A. C. JOHNSTON.

PROCESS OF TRANSFERRING MATERIAL FROM A HIGH TO A LOWER LEVEL AND PILING THE MATERIAL.

APPLICATION FILED JAN. 29, 1907.

964,429.

Patented July 12, 1910.

3 SHEETS—SHEET 1.

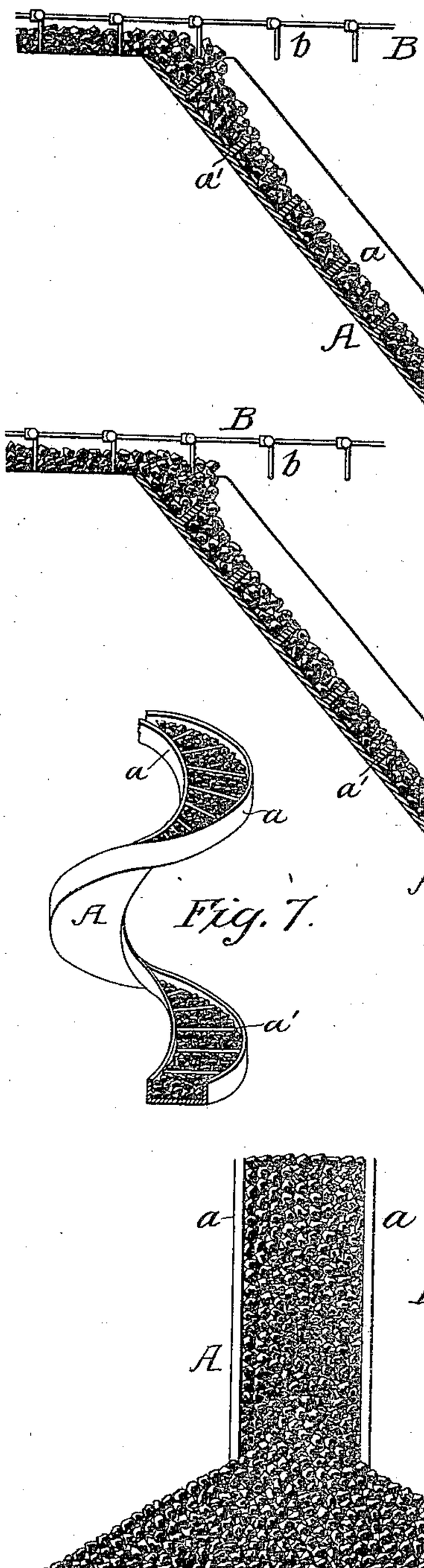

Fig. 1.

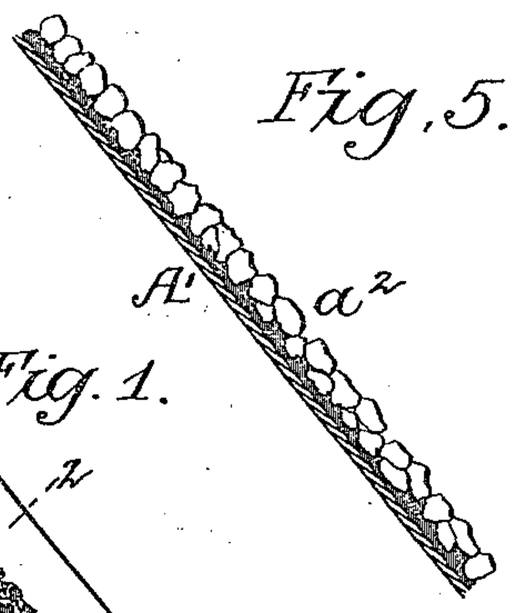

Fig. 5.

Fig. 2.

Fig. 3.

Fig. 7.

Fig. 4.

Witnesses:-
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Titus H. Jones.

Inventor
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Fig. 6.

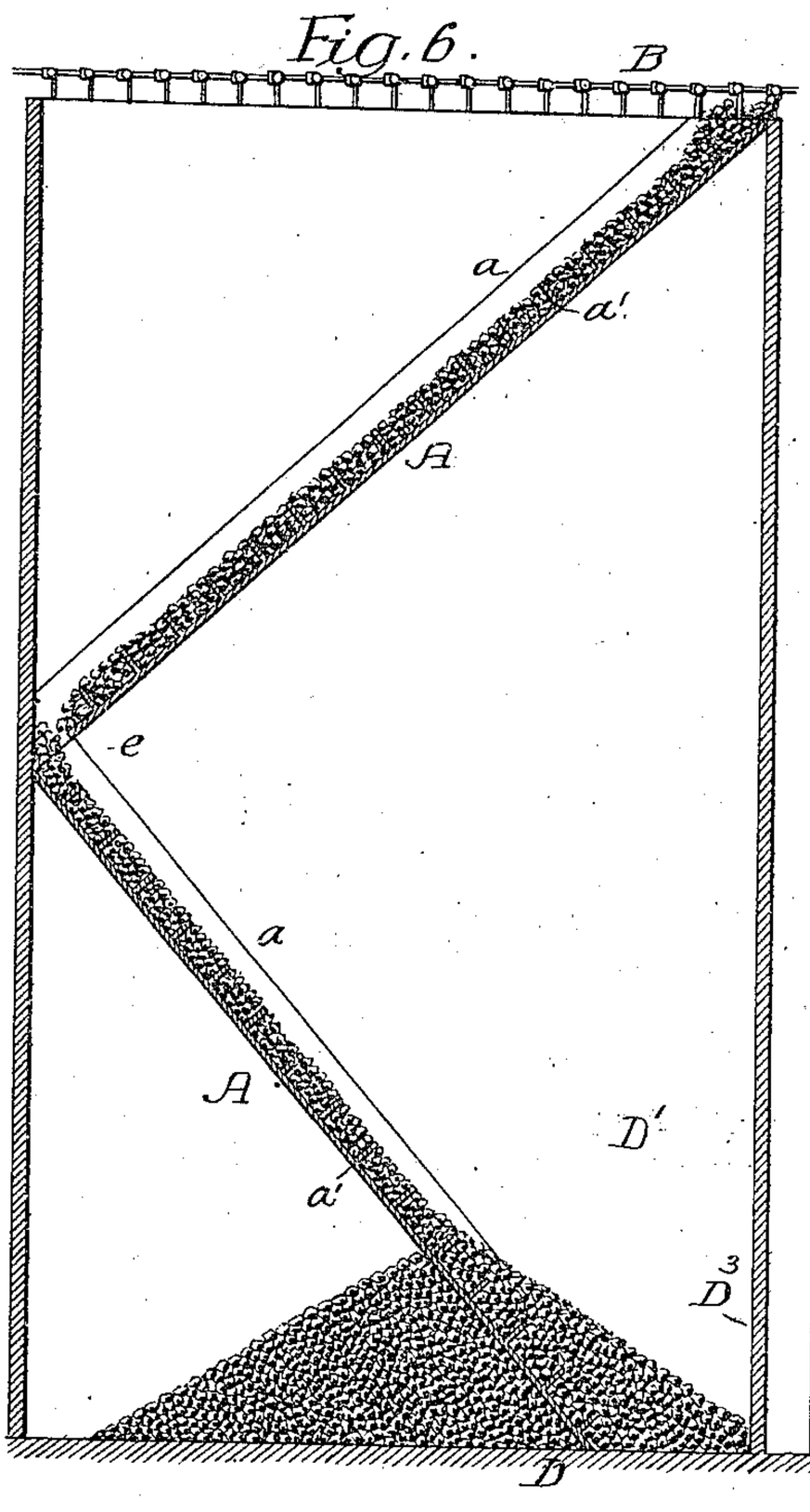


Fig. 9

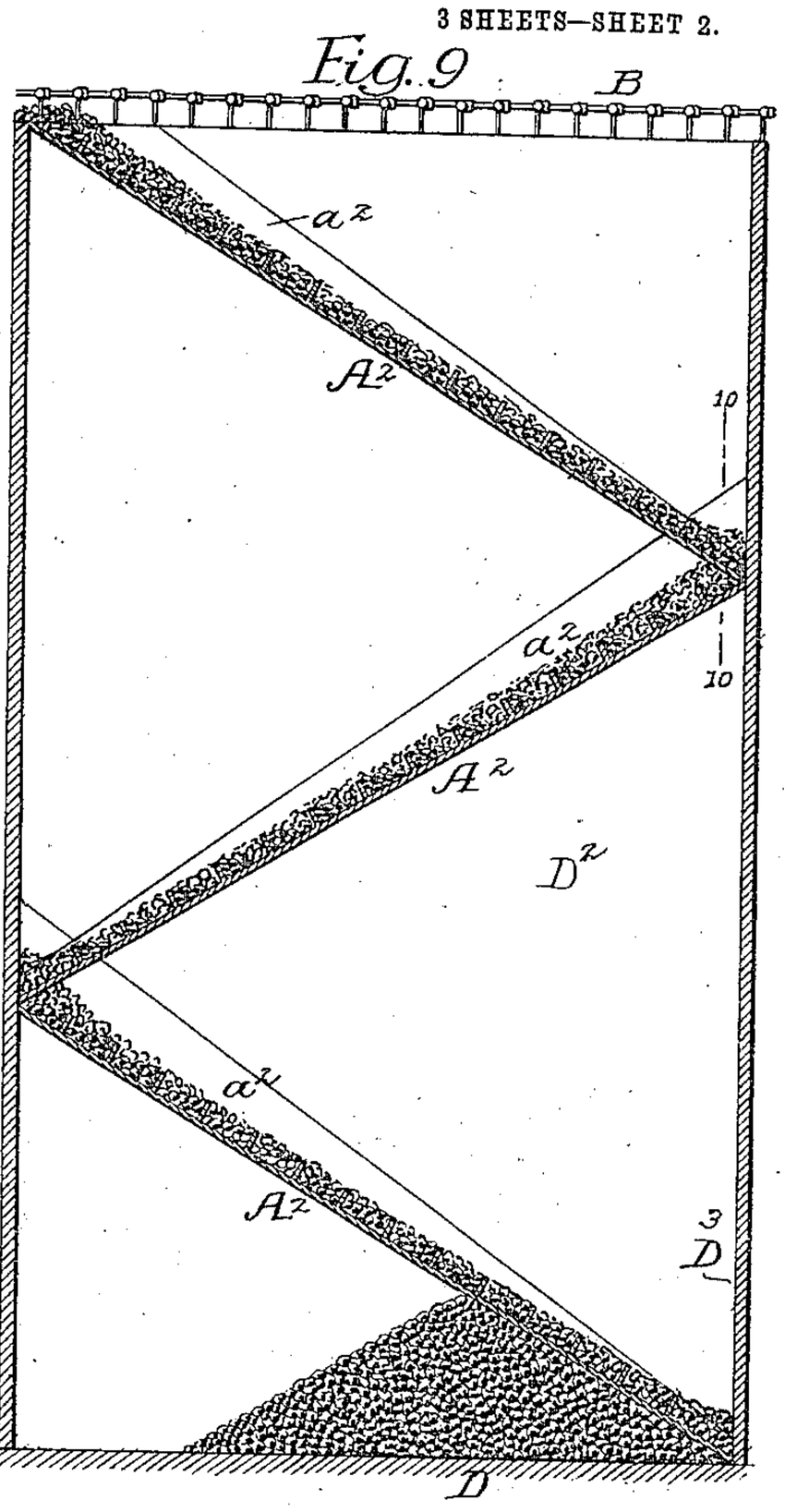


Fig. 10.

Fig. 15.

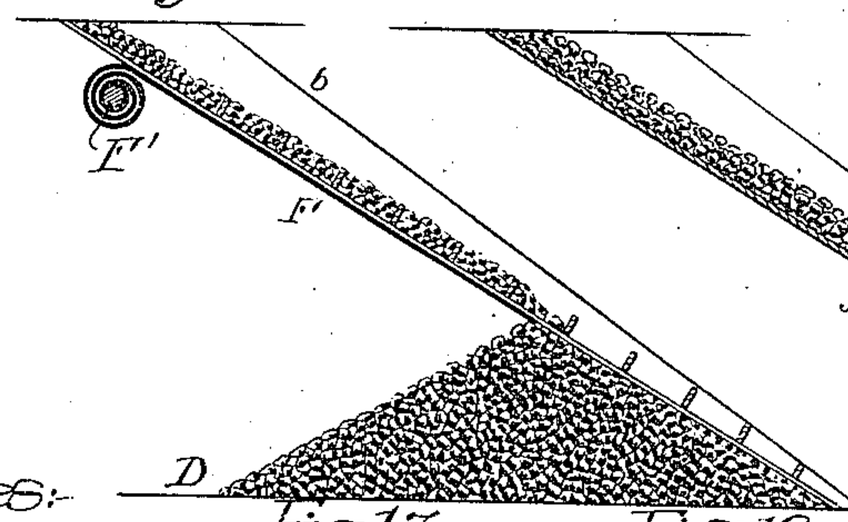
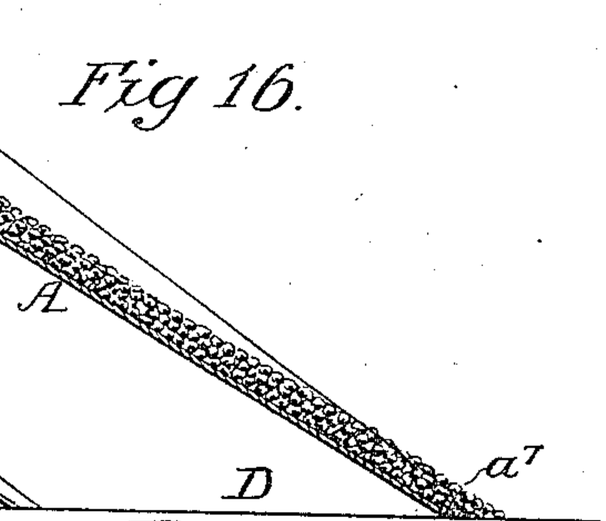


Fig 16.



Witnesses:-
Titus H. Ivors.
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Fig. 17.

Fig. 18.

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3 SHEETS—SHEET 3.

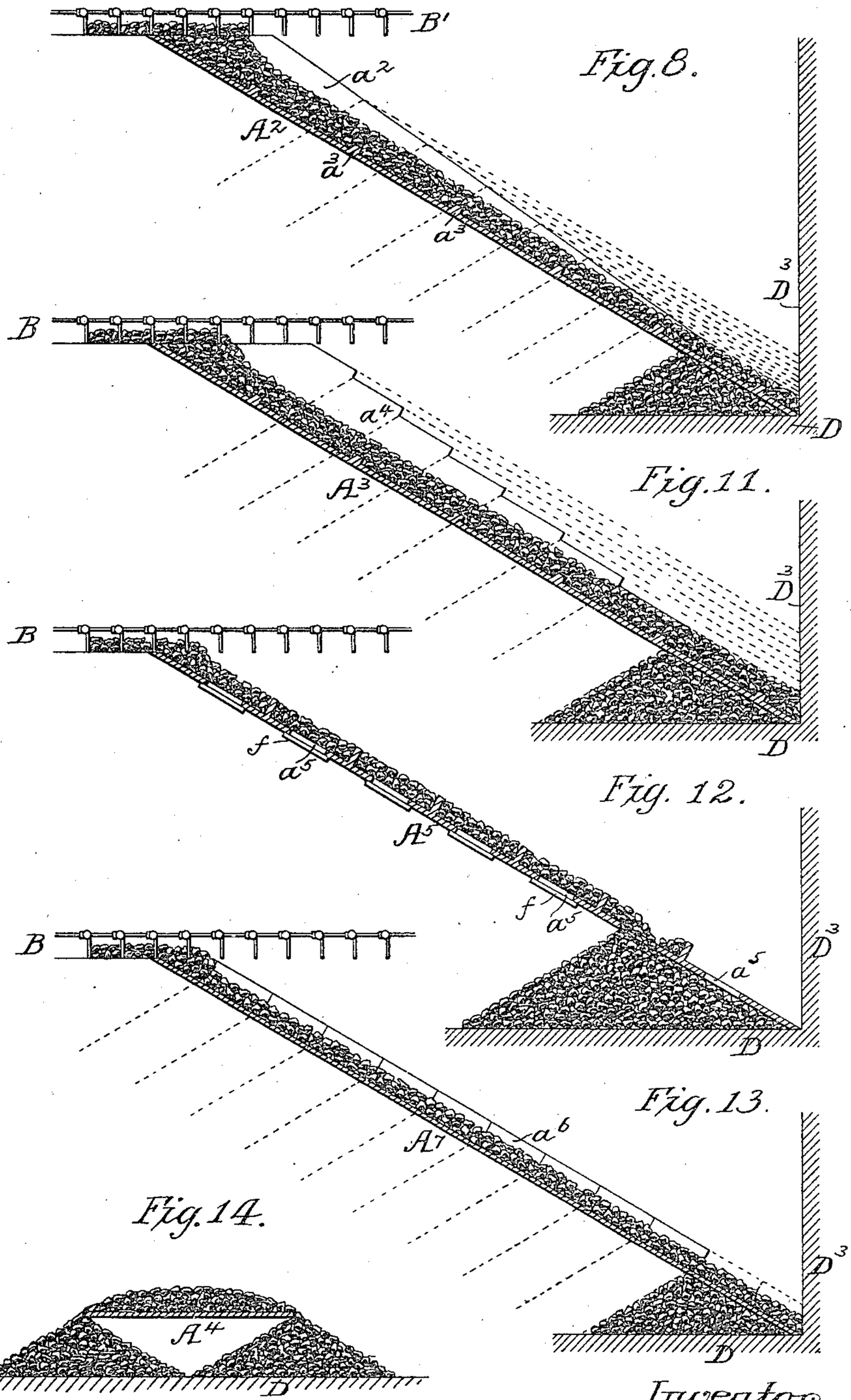

Fig. 8.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

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Inventor:-
Arthur C. Johnston.
by his Attorneys
Howson & Howson

UNITED STATES PATENT OFFICE.

ARTHUR C. JOHNSTON, OF WYNCOTE, PENNSYLVANIA, ASSIGNOR TO DODGE COAL STORAGE COMPANY, OF NAUGATUCK, CONNECTICUT, A CORPORATION OF CONNECTICUT.

PROCESS OF TRANSFERRING MATERIAL FROM A HIGH TO A LOWER LEVEL AND PILING THE MATERIAL.

964,429. Specification of Letters Patent. Patented July 12, 1910.

Application filed January 29, 1907. Serial No. 354,637.

To all whom it may concern:

Be it known that I, ARTHUR C. JOHNSTON, a citizen of the United States, residing at Wyncote, Pennsylvania, have invented certain Improvements in the Process of Transferring Material from a High to a Lower Level and Piling the Material, of which the following is a specification.

My invention relates to the transfer of materials from a high to a lower level, and is particularly adapted to the transfer, without material breakage, of frangible materials such as coal, from a high to a lower level, either for immediate distribution, or to form a pile upon a piling floor or in a bin or other receptacle.

In the accompanying drawings:—Figure 1, is a vertical sectional view of one form of apparatus for carrying out my invention, in which the coal is delivered from a conveyer at a high level and directed into a conveyer at a lower level; Fig. 2 is a transverse sectional view on the line 2—2, Fig. 1; Fig. 3, is a view of an apparatus for carrying out my invention so as to form a pile of material; Fig. 4, is an end view looking in the direction of the arrow, Fig. 3; Fig. 5, is a view of a modified form of apparatus for carrying the invention into effect; Fig. 6, is a view showing my invention as applied to the storing of material in a deep bin; Fig. 7, is a view showing a spiral apparatus for carrying the invention into effect; Fig. 8, is a view showing another form of apparatus whereby my process may be used in forming a pile of coal on a floor or bin; Fig. 9, is a view showing the modification illustrated in Fig. 8 as applied to a deep bin; Fig. 10, is a sectional view on the line 10—10, Fig. 9; Figs. 11, 12, 13, 14, 15 and 16, are views of other modified forms of apparatus, for carrying out my invention, and Figs. 17 and 18, are transverse sectional views of different forms of chutes.

A (Fig. 1) is an inclined chute arranged in the present instance at an angle greater than the angle of repose of the material to be transferred. This chute has vertical side members a, a, and a series of transverse ribs a' extending across the chute from one side to the other, as illustrated in Fig. 2, but other forms of chutes may be used such as shown in Figs. 17 and 18.

At the upper end of the chute A, which may be of any desired length, is shown a flight conveyer B having flights b which deliver the coal or other material to the chute, and at the base of the chute is a conveyer C having flights c which travel over the bed c' onto which the coal rolls from the chute. It will be understood that other means may be employed to feed the material to the chute, or to carry away material from the base of the chute; or the material may be allowed to accumulate at the base of the chute, as shown in Figs. 3 and 4.

Assuming coal to be the material to be transferred, in operation the first coal which is discharged from the conveyer B flows into the several pockets formed by the transverse ribs a' until these pockets have been successively filled, as indicated in Fig. 1, and it will be noticed that in filling these pockets the coal forms a bed having a greater angle than the angle of repose of the material. As the pockets are filled with coal, as shown in Fig. 1, that coal forms a rough bed, over which other coal fed to the chute must flow, and as the feed of the chute is continued, each particle of additional coal will travel down this roughened surface, rolling upon the coal held in the pockets of the chute, until it either reaches an unoccupied pocket and is there retained, or until all the pockets having been filled, it rolls off the chute into the conveyer C at the bottom. In this way material breakage of the coal is prevented since it is not subjected to any material vertical drop but to a mere rolling and sliding action throughout the length of the chute over a surface sufficiently rough, to act as a retarding bed preventing any such acceleration in the speed of the flow of material as would be calculated to cause breakage. In the case of the apparatus shown in Fig. 1, the coal itself forms the roughened bed over which the material to be transferred must flow, but it will be understood that this bed may be formed by any other means which will prevent the too rapid rush of coal down the inclined chute, or any material vertical drop of the coal. In Fig. 5, for example, I have shown a modification in which the bed a^2 of the chute A′ is made of stones of suitable size, set in cement, thus forming a permanent roughened bed without

the use of transverse ribs such as shown in Fig. 1.

Fig. 7, illustrates a spiral chute for carrying out my improved process, this is especially desirable at points where there is comparatively little room to locate a chute and may be used to fill high and narrow bins.

Figs. 3 and 4, illustrate a case in which my invention is used to form a conical pile say of coal, the apex of the pile as the latter increases in height, shifting toward the point of supply at the upper end of the chute. It will be noticed that in this case the coal as it travels down the inclined chute and comes in contact with the accumulation of coal on the floor D at the base of the chute, is thereby caused to escape over the sides of the latter at a point which is constantly shifting toward the top of the chute, the coal thus escaping from the chute continuing to flow down the mass of coal previously accumulated until the angle of repose is attained. This form of apparatus is particularly adapted for filling bins with coal, and in the case where the depth and width of the bin or other receptacle may make desirable the use of two or more lengths of chute to deliver the coal from the top of the bin to the bottom in accordance with my method, it may be carried out by the form of apparatus illustrated in Figs. 6 or 9. In the arrangement, Fig. 6, the chutes are of the construction illustrated in Fig. 1. One chute terminating at a point directly above the other chute and in the upper chute is an opening *e* through which the coal flows to the surface of the lower chute. In Fig. 9, the chutes are so proportioned that the lower end of each chute section is narrower than the upper end of the chute section next below, as illustrated in Fig. 10, so that the coal when it reaches the lower end of the upper chute will flow over the sides and onto the upper end of the chute next below without being subjected to any vertical drop, thus in either case securing the continuous flow of material from the upper end of the bin D′ to the bottom, or to the apex of the pile formed within the bin.

In Fig. 8, I have shown another modification of means for carrying out my invention. In this instance the chute is arranged at about the angle of repose of material to be piled, and the side walls a^2 of the chute A^2 taper, being level with the bed of the chute at the lower end thereof and increasing in height toward the upper end of the chute, as illustrated. I preferably employ cross ribs a^3 of any height desired. The coal as it is discharged from the conveyer B′ at the upper end of the chute travels down the latter accumulating back of the several transverse ribs until there is a bed of coal throughout the entire length of the chute. This bed is shallowest at the base of the chute, increasing in depth toward the upper or feed end, as illustrated in Fig. 8. As the coal continues to flow down this chute, it travels over the coal caught in the pockets formed by the ribs and constituting the roughened and retarding surface as in the forms of apparatus hereinabove described; but in this case the coal will tend to accumulate in some instances at the upper end of the chute, and then will flow gradually down to the base of the chute, or, if a pile is being formed at the base, as shown in Fig. 8, until it reaches the apex of the pile, when it will flow laterally over the sides of the chute and add to the pile. As indicated in diagrammatic lines in this figure, as the pile increases in height the height of coal in the chute also increases proportionately. The depth of the coal in the chute, therefore, will be determined by the height of the pile since the retarding surface of coal in the chute will assume the angle of repose of the material to be piled. Therefore, where the sides of the conveyer taper as illustrated in Fig. 8, the coal will flow from the chute at the apex of the pile which will be on a level with the sides of the chute.

In Fig. 9, I have shown a series of chutes of the form illustrated in Fig. 8, mounted in a bin D^2.

In Fig. 11, I have shown the sides a^4 of the chute A^3 stepped so that as the pile increases in height the point of lateral discharge of material from the chute will rise from one step to another throughout the length of the chute. In some instances, the sides of the chute may be dispensed with, the bed of the chute being made flat as shown at A^4 Fig. 14 and wide enough to allow of a given body of coal being retained in the center of the chute, and as coal flows down the chute, it will flow over the body of coal on the chute and then when it reaches the apex of the pile will flow laterally over the edges of the chute and over the pile.

Fig. 12, illustrates the carrying out of my process by means of apparatus in which the discharge of coal from the chute is through openings in the bottom of the chute A^5. These discharge openings a^5 are closed by means of suitable slides *f* which may be withdrawn to allow of the passage of the coal through the openings.

In Fig. 15, I have shown a chute A^6 having an open bottom arranged to be closed by a ribbon F mounted upon a drum F′, the ribbon is coiled upon the drum as the pile increases in height to alter the discharge point. The sides a^6 of the chute A^7 may be made in sections, as shown in Fig. 13: these sections to be dropped or removed as the height of the pile increases.

It will be understood that while I have shown transverse ribs in the several figures to retain material to form the roughened sur-

face, the ribs may be dispensed with, as the piling floor D or the side D^3 of the bin will form a stop or abutment for the material to allow it to accumulate in the chute, or a single cross rib a^7 may be used at the base of the chute as in Fig. 16.

The essential feature of the invention is the retarding of the material in its downward flow so as to prevent such acceleration of speed of flow as would lead to breakage when the flowing material comes in contact with the bed of a conveyer or other receptacle, at the base of the chute, or with preceding accumulations of material.

The angle at which the chute is placed may vary without departing from the essential features of my invention, and the process may be employed either for the transfer of material from an elevation to a point at the lower level, or for the formation of piles of material, or the filling of bins or other receptacles. In employing the process for the filling of a bin or forming a pile it will be understood that when the pile of material has reached the upper end of the chute employed, the discharge of material may continue, the point of discharge being moved forward and the process repeated until the entire bin has been filled with material.

I claim:—

1. The process herein described for transferring material from a high to a lower level, said process consisting in arranging a structure at an incline greater than the angle of repose of the material, allowing an initial body of granular material to flow down said incline, so as to accumulate and form throughout the length of the incline a roughened surface, then causing the material to flow by gravity over the said roughened surface, reducing the rapidity of flow and thus preventing the excessive breakage of the material while in transit, or when it has reached the lower level.

2. The process herein described of transferring material from a high to a lower level, said process consisting in first arranging a structure at an incline greater than the angle of repose of the material, allowing an initial body of granular material to flow over said incline and accumulate at the base of the incline, forming an abutment at the base and a roughened surface from this abutment to the discharge point at the upper end of the incline, then continuing the flow of the granular material over the roughened surface thus formed and allowing it to flow over the accumulated material at the bottom of the incline, thus preventing the breakage of material as it is delivered from a higher to a lower level.

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

ARTHUR C. JOHNSTON.

Witnesses:
E. R. Loughery,
Wm. A. Barr.