No. 763,179. PATENTED JUNE 21, 1904.

T. F. HALL.

GRAIN ELEVATOR.

APPLICATION FILED MAY 13, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

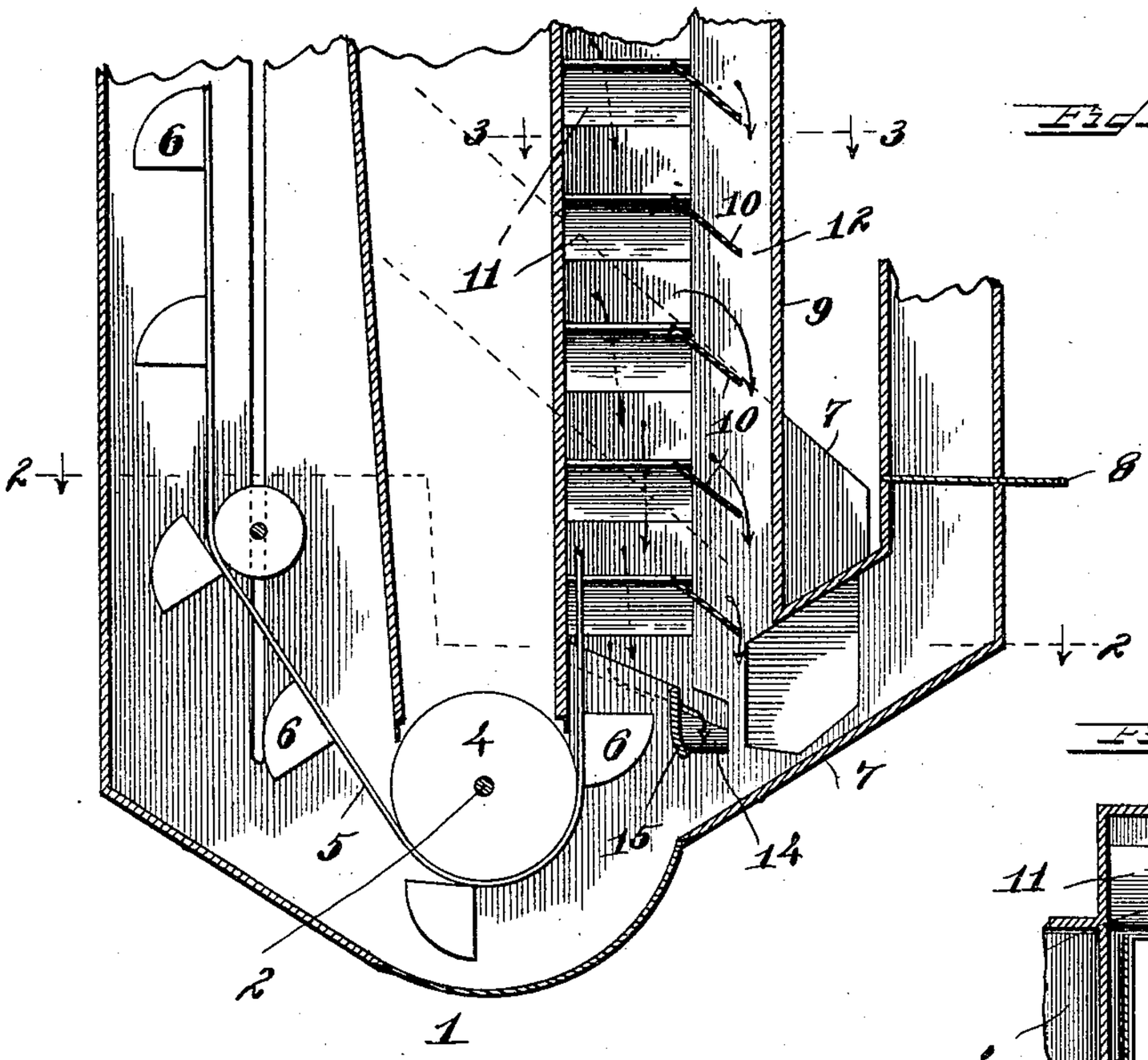


Fig. 3.

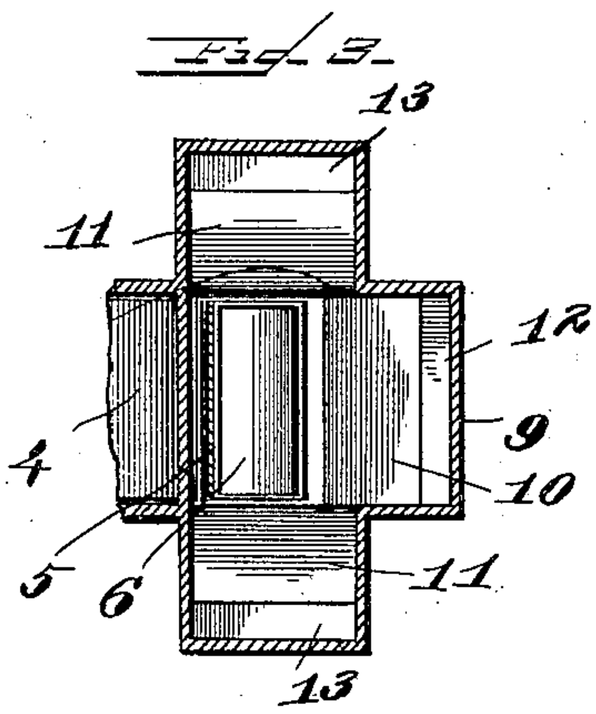
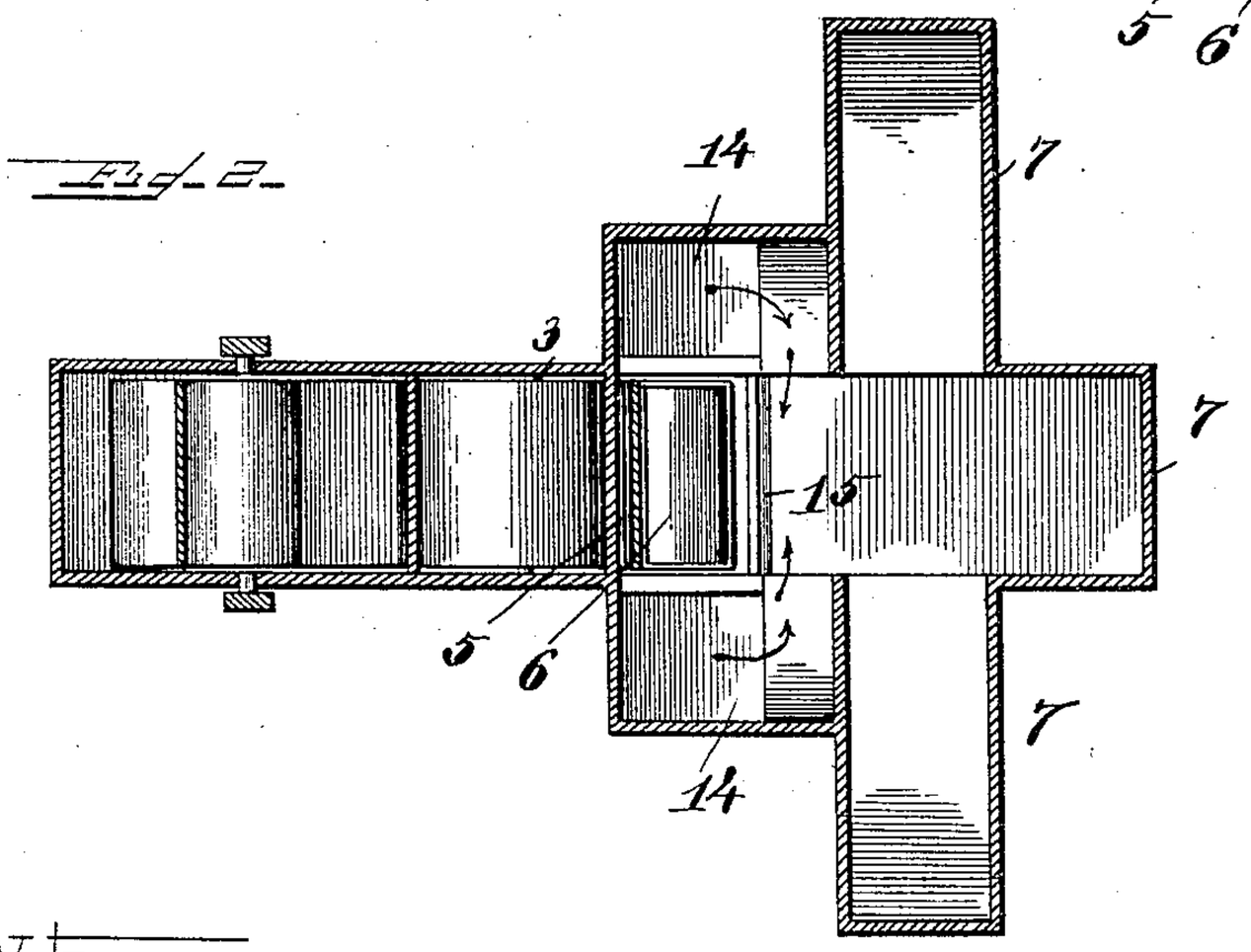


Fig. 2.



Witnesses.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4.

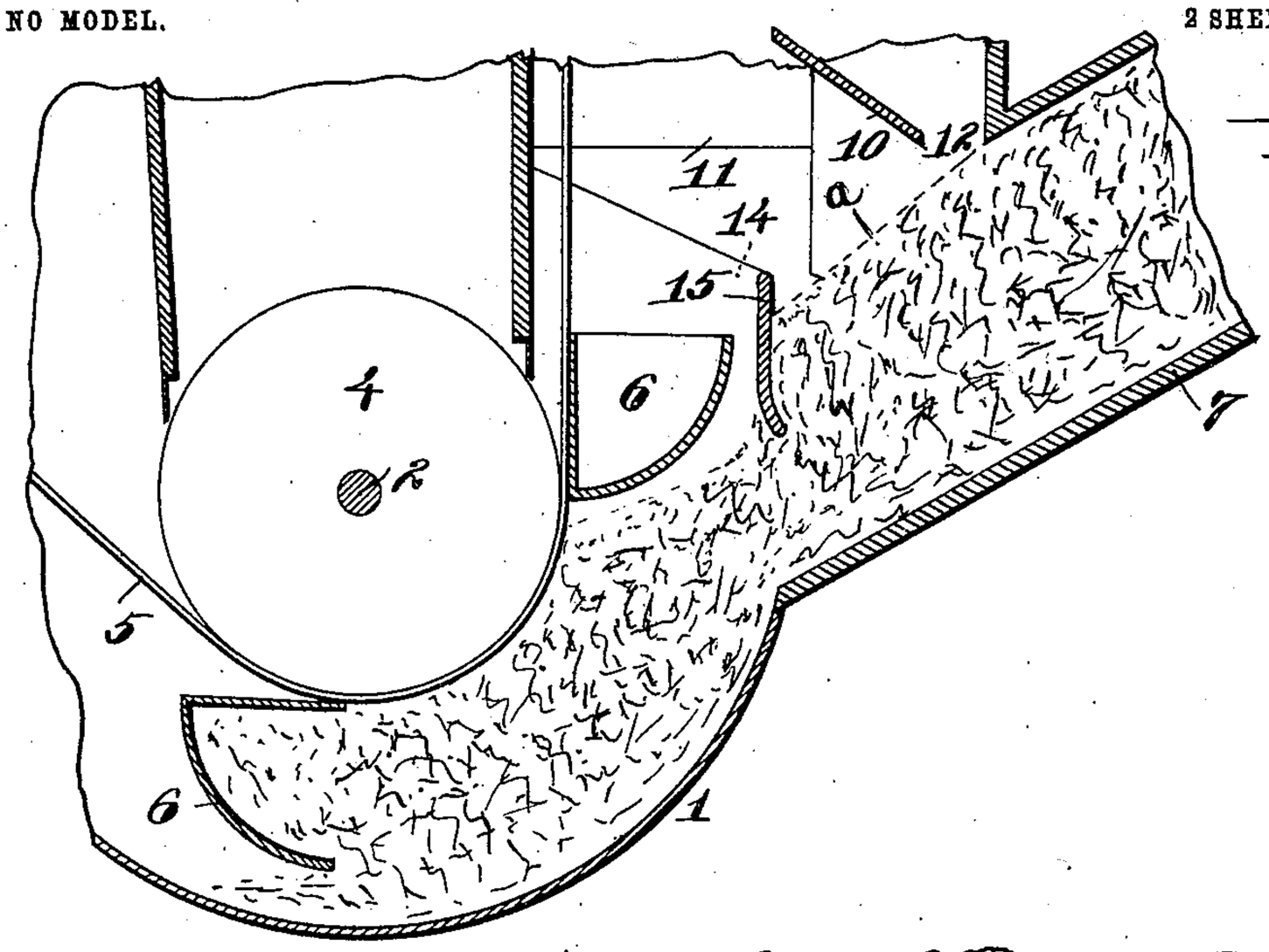
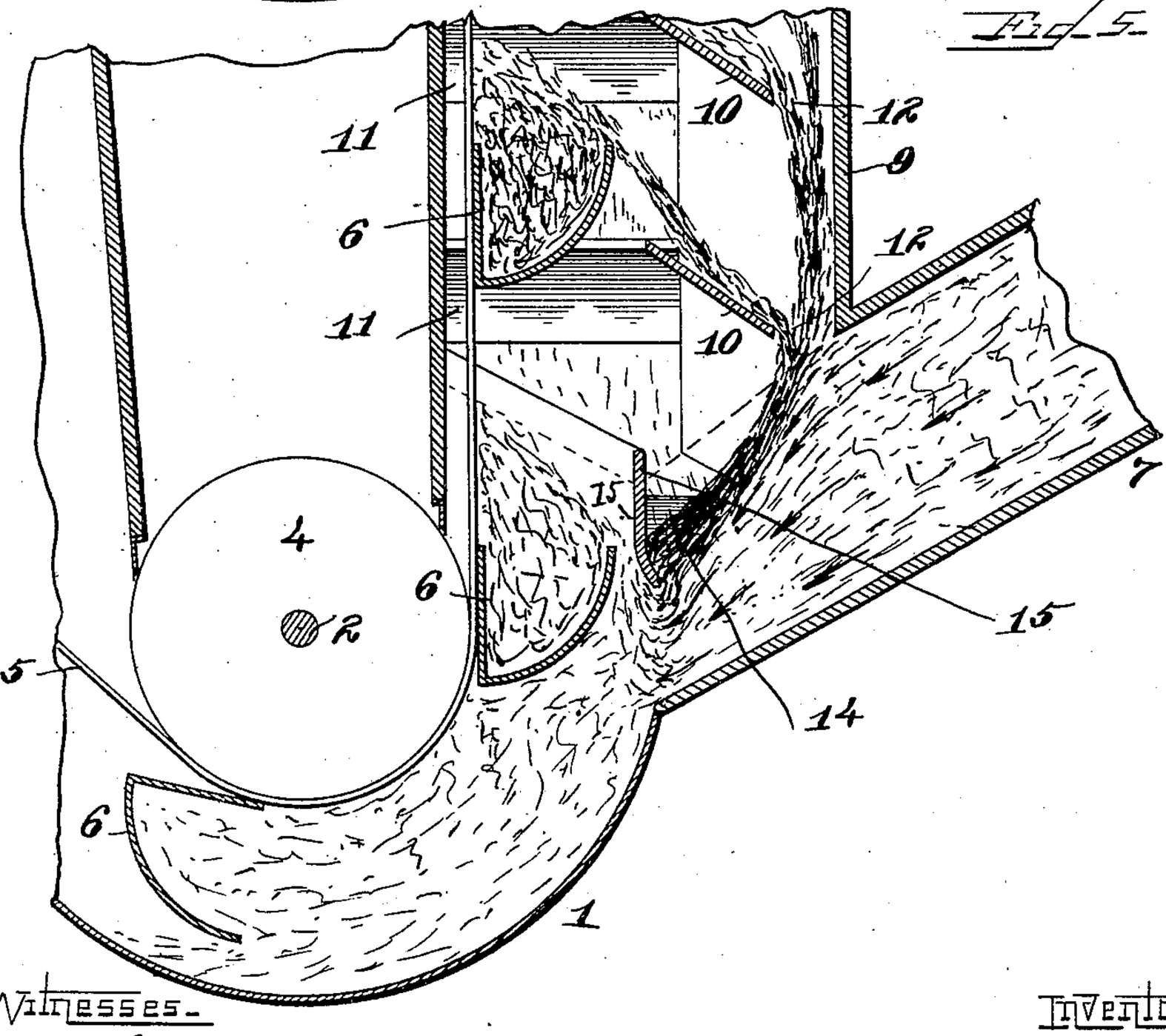


Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS F. HALL, OF OMAHA, NEBRASKA.

GRAIN-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 763,179, dated June 21, 1904.

Application filed May 13, 1903. Serial No. 156,873. (No model.)

To all whom it may concern:

Be it known that I, THOMAS F. HALL, a citizen of the United States, residing at Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Grain-Elevators, of which the following is a specification.

The object of this invention is the production of means for preventing the clogging of elevators in handling small grains and other granular substances. The invention is based upon the theory that such substances being somewhat fluid have a certain angle of repose. A liquid comes to rest with its upper surface in a horizontal plane; but a mass composed of particles like kernels of grain is less fluid and after disturbance comes to rest with its upper surface at an angle *a* with the horizontal. This is best illustrated by placing vertically an open discharge-spout at a certain distance above a large level floor and passing a granular mass—as, for instance, a quantity of grain—through said spout. The grain will fall from the spout upon the floor, its mass assuming thereon the form of a cone. As the grain continues to flow the apex of the cone rises and the base spreads, the angle of its sides, however, remaining the same throughout its growth. Finally, the apex of the cone rises sufficiently to reach the spout and choke the discharge-opening therein, stopping the flow therefrom. The inclination of the sides of the cone thus formed with reference to the horizontal is the angle of repose referred to, and this angle is practically constant for all grains in marketable condition. Other substances have different angles of repose; but the angle of each is constant for similar conditions of the substance.

In the embodiment herein shown the invention is applied to the boot of a grain-elevator and comprises, essentially, a barrier for holding back the grain in the spout and preventing the flooding of the lower part of the boot and the consequent "pumping" of the grain up the rising leg of said boot and the choking thereof. Instead of the vertically-arranged spout of the foregoing example circumstances necessitate an inclined spout; but the angle of repose, though different from that of the conical pile, is as certain and constant.

In the accompanying drawings, Figure 1 is a vertical sectional view through an elevator-boot embodying the features of my invention, which section is taken on the plane parallel with the side faces of said boot. Fig. 2 is a horizontal section on dotted line 2 2 of Fig. 1. Fig. 3 is a similar view taken on dotted line 3 3 of Fig. 1. Fig. 4 is a vertical section similar to that of Fig. 1, showing the position of the substance to be elevated when said substance is first admitted into the boot. Fig. 5 is a similar sectional view showing the action of the substance to be elevated during the operation of the elevating means.

In the construction of an elevator embodying this invention I provide a boot 1 of usual construction, having a shaft 2 journaled in suitable bearings 3 in the lower end thereof. A pulley 4 adapted to carry the endless belt 5 is fixed upon the shaft 2, and said belt is provided with the elevator-buckets 6 of common construction. In the drawings I have shown only the lower end of the boot, the upper end being of the usual form. The substance to be elevated is admitted to the lower end of the boot at 1^a by means of one of the chutes 7 on the rising side of the endless belt 5. Each of these chutes is provided with a closure-slide 8 for controlling the flow of grain to the boot. The leg 9 on the rising side of the boot is considerably larger than is usual in elevators to provide not only for the rising loading-buckets, but for the inclined wings 10, arranged in said leg in a vertical series at the front edge of said buckets, and similar wings 11, also in vertical series, at the ends of the buckets, the object of these wings being to catch the surplus grain that falls from the overflowing buckets as said buckets rise in the leg 9 of the boot and to carry said grain away from the vertical series of buckets, so that it will not fall from one bucket onto the next succeeding bucket, as in elevators of common construction, and, collecting in the leg, clog and stop the elevator. At the lower outer edges of these wings spaces 12 and 13 are provided between

the wings 10 and 11 and the adjacent walls, respectively, of the leg 9, permitting the downward passage of said surplus grain, which, coming from the wings 10, falls into the boot at the point where the grain enters said boot from the grain-chute 7 and from the wings 11 is directed into the boot at the same places by the inclined shelves 14 at opposite sides of the leg 9. A barrier 15 is placed within the boot transversely of and opposite the lower open end of the grain-chute 7. The lower edge of the barrier 15 may be curved forward toward said grain-chute, as shown; but this is not essential, and said barrier is located at a point adjacent to the forward edges of the rising buckets 6, also adjacent to the line of repose *a*, Fig. 4, of the substance being elevated.

In operation grain or other substances to be elevated is admitted to the interior of the boot 1 through the chute 7. When the substance flows into the boot 1, it assumes therein the position indicated in Fig. 4, said substance filling the lower part of the boot on the elevating side thereof, rising upon the forward side of the barrier 15 to a point near the upper edge thereof. In this position the flow through the chute 7 ceases and the grain comes to rest at its angle of repose. When the rotation of the pulley 4 begins and the buckets 6 are caused to pass through the boot and upward through the rising leg 9 thereof, the grain in the lower part of the boot is displaced, the angle of repose is disturbed on the forward side of the barrier, and the flow through the chute 7 is resumed. The rising buckets are filled to overflowing and the overflow falls from the buckets to the forward side of the barrier and upon the wings 10 and 11. The grain falling upon the wings 10 and 11 is directed by said wings downward at the outer side of said leg 9 into the stream of grain flowing into the boot from the chute 7. This overflow falling upon the stream of grain as it emerges from the chute 7 tends to restore the angle of repose on the forward side of the barrier and to that extent retards the inflow from chute 7; but the rising buckets withdrawing the grain from the lower portion of the boot in larger quantities than the falling overflow disturbs this line of repose much faster than the tendency of the overflow to restore it. Consequently the upper marginal line of the grain at the barrier falls, and as it falls the inflow from the chute 7 is quickened; but the overflow grain falling on the upper marginal line referred to, with its steep incline, is the first grain to pass into the boot, because it is on the steepest incline. This marginal line continues to fall and the angle steepens, and the inflow from the chute 7 consequently quickens until the deficiency in the boot is supplied. When this deficiency is supplied, the inflowing grain from the chute 7 would naturally cause the marginal line to again rise at the barrier to restore the angle of repose, but the overflow continually falling on this marginal line regulates the inflow from the chute 7 by its tendency to choke it. Therefore the action of the buckets, the inflow and the overflow, all acting together with the barrier, automatically hold in check and regulate the supply of grain to the boot. Should the movement of the elevator be stopped, the grain comes to rest against the forward side of the barrier in the position indicated in Fig. 4, the height of grain there indicated corresponding substantially with its angle of repose when the delivery-spout is in the position shown. Used somewhat differently, the barrier 15 may be raised entirely above the line of repose referred to, and clogging in the leg 9 will still be prevented, inasmuch as the position of the barrier will regulate the height to which the grain will rise behind it. It therefore is apparent that the barrier may be placed in a different position with relation to the angle of repose mentioned, also changed in shape and size to meet different conditions and for substances having different degrees of fluidity and to facilitate such movement might be adjustably mounted in its place, also that many other changes in the general construction and arrangement of parts of the embodiment herein shown might be resorted to without departing from the spirit and scope of this invention, wherefore I desire to have it understood that I claim said invention broadly in all its various forms and applications.

I claim as my invention—

1. In a means for automatically stopping the flow of a granular substance from a delivery-spout, in combination, a spout for delivering the material; and a stationary barrier located at a distance from the discharge end of said spout in a position to support between the barrier and the spout a portion of the substance theretofore discharged from said spout to partially choke the flow therefrom.

2. In an elevator, in combination, a mechanism for elevating granular material; a delivery-spout therefor; and a stationary barrier located at a distance from said spout, in a position to partially choke the flow from the spout to prevent flooding the elevating mechanism.

3. In an elevator, in combination, a mechanism for elevating granular material; a delivery-spout and a stationary barrier for the discharge-opening of said spout somewhat removed therefrom, but extending above and below the line of repose of said material, to choke the flow from the spout.

4. In an elevator, in combination, a mechanism for elevating granular material; a delivery-spout therefor; and a barrier located intermediate said mechanism and the discharge

end of said spout, at a distance from the spout and extending above and below the line of repose of said granular material.

5. In an elevator, in combination, a line of elevating-buckets; a delivery-spout for delivering material to said line of buckets; and a stationary barrier located adjacent to said line of buckets and at a distance from said spout.

6. In an elevator, in combination, a line of elevating-buckets; a delivery-spout for delivering material to said line of buckets; and a stationary barrier located intermediate said line of buckets and said spout at a distance from said spout.

7. In an elevator, in combination, a line of elevating-buckets; a delivery-spout for delivering material to said line of buckets; and a barrier located intermediate said line of buckets and said spout, and extending above and below the line of repose of the material being delivered.

8. In an elevator, in combination, a vertical elevator-leg; a line of elevating-buckets in said leg; and fixed means in said leg intermediate the upper and lower ends thereof for directing the overflow from said buckets away from the line of buckets.

9. In an elevator, in combination, an elevator-leg; a line of elevating-buckets in said leg; and a wing in said leg for directing the overflow from said buckets away from the line of buckets.

10. In an elevator, in combination, an elevator-leg; a line of elevating-buckets supported within said leg at one side thereof; and means for directing the overflow from said buckets to the opposite side of said leg.

11. In an elevator, in combination, an elevator-leg; a line of elevating-buckets supported within said leg at one side thereof; and a wing in said leg for directing the overflow from said buckets to the opposite side of said leg.

12. In an elevator, in combination, a line of elevating-buckets; a spout for delivering material to said buckets; and means for directing to a distance the overflow from said buckets and for discharging said overflow into the stream of material issuing from the delivery-spout.

13. In an elevator, in combination, an elevator-leg; a line of elevating-buckets in said leg; a spout for delivering material to said buckets; and a wing in said leg for directing to a distance the overflow from said buckets and for discharging said overflow into the stream of material issuing from the delivery-spout.

14. In an elevator, in combination, an elevator-leg; a line of elevating-buckets in said leg; and a wing in said leg in front, and at each side of said line of buckets, for carrying to a distance the overflow from said buckets.

15. In an elevator, in combination, a mechanism for elevating granular material; a delivery-spout therefor; a barrier located at a distance from the discharge end of said spout; and means for directing the overflow from the elevating mechanism to a point between the barrier and the discharge end of the delivery-spout.

16. In an elevator, in combination, a line of elevating-buckets; a spout for delivering material to said buckets; a barrier intermediate said line of buckets and the discharge end of said spout for controlling the flow from said spout; and means for carrying to a distance the overflow from said buckets and for discharging said overflow at a point between the barrier and the delivery-spout.

17. In an elevator, in combination, an elevator-leg; a line of elevating-buckets in said leg; a spout for delivering material to said buckets; a barrier intermediate said line of buckets and said delivery-spout for controlling the flow from said spout; and a wing in said elevator-leg for carrying to a distance the overflow from said buckets and for discharging said overflow at a point between the barrier and the delivery-spout.

THOMAS F. HALL.

Witnesses:
MAUDE M. RECTOR,
RICHARD S. HORTON.