No. 791,352. PATENTED MAY 30, 1905.

H. MARCUS.

CHUTE.

APPLICATION FILED AUG. 7, 1902.

3 SHEETS—SHEET 1.

Fig. 1

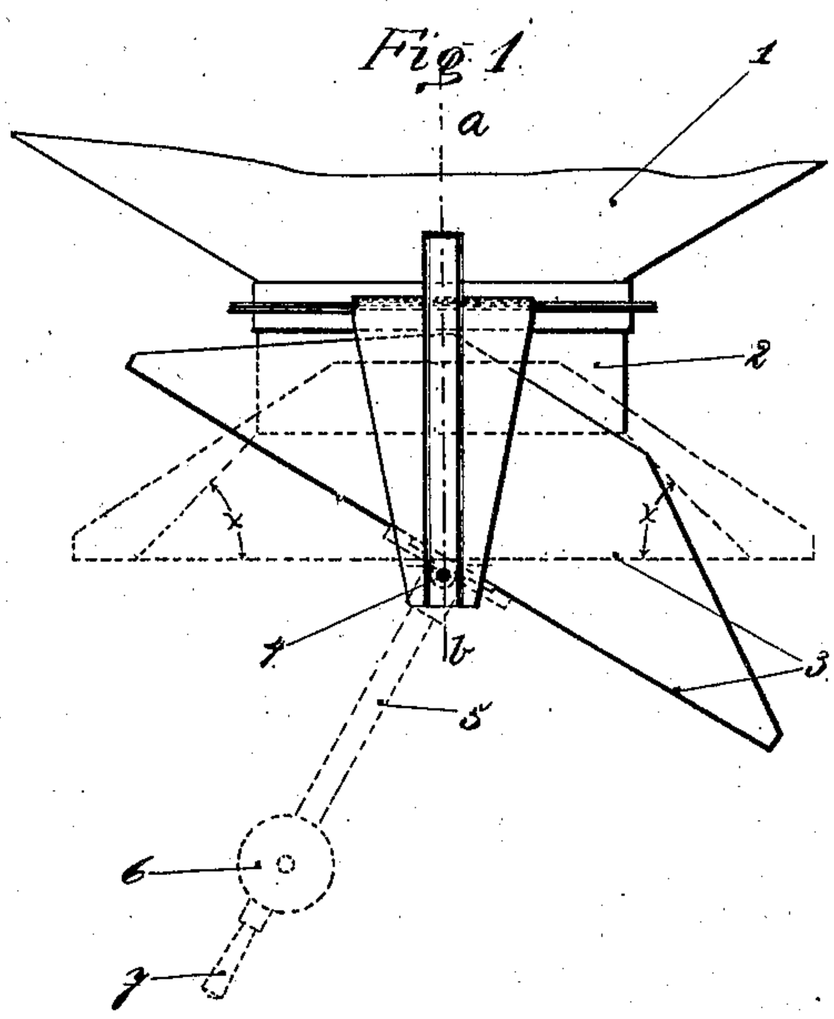


Fig. 2

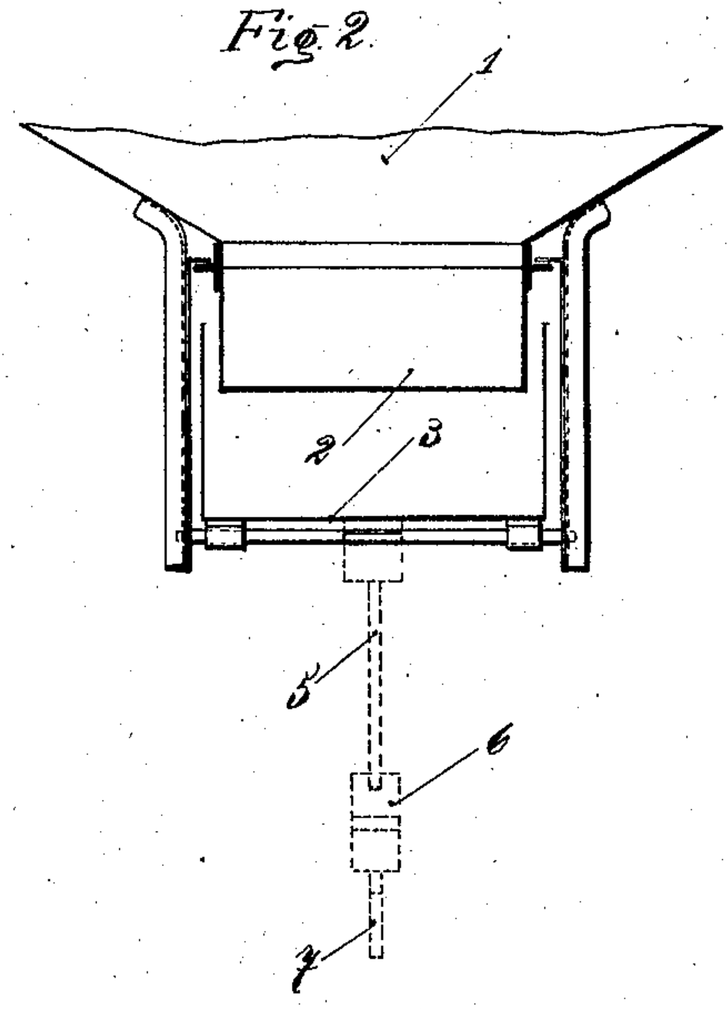


Fig. 3.

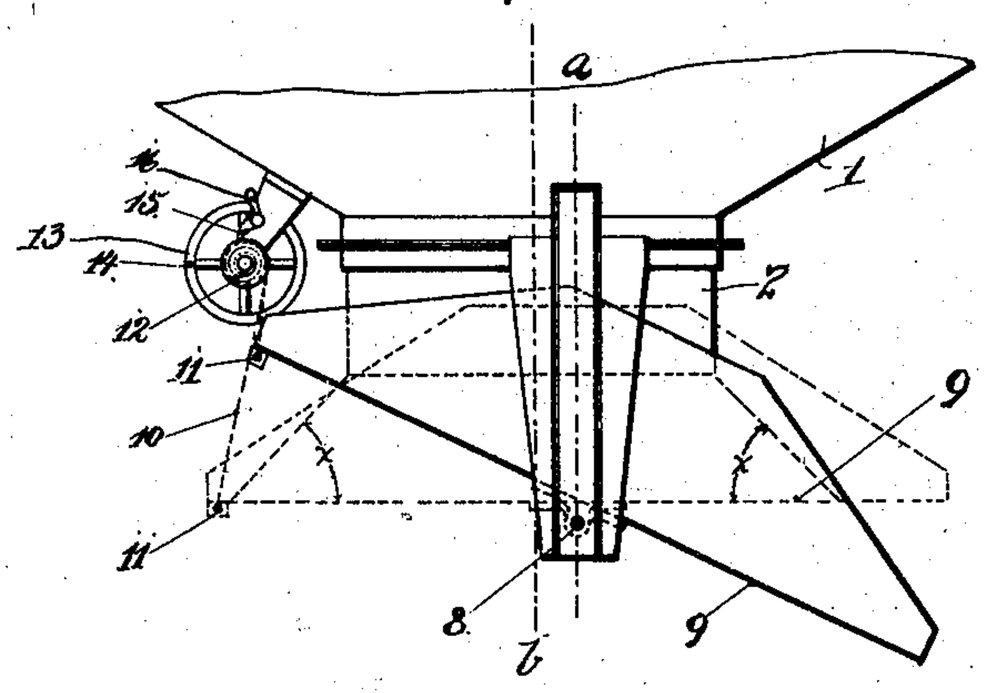
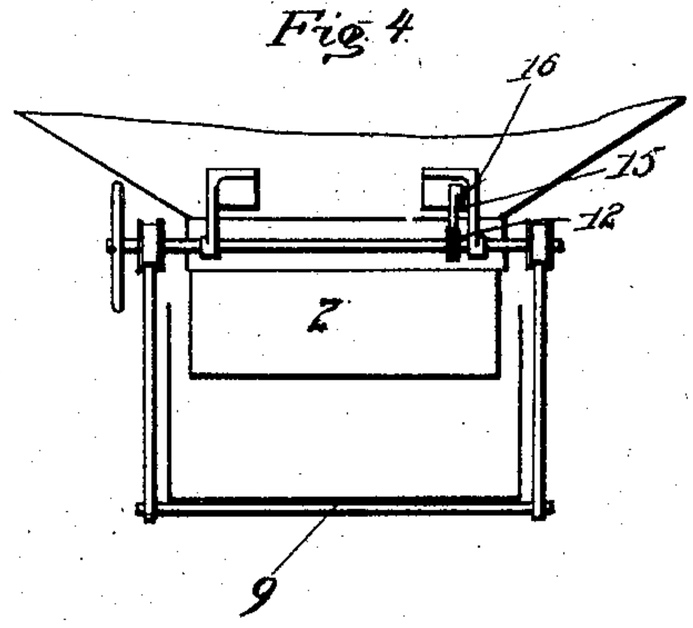


Fig. 4



Witnesses.
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Wm. P. Hammond

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3 SHEETS—SHEET 2.

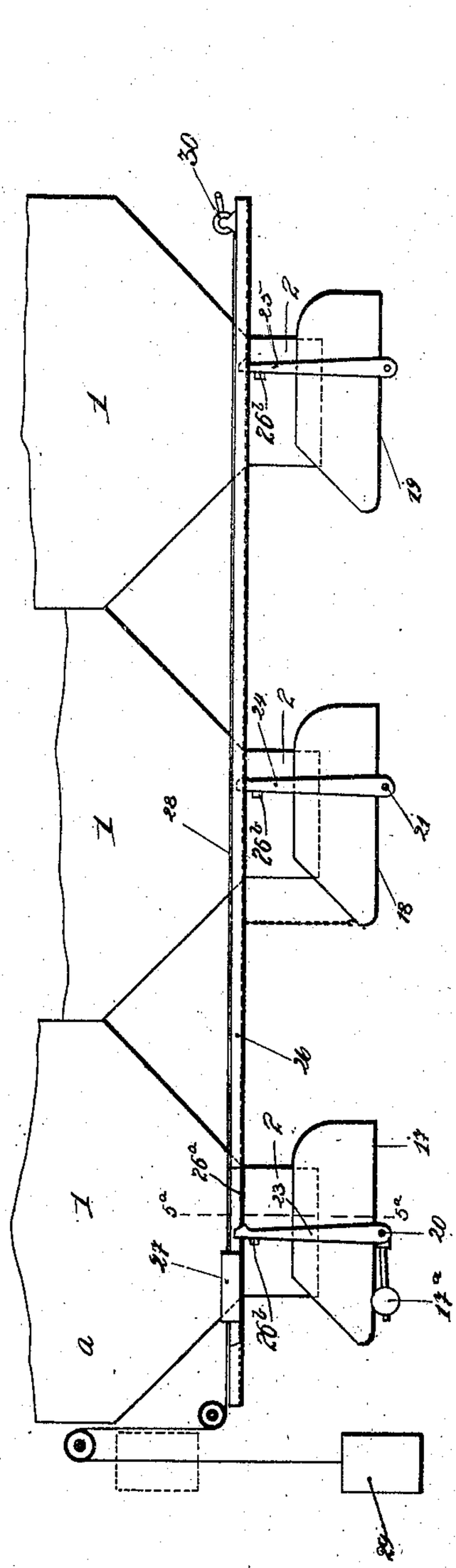

Fig. 5.

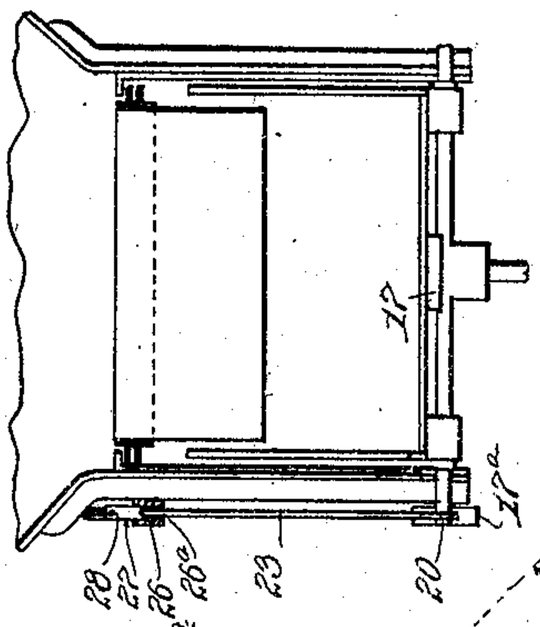

Fig. 5a.

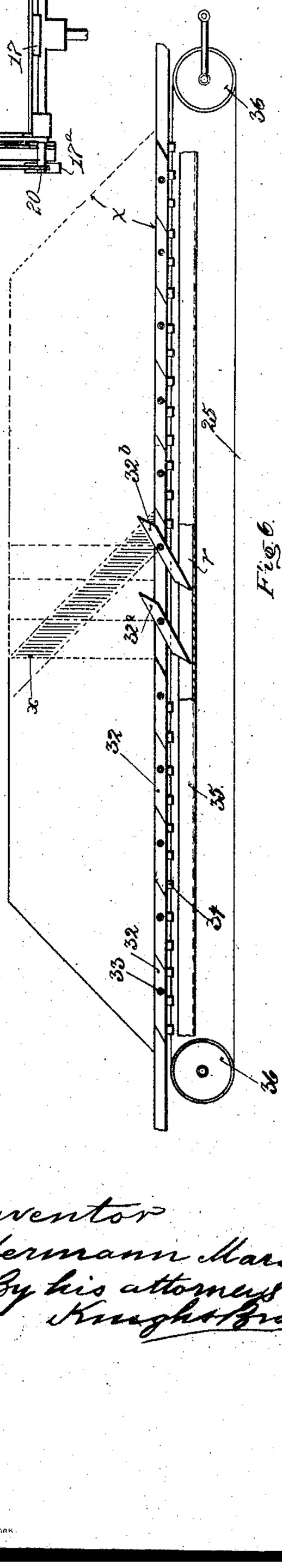

Fig. 6.

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3 SHEETS—SHEET 3.

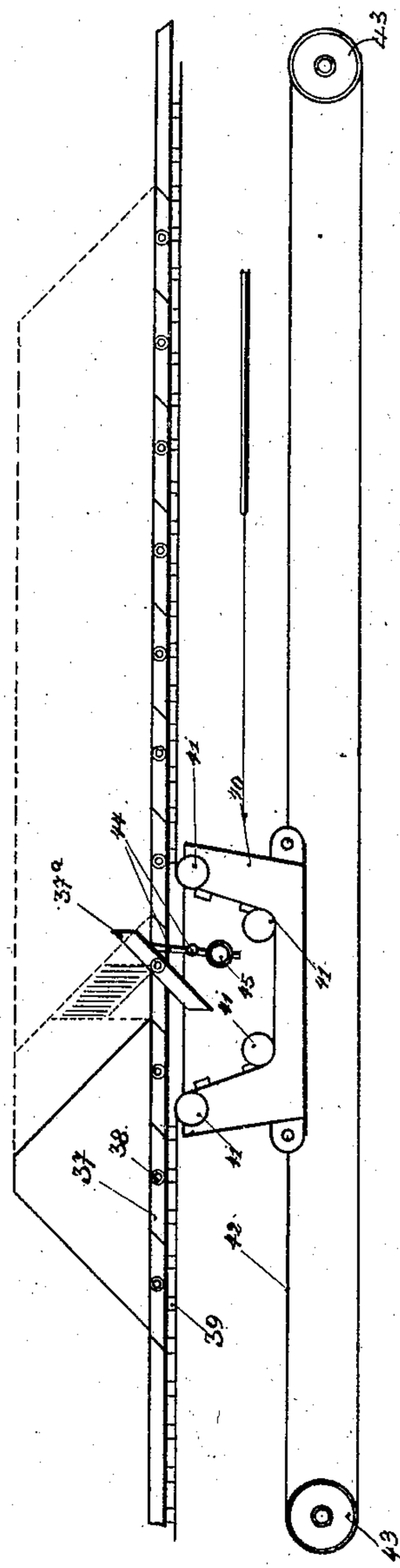

Fig. 7.

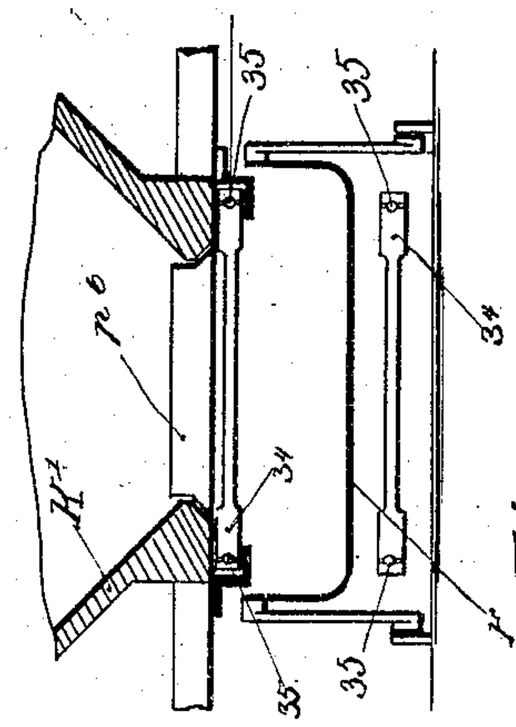

Fig. 9

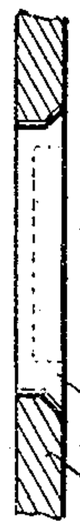

Fig. 12.

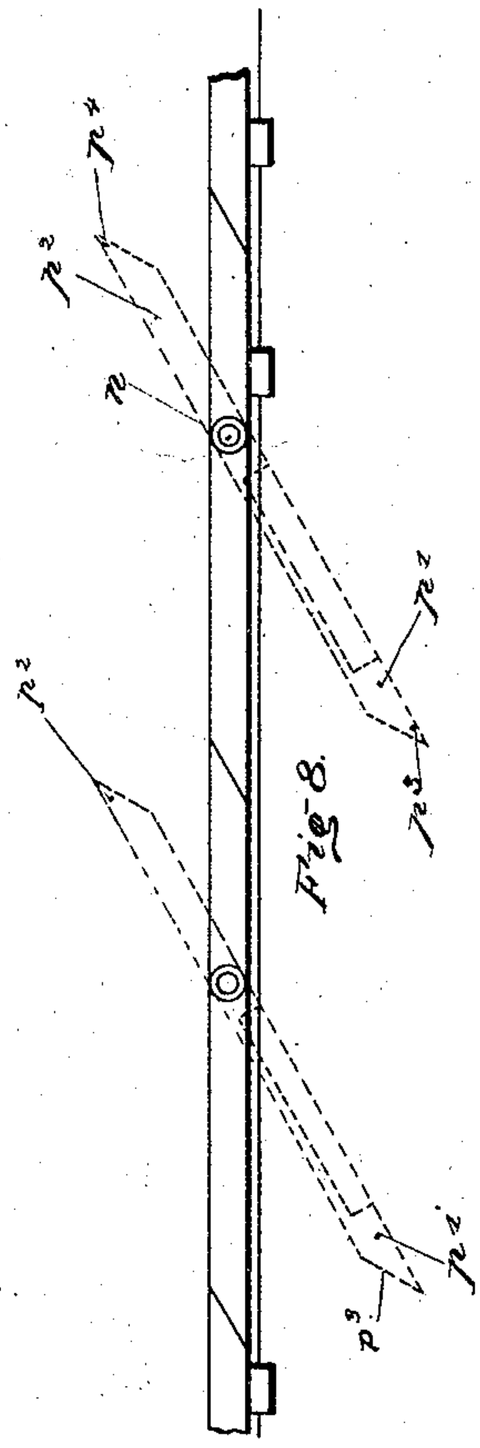

Fig. 8.

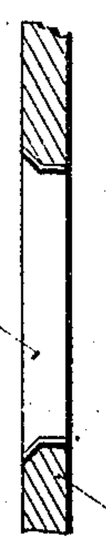

Fig. 11.

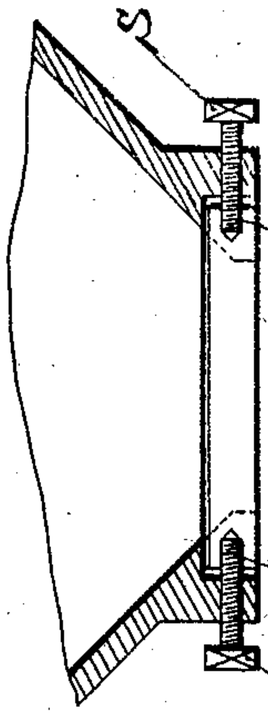

Fig. 10.

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No. 791,352. Patented May 30, 1905.

UNITED STATES PATENT OFFICE.

HERMANN MARCUS, OF COLOGNE, GERMANY.

CHUTE.

SPECIFICATION forming part of Letters Patent No. 791,352, dated May 30, 1905.

Application filed August 7, 1902. Serial No. 118,831.

To all whom it may concern:

Be it known that I, HERMANN MARCUS, engineer, a subject of the King of Prussia, German Emperor, residing at 32 Karolingerring, Cologne, in the Kingdom of Prussia, Germany, have invented certain new and useful Improvements in Chutes, of which the following is a full, clear, and exact description.

The present invention relates to chutes for discharging and regulating or controlling the outflow of materials from silos, shafts, trunks, feeding-hoppers, and other receptacles.

One object of my invention is to utilize the mass of material flowing from the spout of a silo or other receptacle as a means for closing the discharge-aperture of the spout by depositing a mass of material in a free pile with sloping sides between the discharge-aperture and a tilting plate which is held in normal horizontal position by suitable means.

Another object of my invention is to provide a series of such tilting plates or slides.

Another object of my invention is to provide improved means for supporting and releasing the tilting plate or slide.

My invention consists in certain novel features of construction and combination of parts, as hereinafter described and claimed.

In the accompanying drawings, Figures 1 to 5[a] illustrate examples of the construction of the apparatus. Figs. 6 and 7 show the arrangement of the apparatus for the method of automatically discharging silos and the like. Figs. 8 to 12 show, on an enlarged scale, detail views of the apparatus shown in Figs. 6 and 7.

To the silo or other receptacle 1, Figs. 1 and 2, there is connected the outflow-aperture 2 in the well-known way. The closing of this aperture for the purpose of regulating the outflow of the material from the silo is effected by means of the tilting bottom plate 3, which is pivotally supported at right angles to the axis *a b* of the aperture below the same at the point 4. The material coming from the silo bears upon the plate 3, and when the plate is horizontal the material has a slope or angle of inclination *x*. As the support 4 is situated in the central axis *a b* of the silo, then in the horizontal position of the plate 3 (shown in dotted lines in Fig. 1) the pressure will be uniformly distributed on both sides of the plate. If the plate be turned on its axis 4, for example, into the position shown in full lines in Fig. 1, the material will flow off toward the right-hand side. Of course the flow can be made to take place to the right or to the left hand side, as desired, according as the plate is turned on its axis to one side or the other. When the plate is in a suitably-inclined position, there is an excess of pressure on the downwardly-directed side, and it is often also desirable to balance this pressure and to do so by means of a counterweight connected to the plate. In Fig. 1 this counterweight 6, as also its supporting-lever 5, is shown in dotted lines. This lever 5 is mounted at right angles to the plate 3, so as to utilize the advantage of its weight 6, not coming into operation when the plate is in a horizontal position, but only when the plate is inclined, and the more so the greater the inclination of the plate—that is to say, the greater the excess pressure on one side. Another advantage is that the plate can be inclined to one or the other side, as desired, so that the outflow can take place either on the right or on the left hand. In any case the counterweight will always balance the excess pressure, so that in turning the plate only the friction of the journals has to be overcome—that is to say, the requisite exertion of force is reduced to a minimum. It will depend on the size of the counterweight whether it will serve only to balance the excess pressure or whether it will overcome this pressure and will automatically return the plate back into its horizontal position. In the first case as soon as the plate has assumed a certain position it will remain in that position until it is moved back again by hand or by mechanical means; but in the second case a suitable retaining device must be employed to keep the plate in the inclined position, and when this device is released the plate will return automatically into the horizontal position. When it is desired that an operation—for example, the opening of the silo, but more frequently the

closing of the same—shall take place rapidly in an automatic manner and it is desired to dispense with a counterweight of this kind, the entire apparatus can be modified in such a manner that the material will exert an excess pressure on one side of the plate in every position. This modification is shown in Figs. 3 and 4, where the pivotal center 8 of the plate 9 is arranged somewhat to one side of the central axis *a b* of the silo-aperture, so that the pressure of the material is greater on one side than on the other even when the plate 9 is inclined. As the plate will not by itself remain in the inclined position shown in full lines in Fig. 3, it is advisable to employ a retaining device, which in the form shown in Fig. 3 consists of a belt or rope 10, connected at one end at a point 11 to the plate 9 and at the other end can be wound up on a drum 12 by turning the hand-wheel 13. The drum 12 also carries a ratchet-wheel 14, which can be engaged by a pawl 15 in order to keep the plate in its drawn-up position. By operating the handle 16 of the pawl 15 the latter is thrown out of gear, and by the action of the excess pressure from the silo upon the raised side of the plate the plate will at once fall back into the position shown in dotted lines in Fig. 3, and thus close the silo.

When a number of silos each of which is capable of being closed singly are arranged side by side, the arrangement is suitably made as shown in Fig. 5. In this case also it is advisable that the plates or slides 17, 18, and 19 shall open also by mechanical means, but shall be closed automatically by the pressure of the material or by means of a counterweight. The plate 17 has its pivotal center 20 in the central axis *a b* of the silo, as shown in Fig. 1, while the plates 18 and 19 have theirs outside the center, as shown in Fig. 3. Plate 17 is provided with a counterweight 17^a, so that there will always be on one side an excess pressure which compels the plate when opened by mechanical means to return automatically into the horizontal position. In the case of the plates 18 and 19 there is no counterweight, because they are exposed to an excess of pressure of the material on one side by reason of their situation on one side of the bearing. It is obvious that it is advisable to provide stops which prevent the slides or plates when closing rapidly under the influence of the excess pressure from swinging past the horizontal position to the other side.

The actuation of the plate may be effected in any desired manner. For example, as shown in Fig. 5, the several plates may have levers 23, 24, and 25 connected to them, which are guided in the slots 26^a of a U-shaped iron 26, in which there is also mounted a block 27.

26^b represents lugs on the sides of the apertures 2, which act as stops for the levers.

A closed or open rope or chain 28, provided at one end with a counterweight 29 and which is capable of being wound at the other end upon a drum 30, serves by rotating the drum 30 to move the block 27 in the U-shaped iron in such a manner as to turn the levers 23, 24, and 25 on the centers 20 21 22, and thus move the plate 17, 18, or 19 into an inclined position. In Fig. 5^a I show a detail section taken on the line 5^a 5^a, Fig. 5, to illustrate the U-shaped iron.

The conveyer-belt 31 serves for conveying the material caused to flow out of the silo or other receptacle by means of the above-described closing devices and may be charged to any desired length by the use of a suitable number of such closing devices.

If, as above mentioned, the mode of action of the above-described plates is employed for closing silos or the like by using a large number of such plates following each other in series, then we have a method for the automatic discharge of the silos caused by the influence of the slope or inclination of the material piled up in the silo. So far as the slope extends the pressure of the material on a plate arranged below it will be irregular or non-uniform. The consequence of this is that the plate which is pivotally supported in the center line of the surface that receives the pressure will place itself automatically by the unequal pressure at an inclination—that is to say, will open—and thus allow the material to flow out. Fig. 6 shows the best way of arranging the plates 32 side by side, which are suspended pivotally at the point 33. The plates are normally locked, so that they assume the horizontal position. As above stated, the material bears with a slope or inclination on the plates, and therefore so far as the slope extends a non-uniform or unequal pressure is produced under the lower portion of the slope on the several plates, which are pivoted on their centers, Fig. 6, and this pressure on one side of the plate will always be greater than on the other side of the plate, according to the hatched half of the pressure-line *x*. If these plates are not locked, they will open by reason of the unequal pressure and the material can flow out of the passage. The locking is preferably effected by means of cross-bars 34, which are fixed on ropes or chains 35. The latter are placed around rollers 36, and as the cross-bars 34 are omitted at certain intervals, so as to miss one or more of the plates, (in Fig. 6, for instance, cross-bars are omitted beneath the two plates 32^a and 32^b,) these plates are not locked and will therefore be opened by the action of the slope. When the arrangement is such that the inner half of the plate is heavier, then the plates will close again automatically as soon as the material has run down to the next plate that is locked. If now the bars are moved farther on, so that the next following plate becomes free, this plate will open by the ir-

regular pressure upon it caused by the slope and the automatic discharge from the silo or other receptacle will continue to take place. It may also be mentioned that the whole locking arrangement is designed for the purpose of stopping the outflow of the material at intervals and that without its use the material would begin to flow out, commencing with the first plate, and would continue to flow out until the last plate was reached, because the slope shifts back from plate to plate, so that always plates in advance would experience this irregular load and would be opened by that action.

Fig. 7 is a similar arrangement to that of Fig. 6. In this case the plates 37 are also suspended at points 38 and are intended to open automatically under the action of the material. The difference in the two figures exists only in the manner in which the locking of the several plates can be best effected. The locking shown in this case consists of cross-bars 39, which are guided over four rollers 41 in a hopper-shaped box, and thus unlock a plate each time, so that the said plate will open under the non-uniform pressure of the slope of the material. The shifting of the box or hopper is effected preferably by means of the rope 42, which is led over rollers 43. With this arrangement there may also be provided a lever 44, which carries a counterweight 45 on one end and which serves with its other end, by the action of the counterweight, to open and to close the plate which happens to be unlocked—that is to say, to aid the action of the non-uniform pressure of the material, on one hand, and also the action of the non-uniform weight of the two sides of the plate, on the other hand. Such an arrangement becomes necessary occasionally—for instance, when particles of the material get in the slits between the several plates, and thus cause them to become jammed. When the box or hopper 40 is in the position shown in Fig. 7, the lever 44 will open the plate 37^a, and when the box 40 is pushed farther on and the lever 44 is thus also moved farther on and as soon as its end which is in contact with the plate has slid past the center pivot of a plate it will compel said plate to close. Of course the lever 44 must be made to turn over or be removable, so as to allow the box 40 to be moved back under the plates, as otherwise the lever would get in between two plates and would prevent the box from being moved back.

The plates themselves are preferably constructed as shown on an enlarged scale in Figs. 8 to 12. Each separate plate, Fig. 8, consists of the halves p' p^2, of which the half p' is made preferably hollow, so that in the unloaded condition the heavier portion p^2 has always a tendency to keep the plate in the horizontal closed position. The front p^3 and back p^4 edges of the plate are beveled off, so that the several plates can bear upon one another, and the side edges p^5 p^6 are made partly straight and partly beveled. In this connection it should be noted that Fig. 11, which shows the formation of the side edges, is a section through the part p^3, while Fig. 12 is a section through the part p'.

It is to be understood that the walls K of the passage K′, that serves to receive the plates, are made similar to the side walls p^5 p^6, so that a tight joint is produced. In the middle—that is to say, at the pivotal center of the plates—the side walls are formed with hollow bosses n, by means of which the plates can be pivotally suspended by means of the screws 5, as shown in Fig. 10.

Fig. 9, which is a section through Fig. 6, shows the manner in which the cross-bars 34 effect the closure of the plate and how they are preferably connected to the ropes 35 and guided. It may also be stated that r indicates a channel or groove which may conveniently serve for the further conveyance of the material which is drawn off.

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

1. A chute comprising a spout, a tilting plate of greater dimensions than the discharge-aperture of the spout and located at a distance beneath the spout and adapted to support a free pile of material with sloping sides, between the discharge-aperture and the tilting plate, for closing the discharge-aperture, and means for holding the tilting plate in normal horizontal position.

2. A chute comprising a spout, a tilting plate of greater dimensions than the discharge-aperture of the spout, pivoted at one side of the axis of the discharge-aperture and located at a distance beneath the spout and adapted to support a free pile of material with sloping sides between the discharge-aperture and the tilting plate, for closing the discharge-aperture, and means for holding the tilting plate in normal horizontal position.

3. A chute comprising a series of spouts, a series of tilting plates, each of greater dimensions than the discharge-aperture of the spout with which it is associated, and located at a distance beneath the spouts and adapted to support free piles of material with sloping sides between the discharge-apertures and the tilting plates for closing the discharge-apertures and means for holding the tilting plates in normal horizontal position.

4. A chute comprising a spout, a plate of greater dimensions than the discharge-aperture of the spout and located at a distance beneath the spout having a series of tilting sections adapted to support a free pile of material with sloping sides between the discharge-aperture and the tilting sections for closing the discharge-aperture, and means

for holding the tilting sections in normal horizontal position.

5. A chute comprising a spout, a tilting plate of greater dimensions than the discharge-aperture of the spout, having a pivotal center, and located at a distance beneath the spout and adapted to support a free pile of material with sloping sides between the discharge-aperture and the tilting plate, for closing the discharge-aperture, and means for holding the tilting plate in normal horizontal position consisting of a lever secured to the pivotal center and an adjustable counterweight for balancing the tilting plate when discharging material.

In witness whereof I subscribe my signature in presence of two witnesses.

HERMANN MARCUS.

Witnesses:
CHARLES LE SIMPLE,
HENRY QUADFLIEG.