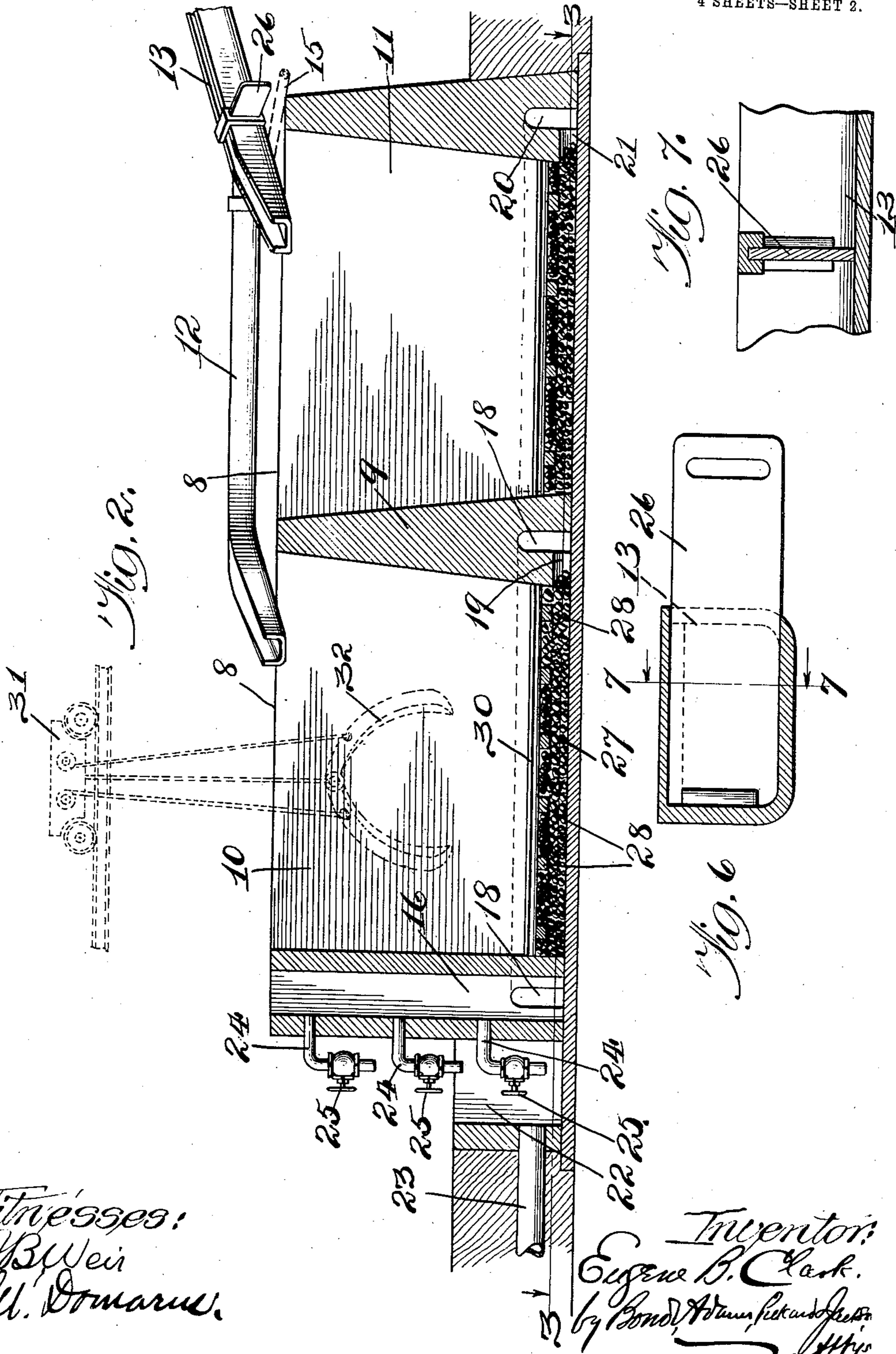
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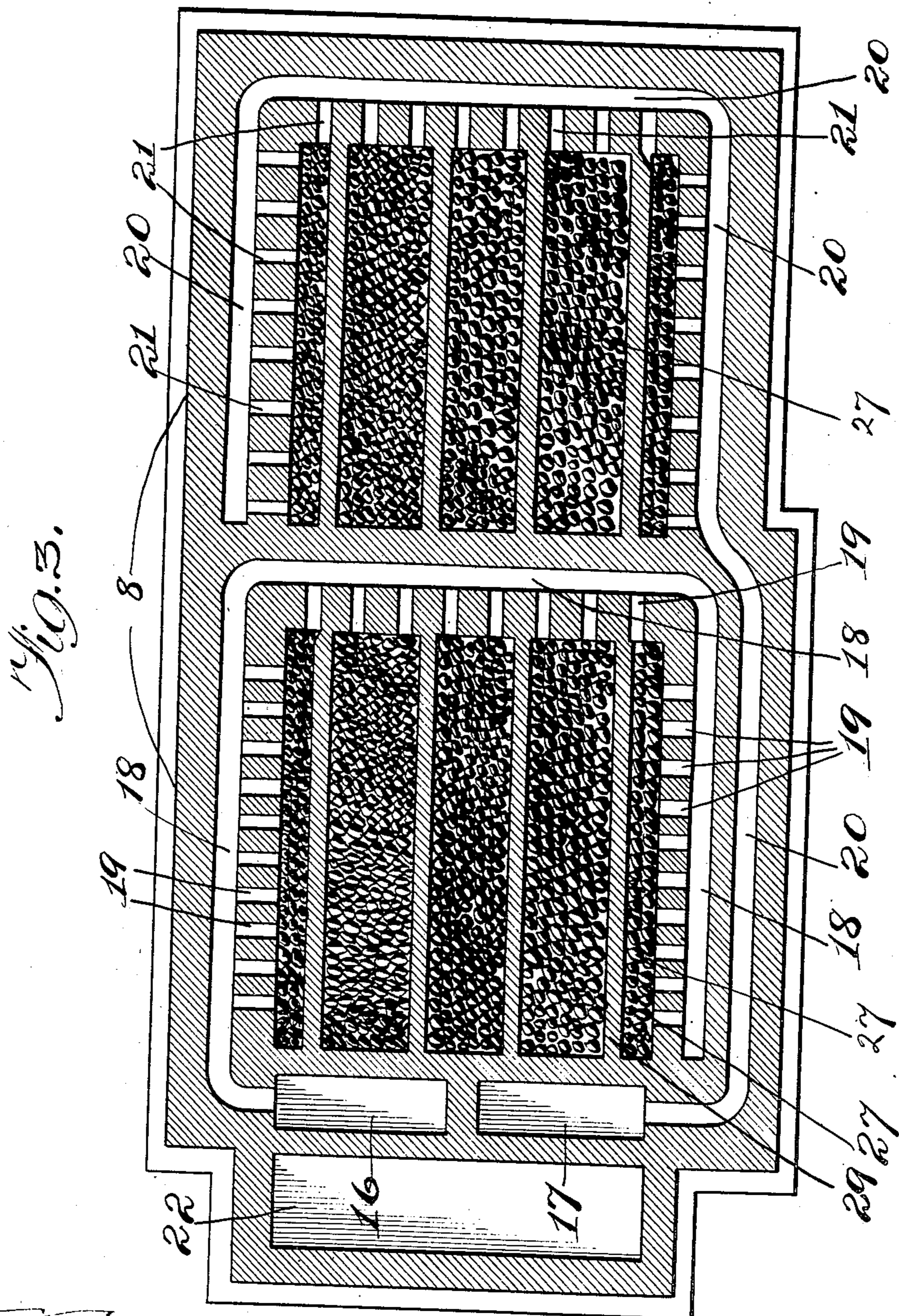
Inventor:
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4 SHEETS—SHEET 3.



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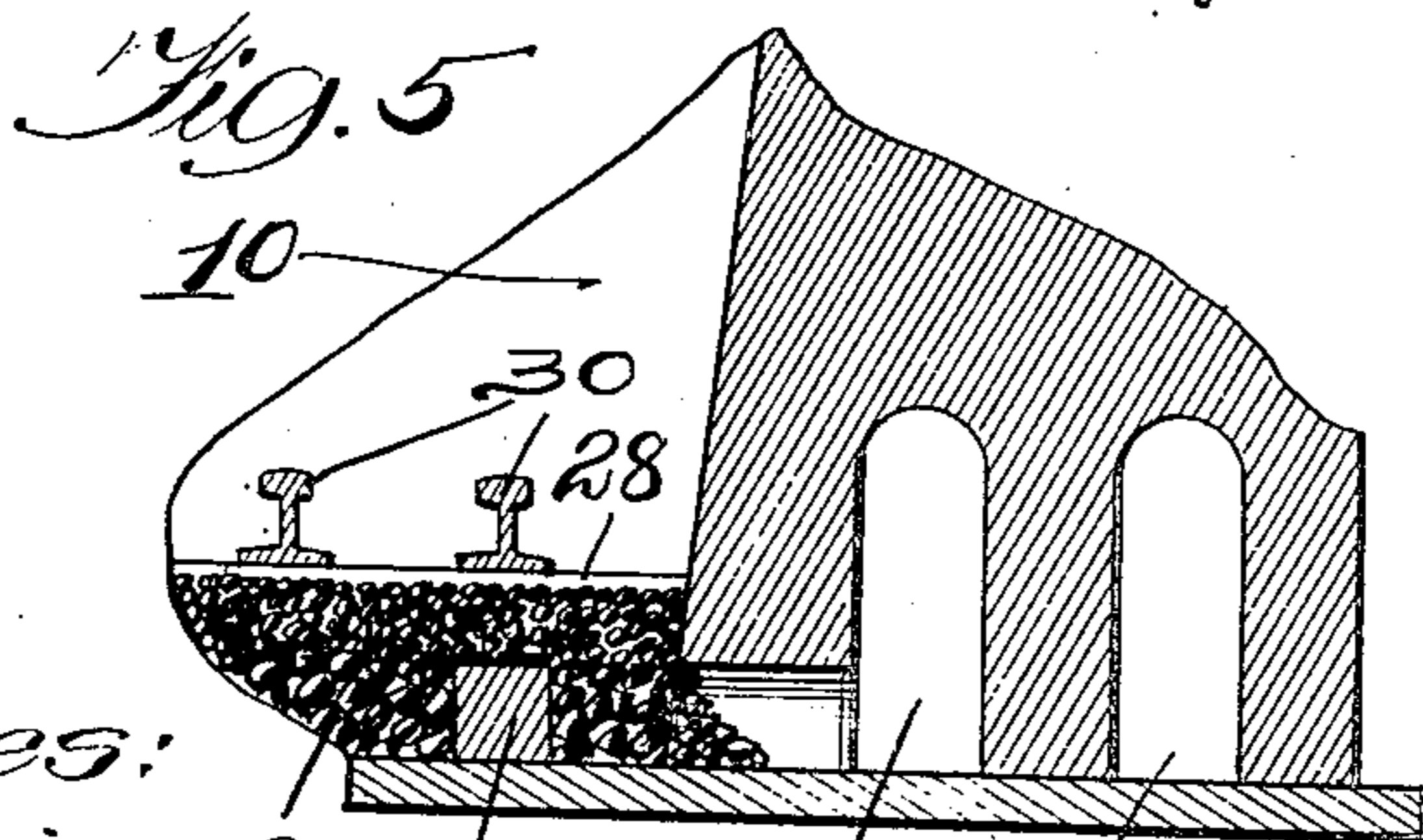
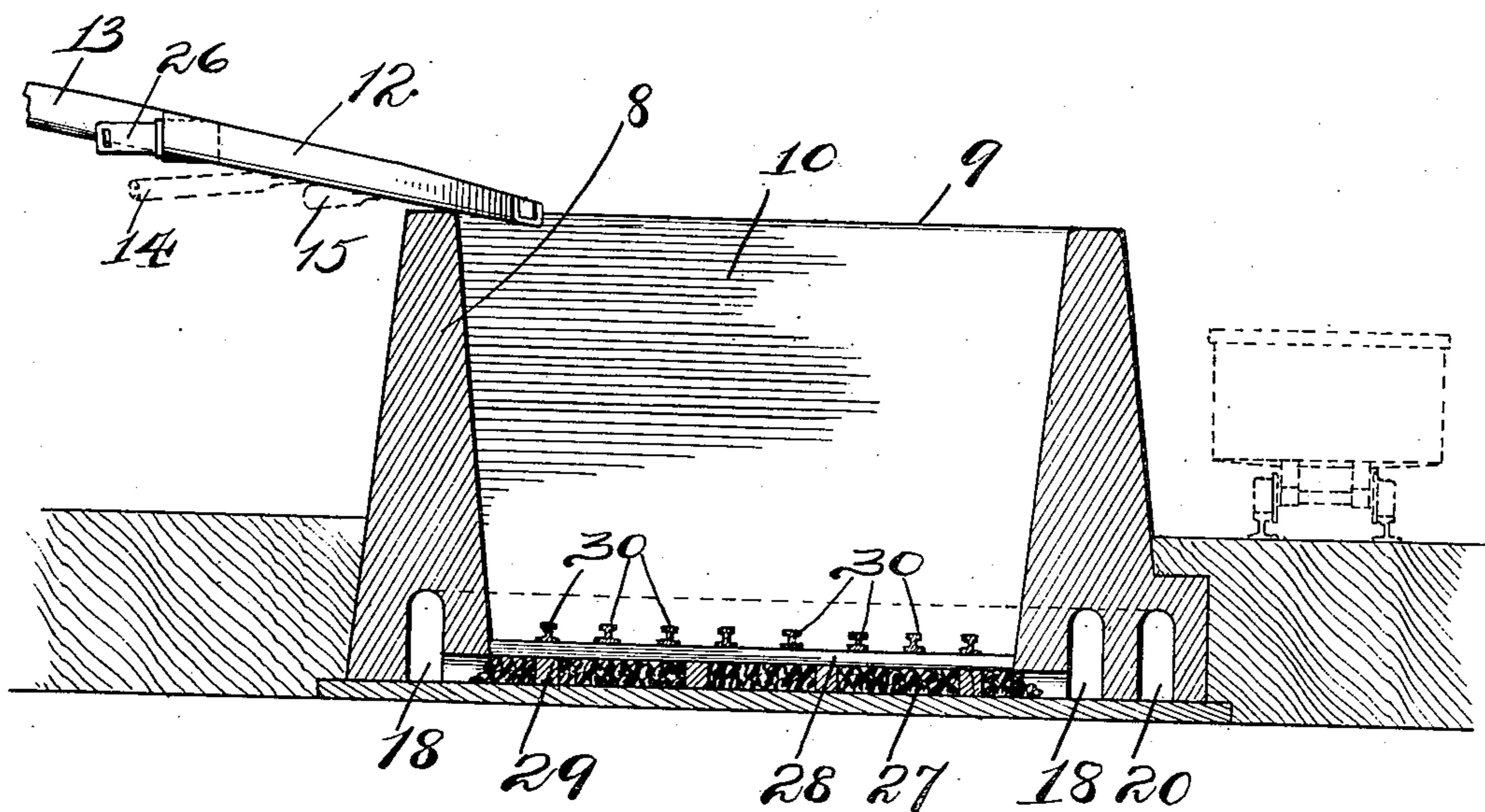
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4 SHEETS—SHEET 4.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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SLAG-GRANULATING APPARATUS.

No. 824,340.

Specification of Letters Patent.

Patented June 26, 1906.

Application filed September 5, 1905. Serial No. 277,059.

To all whom it may concern:

Be it known that I, EUGENE B. CLARK, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Slag-Granulating Apparatus, of which the following is a full and complete specification, reference being had to the accompanying drawings.

My invention relates to an apparatus for the granulating of slag for commercial purposes; and its object is to provide a new and improved apparatus for that purpose.

In the granulating of molten slag or cinder from blast-furnaces and other sources it is essential that the stream of water and cinders should drop into a tank containing water. If the tank does not contain water in sufficient quantity, the cinder will be fluffy and porous, which makes it unavailable for most of the purposes for which it is used. Now if this cinder is excavated from a tank containing water after it has been granulated and without the water having been drawn off from the tank the large amount of water which is necessarily taken out with the cinder and loaded into the car becomes objectionable because it allows too much granulated cinder to escape from the car around upon the tracks. In the winter it is especially objectionable for another reason, because the car-load of wet cinder is apt to freeze solid, making it exceedingly difficult to unload. Icicles form from the bottom of the car to the ground, which freeze the running-gear of the car solid with ice and even freeze the car solid to the ground. Besides, after the removal of the cinder in such apparatus a considerable portion remains in the water remaining in the tank, and if the water is then drawn out more or less cinder will flow out with it into the sewers. On the other hand, when it is attempted to draw the water off from the tank before the granulated cinder is removed devices which have been used to prevent the running off of the granulated cinder with the water would prevent the running off of the water. For instance, screens have been used, but they have been unsuccessful. As the specific gravity of granulated cinder varies with the character of the slag, some being lighter than water and some heavier and some of about the same specific gravity, the openings of the screen clog with the cinder and prevent the outflow of the water. The prin-

cipal object of my invention is to provide an apparatus which will overcome these difficulties.

Another object of my invention is to construct a slag-granulating apparatus which may be rapidly and economically used, one portion thereof being emptied while the other is being filled.

Other objects of my invention are to improve slag-granulating apparatus in sundry details hereinafter pointed out.

I accomplish these objects by means of the apparatus hereinafter described.

What I claim as new will be pointed out in the claims.

In the drawings, Figure 1 is a top or plan view. Fig. 2 is a vertical section on line 2 2 of Fig. 1. Fig. 3 is a horizontal section on line 3 3 of Fig. 2. Fig. 4 is a vertical cross-section on line 4 4 of Fig. 1. Fig. 5 is an enlarged detail, being a partial vertical section showing the filter-bed and water-channels at one side of the bed. Fig. 6 is an enlarged detail, being a view of one of the gates by which the troughs for conveying the slag are opened and closed. Fig. 7 is an enlarged detail, being a section on line 7 7 of Fig. 6.

Referring to the drawings, 8 indicates a tank which is generally rectangular in shape, the walls of which are built, preferably, of cement or concrete or some similar material and which is divided by partition 9 into two compartments 10 and 11.

12 13 indicate chutes or troughs which lead from a blast-furnace (not shown) to the compartments 10 and 11, respectively, and down which the molten slag passes from the furnace to the tank.

14 15 indicate pipes which lead to any suitable source of water-supply (not shown) and open into the troughs or chutes 12 13.

16 17 indicate chambers of the same height as the compartments 10 and 11, which are located at the forward end of the tank.

18 indicates a passage or channel formed at the bottom of the side walls of the tank 8 and at the bottom of the partition 9, which surrounds the compartment 10 upon three sides and opens at one end into the chamber 16.

19 indicates passages at the bottom of the compartment 10, opening therefrom into the passage 18.

20 indicates a passage or channel formed in the side and rear walls of the tank at the

bottom thereof, which surrounds the chamber 11 upon three sides and opens at its forward end into the passage 17.

21 indicates passages which open from the bottom of the compartment 11 into the passage 20.

22 indicates a chamber located in front of the tank 8, and 23 indicates a discharge-pipe by means of which the chamber 22 is discharged.

24 indicates pipes opening at various heights above the bottom into the chambers 16 and 17 and controlled by valves 25. The lower row of the pipes 24 open into the chamber 16 at a height somewhat above the top of the passages 18 and 20 and above the top of the filter-bed, hereinafter described.

26 indicates gates which are adapted to open or close the chutes or troughs 12 and 13, so that either one may be opened for the flow of molten slag from a blast-furnace or other source to the tank 8. Any well-known and approved form of gate or stoppage device may be used.

27 indicates a filter-bed which is preferably formed of broken stone with the largest stones at the bottom, the stones decreasing in size toward the top, where the stones of the smallest size are placed.

28 indicates cross-bars which are supported upon beams 29, which run longitudinally of the tank and which support sections of railroad-rails 30 upon them above the filter-bed 27. The filter-bed and rails are of such height that the top of the rails 30 is a short distance below the opening of the lowest row of pipes 24 into the chamber 16, whereby a minimum height of water a short distance above the top of the filter-bed and rails will be constantly maintained in the chambers 10 and 11 of the tank 8.

31 indicates a traveling crane provided with a grab-bucket 32 of any approved form or description by means of which the granulated cinder may be removed from the tank and which being of any well-known form or description and forming no part of my present invention is indicated only diagrammatically in the drawings and needs, I believe, no further description.

The operation of the above-described devices is as follows: One or both of the chambers 10 11 is partly filled with water to such height as may be desired, determined by opening one or the other of the rows of pipes 24 above the lowest row. It will be obvious that the water by means of the passages 18 19 20 21 will be maintained in the chambers 16 17 at the same height as in the compartments 10 11. The molten slag is thereupon allowed to flow down one of the chutes—say chute 12—where it meets with a stream of water flowing into it from the pipe 14, which partially granulates the slag. The mingled water and slag fall together into the

water in the compartment 10, where the granulation is completed. As the slag continues to flow the granulated slag will settle in the compartment and form a bed above the filter-bed and above the rails 30. Owing to the position of the lowest row of pipes 24 being above the tops of the rails 30 this will cause a constant bed of moist granulated slag to be formed above the stone filter-bed. The water in the chamber 10 will be kept at a constant level as it filters down through the layer of slag and through the filter-bed 27 and passing out through the passage 18 into the chamber 16 is discharged through the pipes 24 into the chamber 22, and thence out through the discharge-pipe 23. The chamber 22 is open at the top and of such size that the water passing into it may be examined to see that no granulated slag is passing off with the water. When the compartment 10 is sufficiently filled with the granulated slag, the lowest row of pipes 24 is opened and the water filtering through the constantly-preserved bed of moist granulated slag above the rails and through the filter-bed, so that it carries no granulated slag with it, is lowered to the level of the lowest row of pipes. Thereupon the gate 26, controlling the chute 12, is closed, the gate controlling chute 13 is opened, and the process is repeated in the compartment 11. While the granulating is taking place in the compartment 11, the granulated slag in compartment 10 is removed by means of grab-bucket 32, the rails 30 preventing the grab-bucket from disturbing the filter-bed 27. While compartment 10 is being emptied, compartment 11 is being filled. When compartment 11 is filled with granulated slag, the chute leading into it is closed and the operation of granulating repeated in compartment 10.

Instead of filling one of the compartments with water to a level which will be sufficient for the entire granulating operation it is obvious that one of the lower rows of discharge-pipes may be opened and water filled into the compartment up to that level and that as the granulation continues that row may be closed and the next one above it opened, and so on till the compartment is filled. I have shown my apparatus in the drawings as divided transversely by a partition separating it into two compartments. It will be obvious, however, that the partition might be otherwise arranged without departing from the spirit of my invention in this respect, and I therefore do not limit myself to a partition so located.

By means of this apparatus and operation I am enabled to prevent the granulated slag from flowing off with the water discharged from the compartments, which not only causes a loss of the granulated slag, but which is objectionable, as allowing slag to flow into the sewers with the discharged water. I also

by arranging the lower row of discharge-pipes 24 above the tops of the rails 30, as has been said, provide that the water can never be drawn off to a point where the rails will not be submerged. This materially assists in the proper filtration of the water through the granulated slag, which, as has been said, forms the top layer of the filter-bed, for if the granulated slag is allowed to become alternately dry and wet, as would be the case if the water were allowed to run entirely away, it has been found that the granulated slag has a tendency to form a solid mass, through which the water will not filter, whereas the likelihood of this condition occurring is greatly lessened or entirely done away with if the granulated-slag layer at the bottom is kept constantly wet by being constantly submerged.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a slag-granulating apparatus, the combination with a tank, and means for feeding mixed slag and water thereto, of means for regulating the height of water in said tank during the granulating operation, a filter-bed in said tank, means for preventing the water in said tank from falling below a minimum fixed level above said filter-bed, and means for discharging the water in said tank down to said level through said filter-bed, substantially as described.

2. In a slag-granulating apparatus, the combination with a tank and means for feeding mixed slag and water thereto, of a cham-

ber adjacent to said tank, a filter-bed in the bottom of said tank, passages connecting the lower part of said tank with the lower part of said chamber, and discharge-pipes opening out of said chamber at different heights, the lowest of said discharge-pipes being above the top of said filter-bed.

3. In a slag-granulating apparatus, the combination with a tank, and means for feeding mixed slag and water thereto, of a chamber adjacent to said tank and of substantially the same height therewith, connections between said tank and said chamber, a filter-bed in the bottom of said tank, and discharge-pipes from said chamber at different heights, the lowest of such discharge-pipes being located a short distance above the top of the filter-bed, substantially as described.

4. In a slag-granulating apparatus, the combination with a tank, and means for feeding mixed slag and water thereto, of a chamber adjacent to said tank and of substantially the same height therewith, connections between said tank and said chamber, a filter-bed in the bottom of said tank, discharge-pipes from said chamber at different heights, the lowest of such discharge-pipes being located a short distance above the top of the filter-bed, and an external chamber into which said pipes discharge, substantially as described.

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Witnesses:

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