No. 721,505. PATENTED FEB. 24, 1903.

A. S. DWIGHT.

APPARATUS FOR FORMING BLAST FURNACE CHARGES.

APPLICATION FILED APR. 27, 1901.

NO MODEL. 5 SHEETS—SHEET 1.

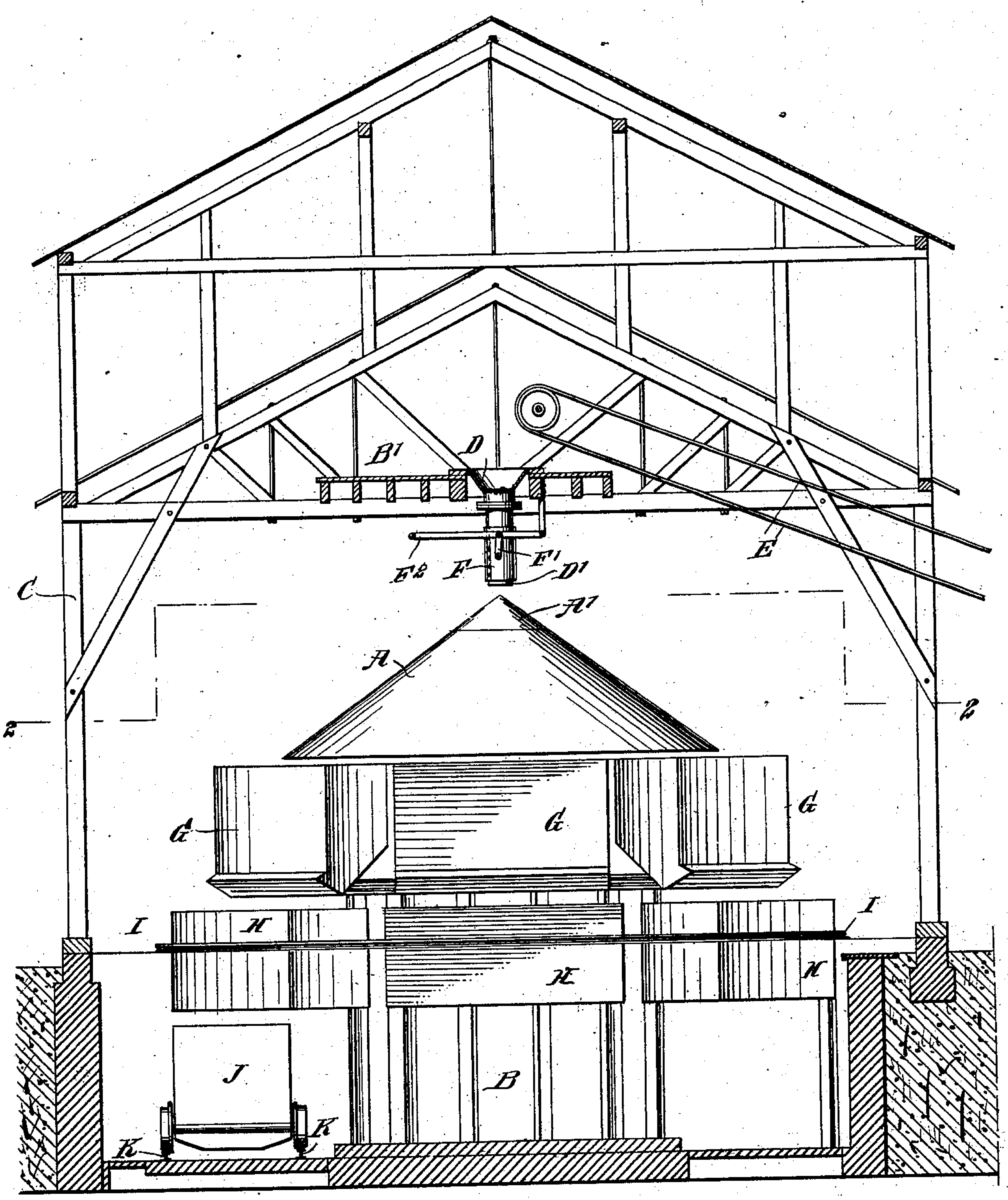

Fig. 1

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ATTORNEYS

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NO MODEL. 5 SHEETS—SHEET 2.

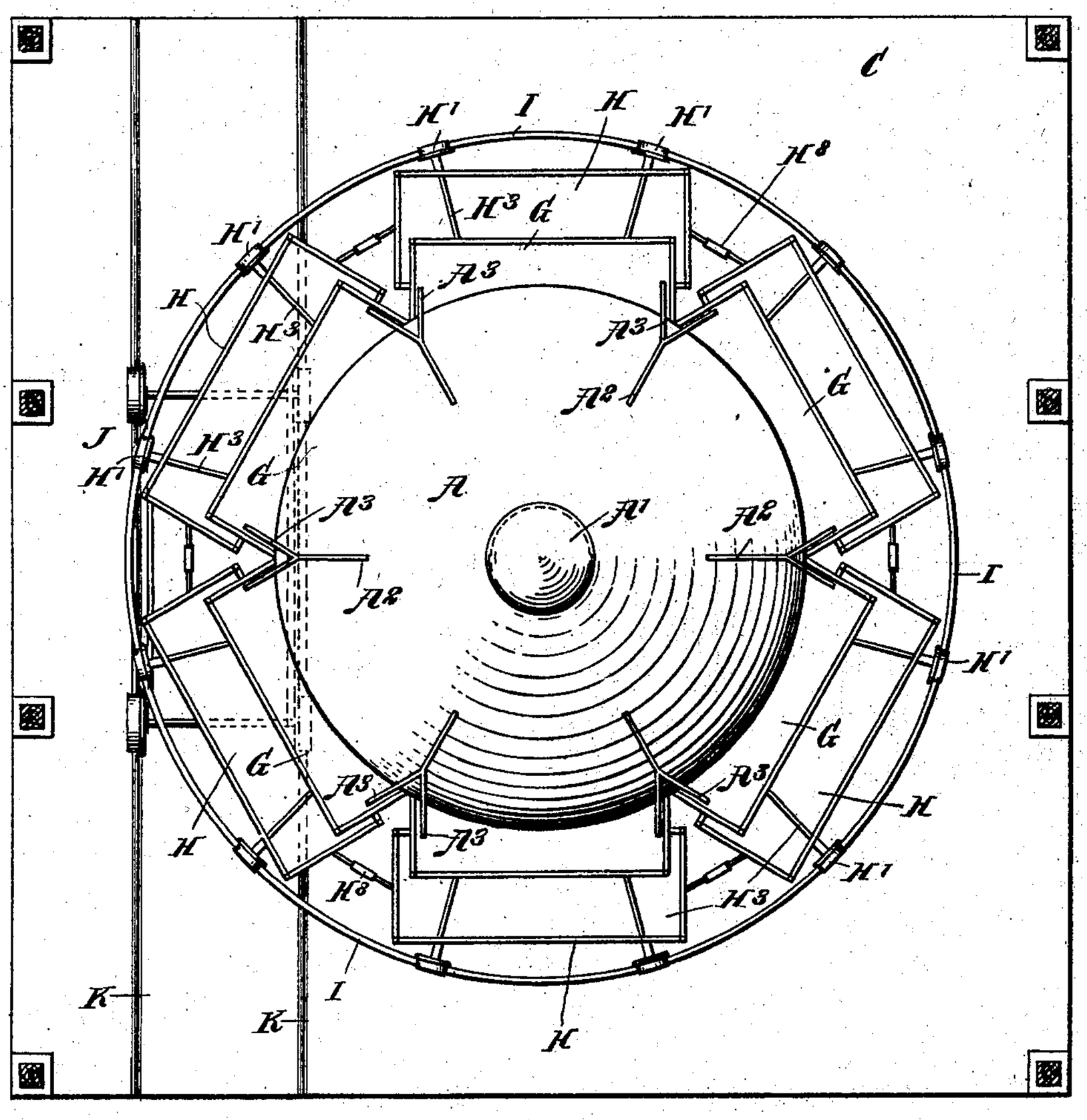

Fig. 2

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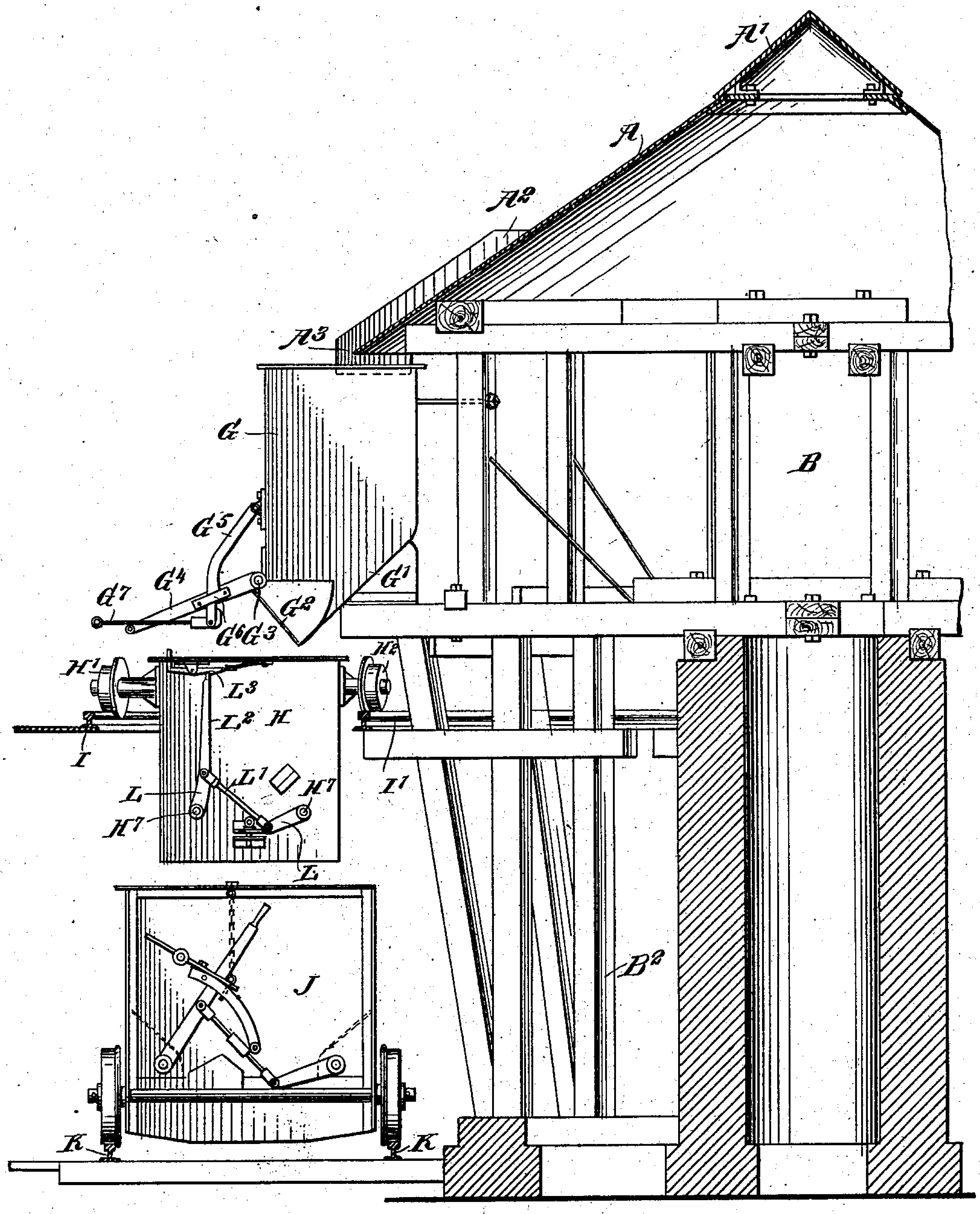
NO MODEL. 5 SHEETS—SHEET 3.



WITNESSES:

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Fig. 3.

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NO MODEL. 5 SHEETS—SHEET 4.

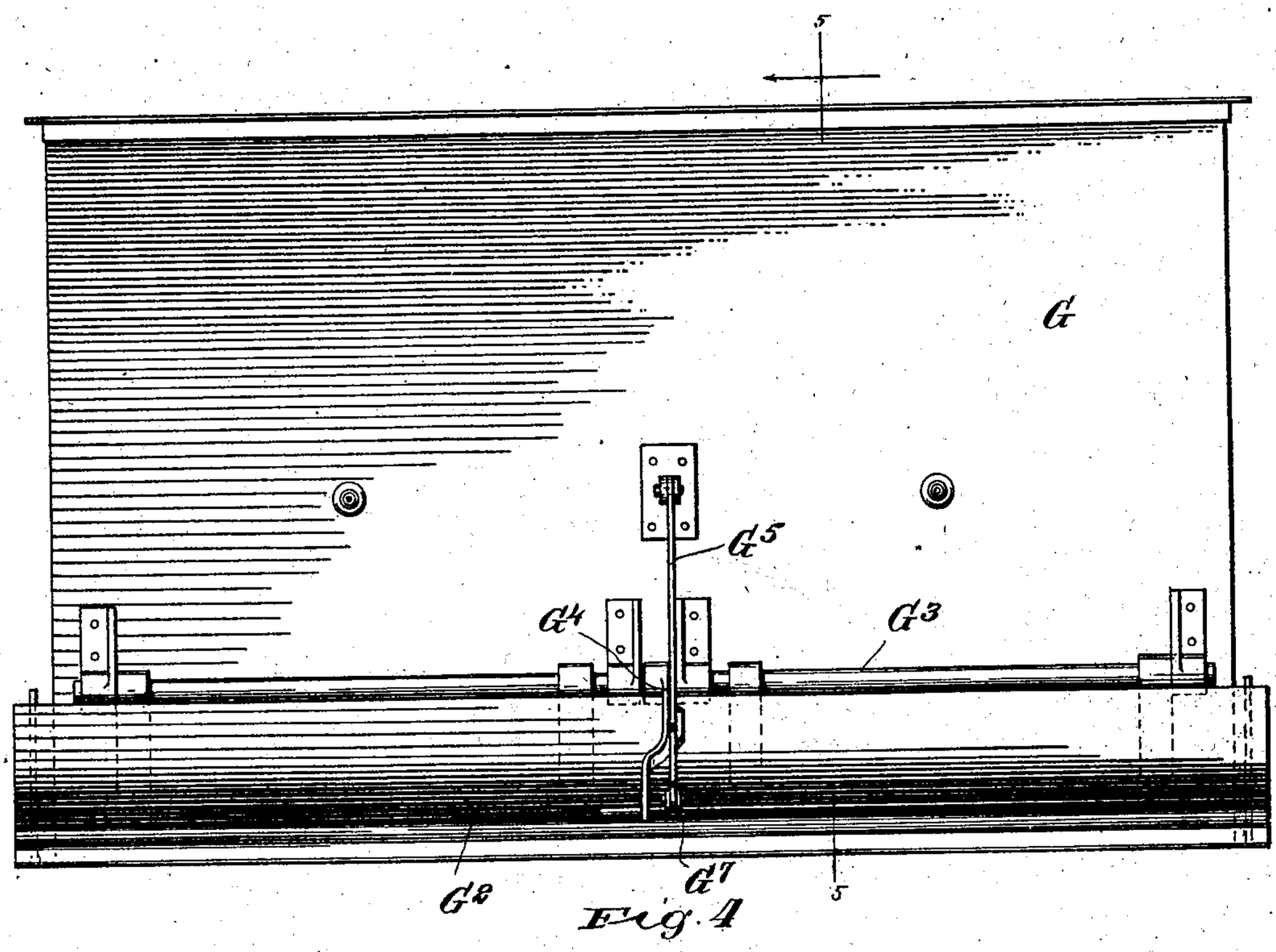

Fig. 4

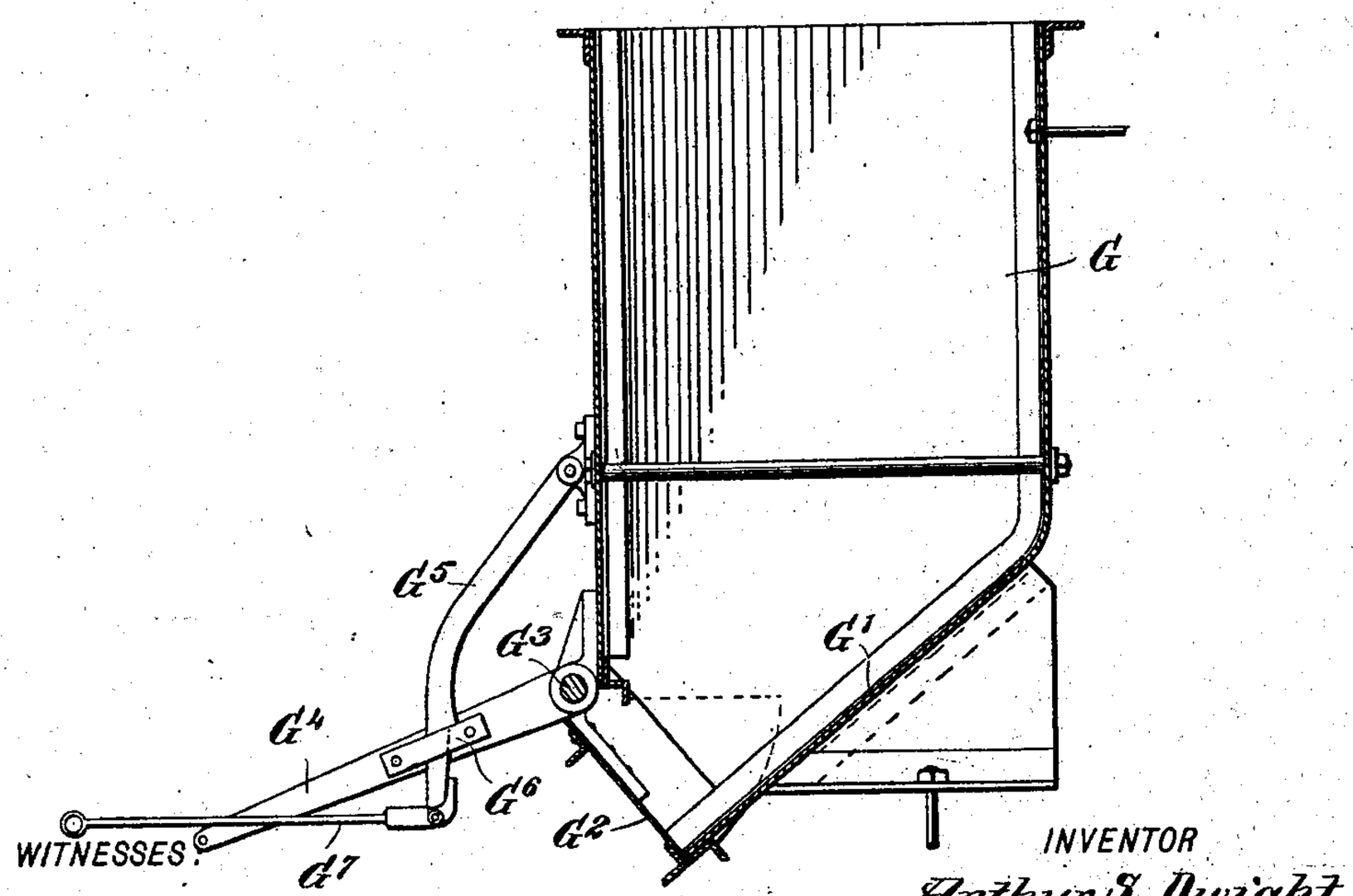

Fig. 5

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NO MODEL. 5 SHEETS—SHEET 5.

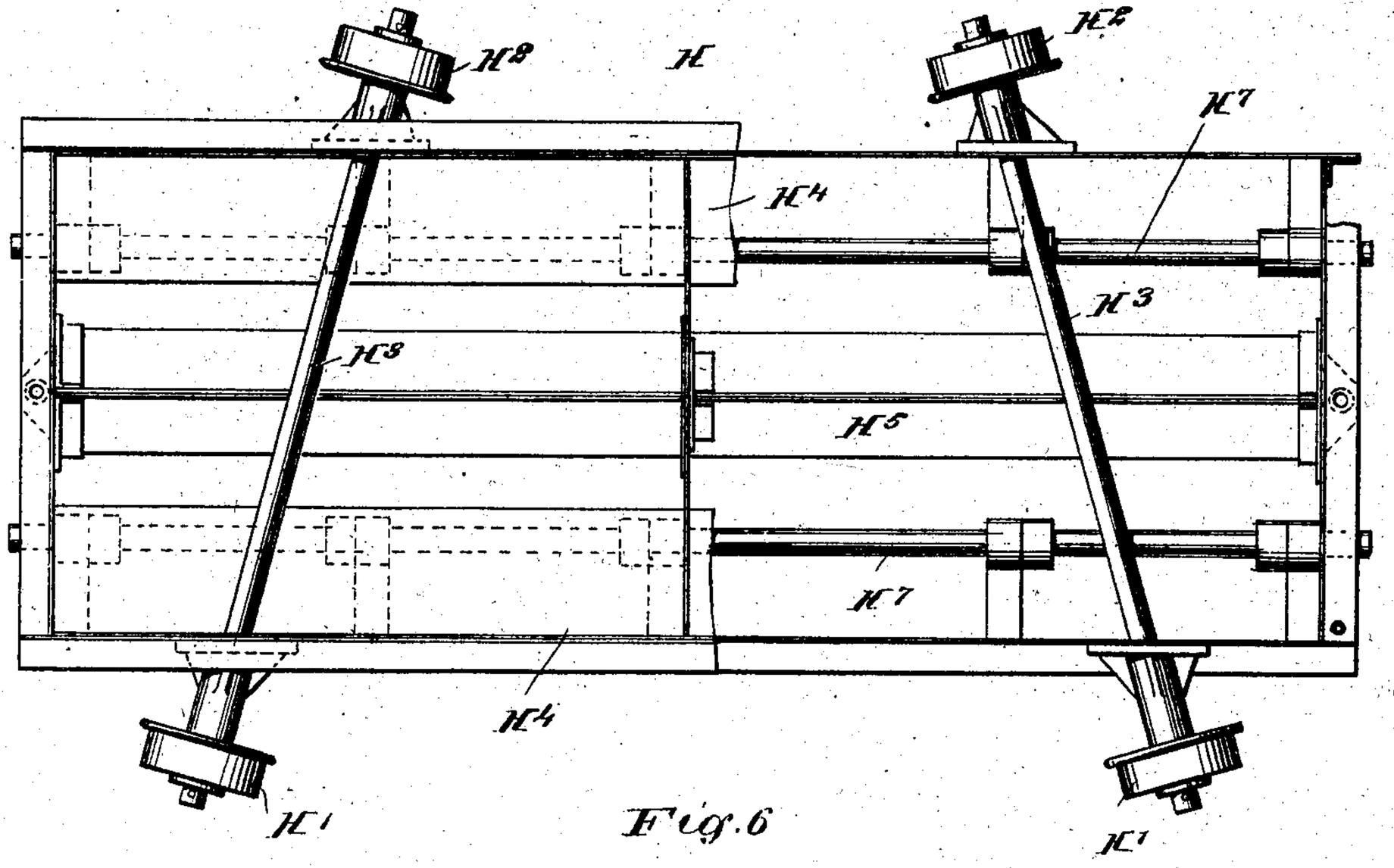

Fig. 6

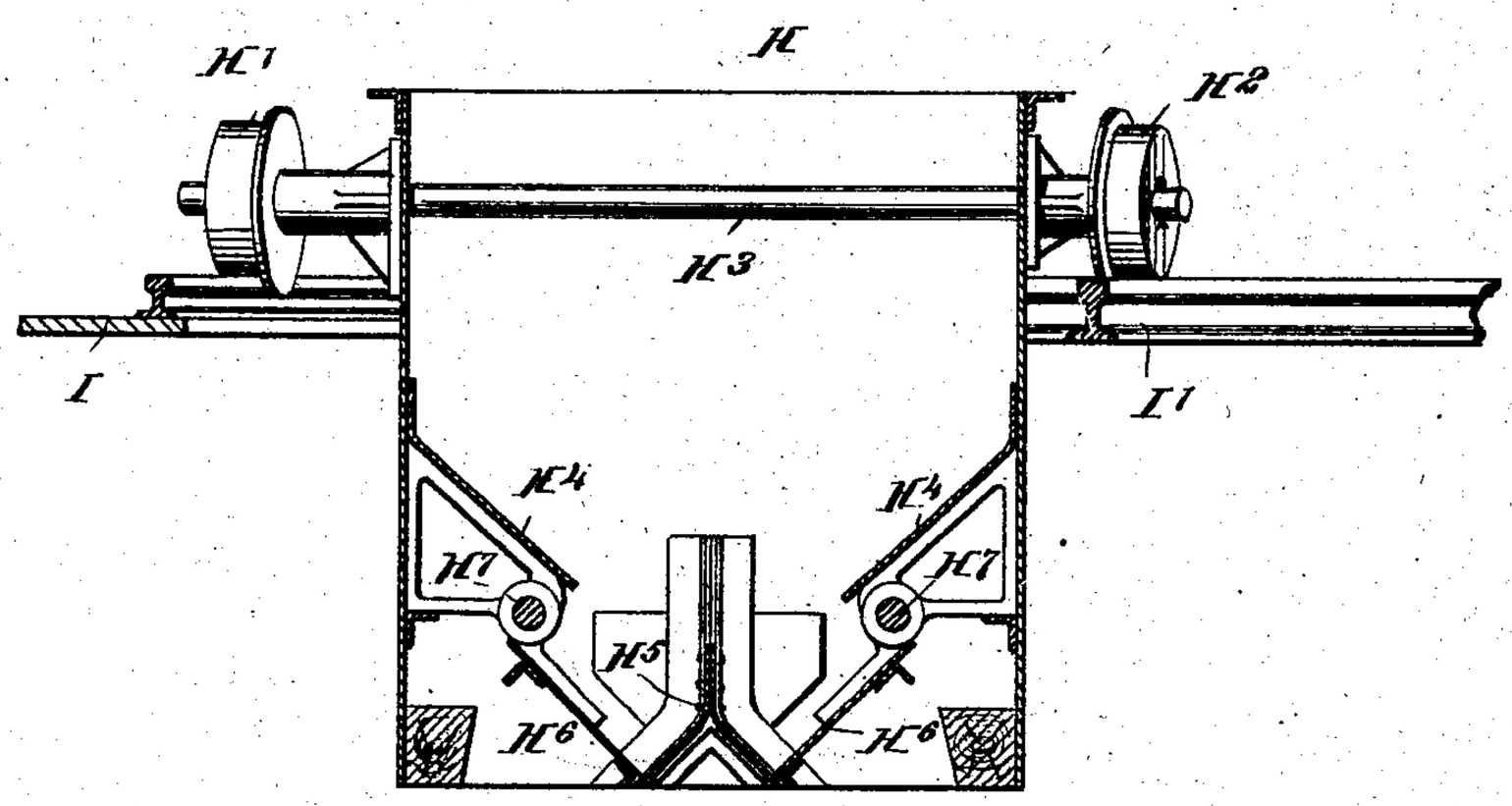

Fig. 7

WITNESSES:

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ATTORNEYS

UNITED STATES PATENT OFFICE.

ARTHUR S. DWIGHT, OF NEW YORK, N. Y.

APPARATUS FOR FORMING BLAST-FURNACE CHARGES.

SPECIFICATION forming part of Letters Patent No. 721,505, dated February 24, 1903.

Application filed April 27, 1901. Serial No. 57,716. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR S. DWIGHT, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Apparatus for Forming Blast-Furnace Charges, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved apparatus for forming blast-furnace charges in a very simple and economical manner, the arrangement being such that the charges prepared are of a certain desired composition and of approximate equal weight and the several ingredients are thoroughly mixed.

The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional side elevation of the improvement with details omitted. Fig. 2 is a sectional plan view of the same on the line 2 2 in Fig 1. Fig. 3 is an enlarged sectional side elevation of the improvement. Fig. 4 is an enlarged front elevation of one of the cartridge-boxes. Fig. 5 is a transverse section of the same on the line 5 5 in Fig. 4. Fig. 6 is a plan view of one of the cartridge-cars with parts broken out, and Fig. 7 is a transverse section of the same.

The principle upon which my invention is based is as follows: If any dry material in granular form or in lumps of preferably not too great size is delivered by a suitable funnel or hopper with sufficient rapidity over the point of a cone or pyramid having a vertical axis, sufficient slope, and smooth surface, then the material will spread uniformly on the surface and slide downward quickly in a thin stream and form a regular ring about the base of the cone or pyramid. In case the several parts are properly adjusted, this annular pile formed by the base of the cone or pyramid will be very regular in cross-section. In case there are two or more ingredients to be mixed they will be fed successively through a hopper and dispose themselves in successive layers on the annular pile, producing thereby a more or less intimate mixture, as may be desired. If the annular pile is divided into a certain number of aliquot parts by proper radii of the circle, each and all aliquot parts will be approximately of the same weight and composition.

The improved apparatus consists, essentially, of a cone A, having a vertical axis and surface of uniform slope, and this cone is supported on its under side on a suitable framework B, arranged in a housing C, and exactly over the apex end A′ of the cone is arranged a cylindrical spout D′ of a hopper D, supported on an overhead platform B′ and into which discharges the upper end of a feed-belt E for carrying the ingredients from a supply to said hopper D. The axis of the spout D′ coincides with the axis of the cone, and on the outside of the said spout is held movably a cut-out sleeve F, hung by links F′ on a lever F^2 under the control of the operator to enable the latter to move the sleeve down upon the cone-surface and stop the ingredients from passing down the cone whenever it is desired to interrupt the formation of the charges or cartridges. On the surface of the cone, at or near the base thereof, are arranged radial wings A^2, terminating at their lower ends in angular deflecting-plates A^3, of which the opposite plates of adjacent wings A^2 stand approximately parallel to one another, and said plates A^3 serve to direct the ingredients into cartridge-boxes G, arranged below the base of the cone A and supported on the framework B, as is plainly shown in Fig. 3.

Each of the cartridge-boxes G is provided with an inclined bottom G′, extending forwardly to form with the front and sides of the box a mouth or discharge-spout normally closed by a door G^2, having its pintle G^3 fulcrumed in suitable bearings on the front of the box G, as is illustrated in Figs. 3, 4, and 5. On the pintle G^3 is arranged an arm G^4, locked in place by a lock-arm G^5, fulcrumed on the front of the box G and engaging a keeper G^6 on the arm G^4, the lock-arm having connected thereto a rod G^7. Thus the door G^2 is normally locked in place; but when it

is desired to discharge the contents of a cartridge-box G into a cartridge-car H, then the operator swings the lock-arm G^5 out of engagement with the keeper G^6 by manipulating the rod G^7, so that the load in the box G and pressing against the door G^2 swings the latter open and the contents of the box is discharged into the corresponding cartridge-car H, located below the mouth of the box G. Each cartridge-car H is provided with outer and inner track-wheels H' H^2, mounted to travel on outer and inner annular concentric tracks I I', supported on the framework B and concentric to the cone A, so that the cars H can be moved around the track from one box G to the other to receive the contents thereof, as above mentioned. The several cars H are connected with each other by suitable couplings H^8, (see Fig. 2,) so that the cars travel together as a continuous train on the tracks I I'.

In order to insure easy running of the cars H on the tracks, the wheels H' H^2 are held on axles H^3, radiating from the center of the tracks, and which center lies in the vertical axis of the cone A. (See Figs. 2 and 6.)

Each cartridge-car H is provided on the inside with longitudinally-extending inclined bottom plates H^4 (see Fig. 7) for discharging the contents at the sides of an inverted-V-shaped partition H^5, the space between the plates H^4 and the partition H^5 being normally closed by doors H^6, held on shafts H^7, extending longitudinally of the car H and journaled in suitable bearings thereon. When the doors H^6 are opened, then the contents of the car H slide down into a transport-car J, mounted to travel on a track K, leading from the apparatus to the furnace in which the charge is to be used.

On the outer ends of the shafts H^7 of each cartridge-car H are secured arms L, connected with each other by a link L', and on one of the shafts H^7 is also arranged a lever L^2, normally locked in place on the end of the car by a spring-pressed locking-lever L^3, so as to hold the doors H^6 normally in a closed position. When the cars H have been moved around on the tracks I I', so that a certain car is over the car J, and the operator now releases the lever L^2 in this cartridge-car, then the doors H^6 swing open by the weight of the charge or cartridge, and the material from this car is now discharged into the car J. The several cars H of the apparatus can be successively moved over the car J, so as to be emptied of their contents, it being expressly understood that the contents of a car H fill the car J, and when this car J has been filled it is moved to the furnace and delivered to the furnace charge for use in the furnace. The empty car J is then returned to its former position under a car H. Each of the cars H after having been emptied of its contents is again closed and the doors H^6 locked in a closed position, so as to be ready to receive a new charge from the cartridge-boxes G, as above described. The car J is constructed with doors and has means for locking and releasing the doors the same as the cars H, so that further description of the same is not deemed necessary.

The ingredients for forming the blast-furnace charge are successively or continuously fed to the hopper D by the feed-belt E or other suitable means, and the material thus discharged into the hopper D passes upon the apex of the cone, so as to spread thereon and travel downward on the surface of the cone, being finally deflected by the plates A^3 into the corresponding cartridge-box G. As one ingredient follows the other, the pile of material in each box G will consist of different layers, and thus an intimate mixture is obtained. By regulating the order and proportion in which the different ingredients are fed a greater or less perfection of mixture can be obtained. When the mixture is complete, the ingredients accumulated in the boxes G are finally discharged into the cars H, and the latter are successively moved around on their tracks I I' and stand over the car J, into which the several cartridge-cars H are successively emptied, the car J taking each charge to the blast-furnaces as needed by traveling upon the tracks K to a proper position at the furnace and discharging its contents and returning for another charge. While one set of cartridges contained in the cars H is being used up a new set is being prepared in the upper row of boxes G, and thus there need be no interruptions or delay in the process of handling the material and preparing the charges.

In preparing charges for smelting-furnaces as heretofore practiced it was necessary to bring the various ores and fluxes from the main supply-bins by cars, barrows, or other suitable means and then mix the ingredients by weight in the car or receptacle in which the mixture was transported to the furnace. Also the practice described was sometimes followed by weighing each ingredient by itself in its own bulk and mixing the ingredients together by successively dumping this bulk into the common receptacle above mentioned. In all cases, however, it was necessary to work with comparatively small quantities, requiring a much greater amount of labor and time than is required by the use of my apparatus above described. Furthermore, by the old method the ingredients are likely to be very imperfectly mixed and very undesirable conditions and irregularities are induced thereby in the running of the furnace. By the use of my apparatus above described the necessary handling of the material is limited to the bringing together of enough of each of the required ingredients to make up a total gross charge, the weight of which shall be the necessary multiple of a unit charge or cartridge. What this multiple shall be is fixed in the design and construction of the apparatus. It is apparent that the economy of handling and

weighing of each of the ingredients of a charge will be considerable when compared with the old practice above referred to.

In a mechanical blast-furnace it is an advantage to secure a certain arrangement with reference to the side walls of the furnace of the coarse and fine material of the charge. A section of the annular pile of the mixture produced by the cone of my apparatus shows a certain concentric or approximate parallelism of structure, so that a person skilled in the art can take advantage of this fact to secure the best arrangement of the charge in the furnace. By rapidly preparing charges of ore flux or fuel for metallurgical operations by my apparatus it is possible to obtain charges that approximate one another in weight and proportion of ingredients much closer than is usually accomplished in the ordinary conditions of actual practice by the usual method of weighing each charge by hand with unskilled or careless workmen and, moreover, much saving of time and labor is effected. It is further understood that by the arrangement described the ingredients are spread uniformly on the cone and are collected in aliquot parts, each forming a charge of uniform size, weight, and contents and with an even arrangement longitudinally of the coarse and fine material.

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

1. An apparatus for forming blast-furnace charges, comprising a hopper, a cone upon the apex end of which said hopper discharges, cartridge-boxes into which the base of said cone discharges, and connected conveyers each receiving the contents of one of the said boxes and delivering the contents to a common place of discharge, and means for receiving and conveying the charges one at a time from the common place of discharge, as set forth.

2. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, fixed boxes below the base of the cone, for receiving the material passing down the surface of the cone in aliquot parts, and radial wings on the surface of said cone and provided with deflecting-plates, as set forth.

3. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, fixed boxes below the base of the cone, for receiving the material passing down the surface of the cone in aliquot parts, and a cut-off sleeve movable on said spout and adapted to be seated on the surface of the cone at the apex end of the cone, the said sleeve being arranged to be moved to and from the cone to stop and start the stream of material, whereby the delivery of the material may be rendered intermittent, as set forth.

4. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, fixed boxes below the base of the cone, for receiving the material passing down the surface of the cone in aliquot parts, and an endless train of cars arranged to move in a circle concentric to the cone and into which the said boxes are adapted to discharge their contents, as set forth.

5. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, fixed boxes below the base of the cone, for receiving the material passing down the surface of the cone in aliquot parts, and cars arranged in the form of an endless train of cars, one car for each box and located below the same to receive the contents of the box, as set forth.

6. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, fixed boxes below the base of the cone, for receiving the material passing down the surface of the cone in aliquot parts, cars arranged in the form of an endless train of cars, one car for each box and located below the same to receive the contents of the box, and doors on the boxes and under the control of the operator, to keep the boxes closed for the accumulation of the material from the cone, and to allow of opening the boxes for discharging their contents by gravity into the cars, as set forth.

7. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, fixed boxes below the base of the cone, for receiving the material passing down the surface of the cone in aliquot parts, cars arranged in the form of an endless train of cars, one car for each box and located below the same to receive the contents of the box, and annular tracks for the train of cars to move on to bring each car to a common place of discharge, and to move the cars from one box to the other, as set forth.

8. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, fixed boxes below the base of the cone, for receiving the material passing down the surface of the cone in aliquot parts, cars arranged in the form of an endless train of cars, one car for each box and located below the same to receive the contents of the box, annular tracks for the train of cars to move on to bring each car to a common place of discharge, and to move the cars from one box to the other, and a transporting-car below the common place of discharge of the train of cars, to allow of discharging the contents of all the cars into said transporting-car, as set forth.

9. An apparatus for forming blast-furnace charges, comprising a hopper, a cone upon the apex end of which said hopper discharges, means for separating the material into aliquot parts, each forming a charge, a receptacle for each of said charges, and connected conveyers one for each charge and to which the charges are transferred from the said receptacles, the conveyers being arranged to move in a circle, as set forth.

10. An apparatus for forming blast-furnace charges, comprising a hopper, a cone under said hopper and in axial alinement therewith, means for separating the material passing down the surface of the cone into aliquot parts or charges, and conveyers, one for each charge and arranged to move in a circle concentric to the cone, the conveyers being adapted to receive and retain a set of charges while a new set of charges is being formed, as set forth.

11. An apparatus for forming blast-furnace charges, comprising a hopper having a cylindrical discharge-spout, a cone under said spout and in axial alinement therewith, a sleeve mounted to move on said spout and adapted to be seated on the cone at the apex end thereof, and a lever under the control of the operator and connected by links with the said sleeve to move the latter to and from the cone, as set forth.

12. An apparatus for forming blast-furnace charges, comprising a cone, a hopper for discharging the material upon the apex of the cone, radial wings arranged on the surface of the cone at the lower portion thereof, the said wings terminating at their lower ends in angular deflecting-plates, the opposite plates of adjacent wings standing approximately parallel to one another, and receptacles into which the charges are directed, as set forth.

13. An apparatus for forming blast-furnace charges, comprising a cone, a hopper for discharging the material for the charges upon the apex of the cone, receptacles for receiving the material passing down the surface of the cone in aliquot parts, a conveyer having members each arranged to receive a charge from one of the receptacles, and a car for carrying the charges one at a time from the conveyer to the furnace, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ARTHUR S. DWIGHT.

Witnesses:
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EVERARD B. MARSHALL.