

A. BIBOLINI & P. RIBONI.
ELECTROSTATIC SEPARATOR FOR SORTING OUT THE CONSTITUENT PARTS OF COMMODITIES
ACCORDING TO THEIR PERMEABILITY.
APPLICATION FILED APR. 25, 1914.

1,154,907.

Patented Sept. 28, 1915.

2 SHEETS—SHEET 1.

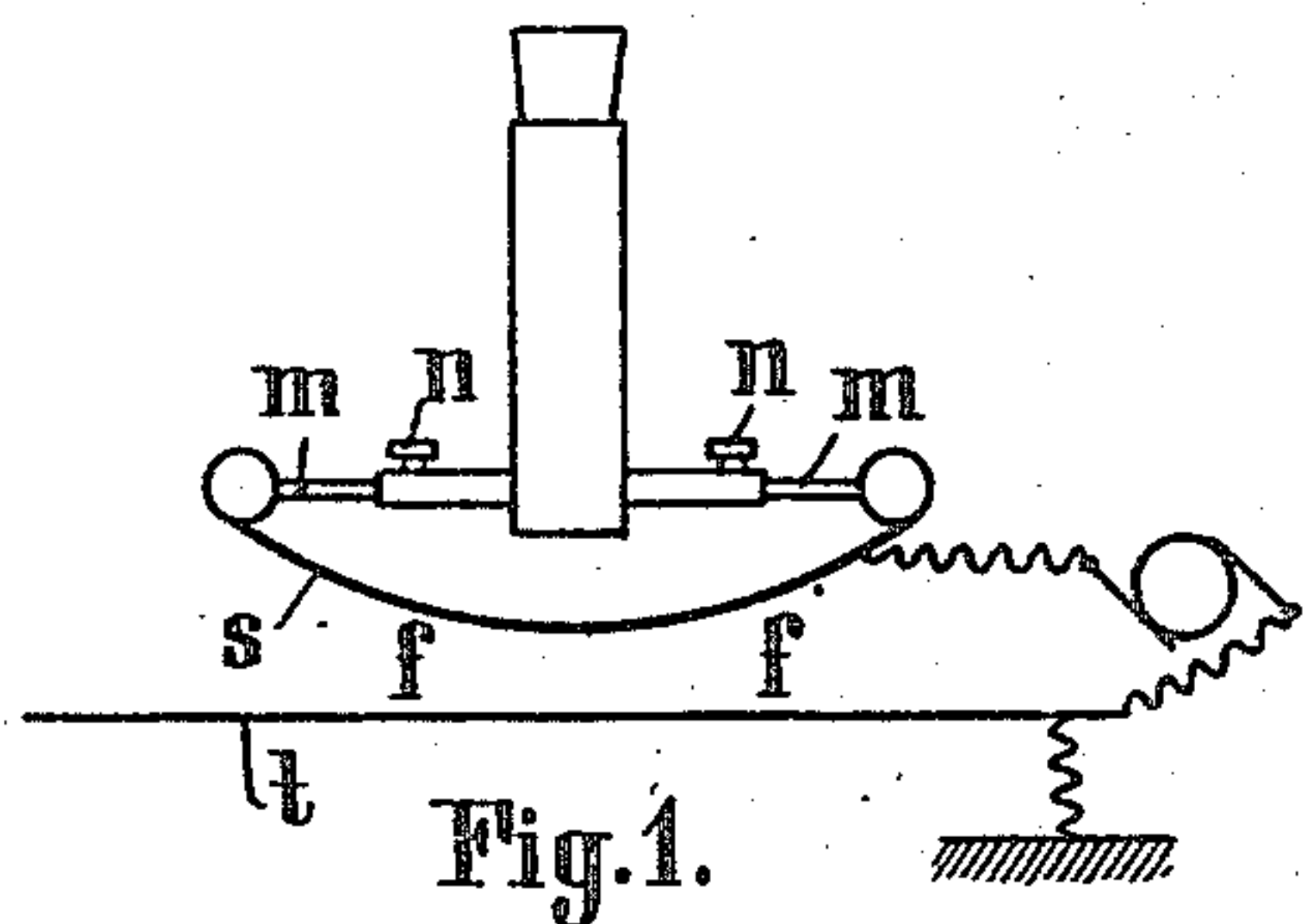


Fig. 1.

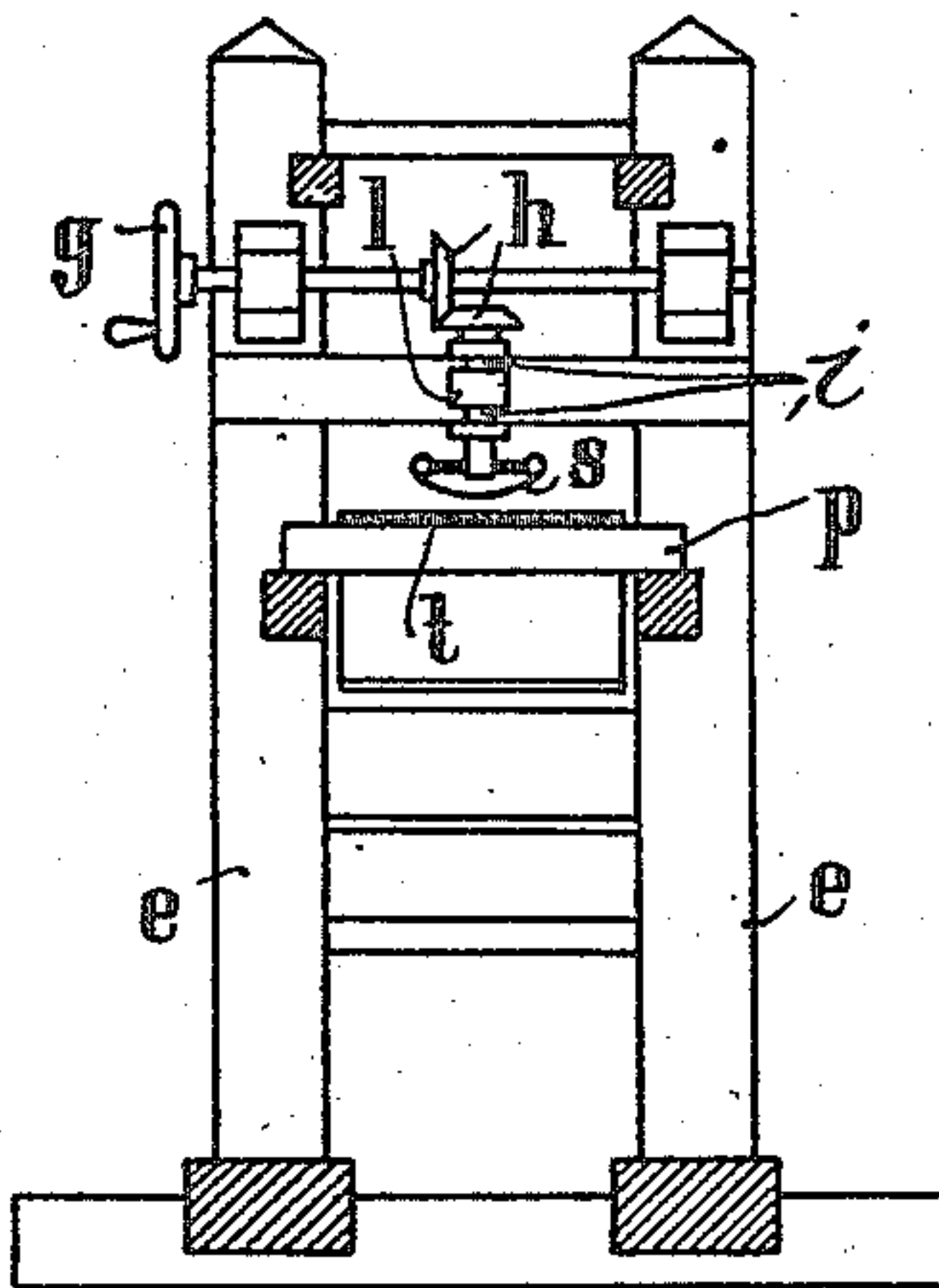


Fig. 2.

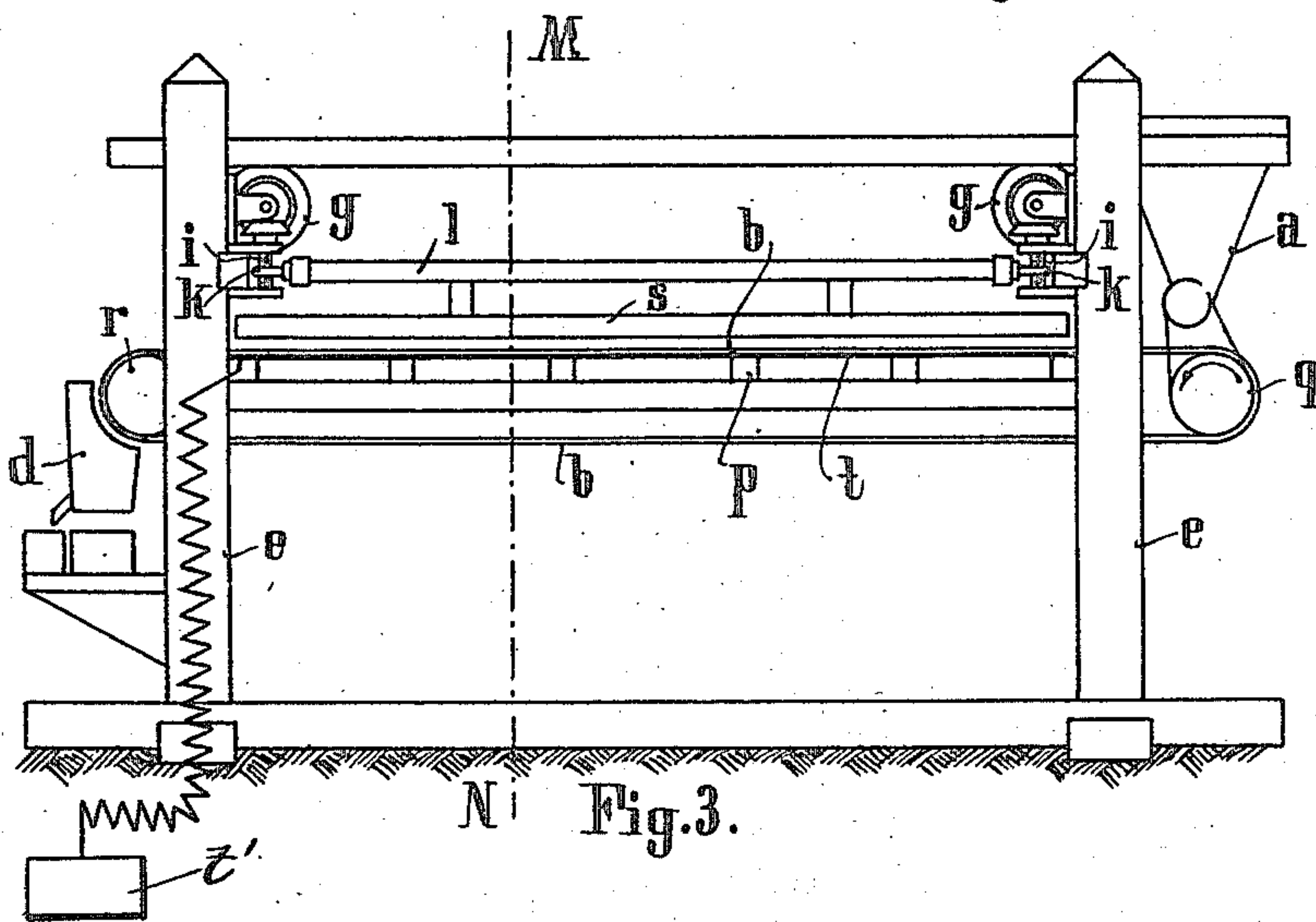


Fig. 3.

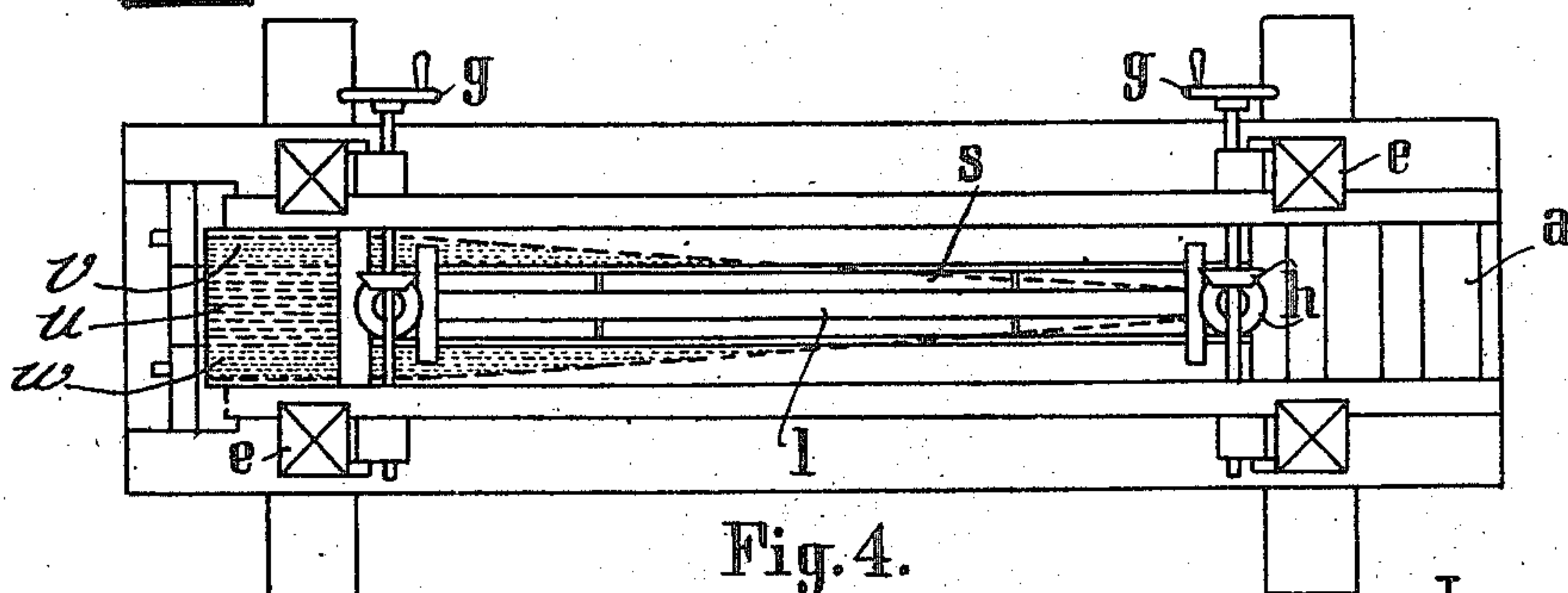


Fig. 4.

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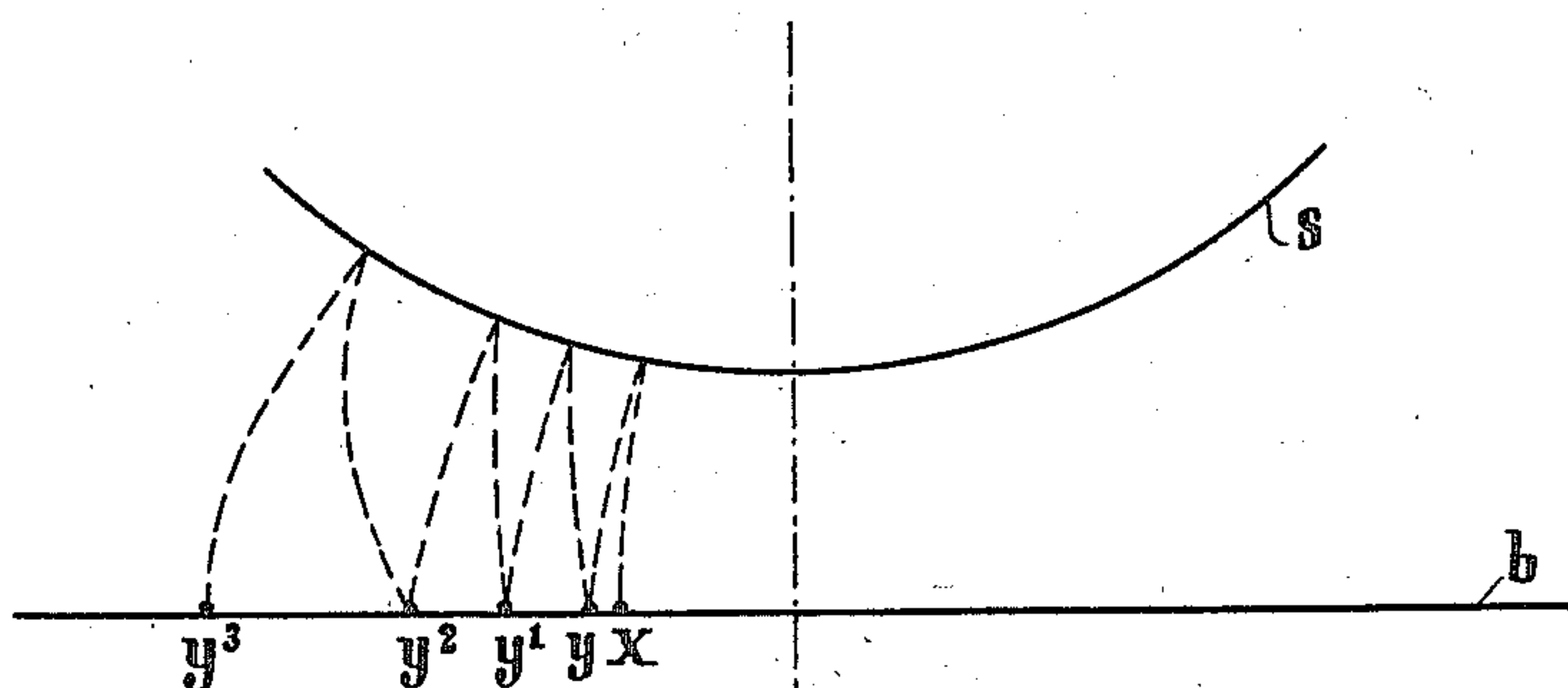


Fig. 5.

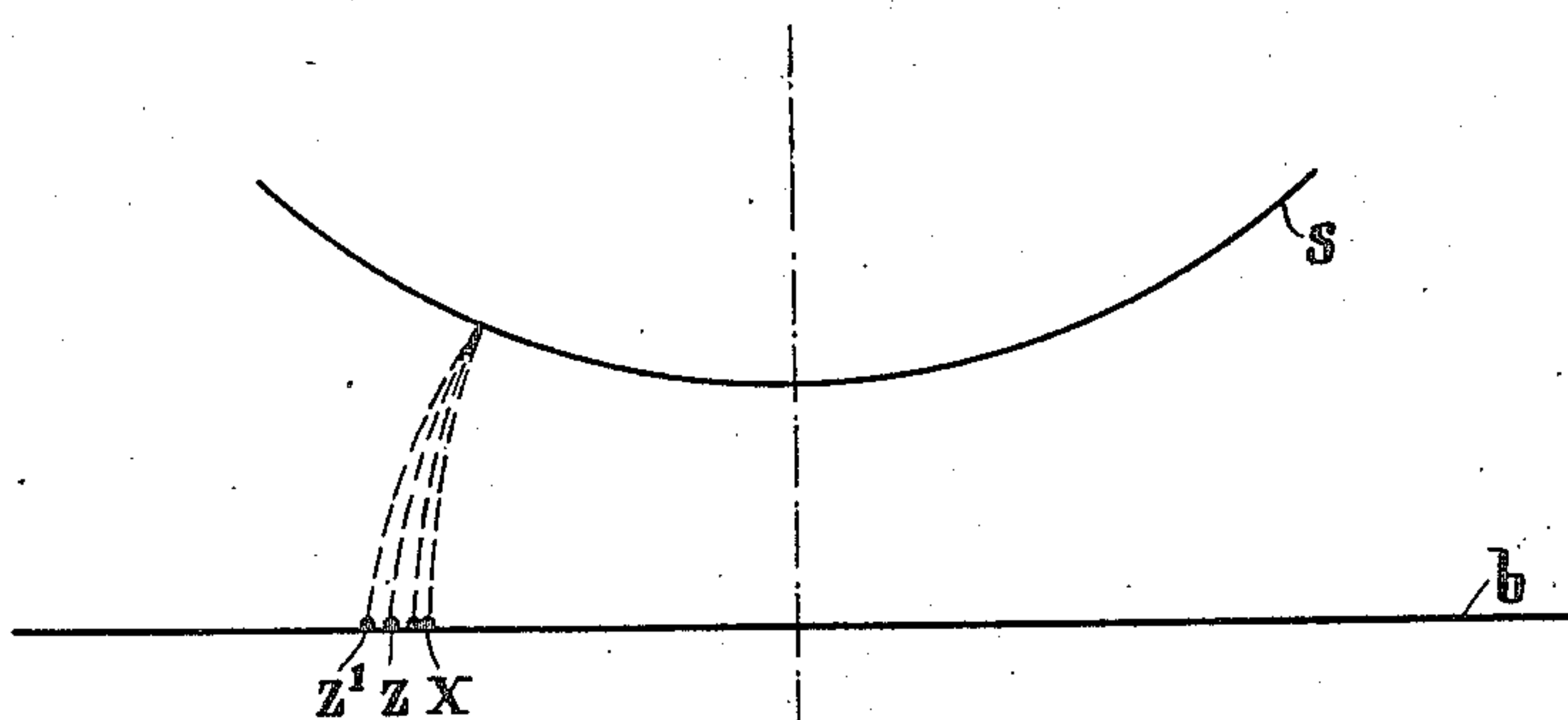


Fig. 6.

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UNITED STATES PATENT OFFICE.

ALDO BIBOLINI, OF AGORDO, AND PIETRO RIBONI, OF NAPLES, ITALY.

ELECTROSTATIC SEPARATOR FOR SORTING OUT THE CONSTITUENT PARTS OF
COMMODITIES ACCORDING TO THEIR PERMEABILITY.

1,154,907.

Specification of Letters Patent.

Patented Sept. 28, 1915.

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To all whom it may concern:

Be it known that we, ALDO BIBOLINI and PIETRO RIBONI, engineers, subjects of the King of Italy, residing, respectively, at Agordo, Province of Belluno, Italy, and at Naples, Italy, have invented certain new and useful improvements in or relating to electrostatic separators for sorting out the constituent parts of commodities according to their permeability, of which the following is a specification.

This invention relates to improvements in connection with electrostatic separators for sorting out the constituent parts of commodities according to their permeability.

Separators of the above type are already known in which a commodity is carried by a non-electrifiable conveyer into an electric field.

According to the present invention there is provided above a badly conducting conveyer a pole or field plate the face of which rises toward both sides transversely to the direction of movement while its length corresponds to about the distance between the feeding and the discharging devices. The grains in passing through the electric field move to and fro between the conveyer and the face of the pole or field plate. As a result of the laterally curved form of the face of the pole or field plate the grains during their to and fro movements become gradually sorted out in such a manner that all grains possessing a higher permeability become removed from the zone of feed in a transverse direction to that of the movement of the conveyer, whereas all grains possessing a lower degree of permeability remain within the zone of feed. Owing to the peculiar formation of the pole or field plate each grain makes a large number of movements toward the superposed pole or field plate and back again to the conveyer band, especially when the band is traveling at a low speed. In this manner a very exact sorting of the substances is obtained, even when the commodity is composed of substances showing but a slight variation in degree of permeability.

An electrostatic separator according to the present invention is illustrated as an example in the accompanying drawings, in which:—

Figure 1 is a diagrammatic view illustrating the electrostatic field. Fig. 2 is a cross-

section on the line M—N of Fig. 3 which shows the apparatus in side elevation. Fig. 4 is a plan. Figs. 5 and 6 illustrate diagrammatically the to and fro movements of the grains between pole and conveyer.

Referring to the drawings; on a frame *e* is secured, by means of a support *l*, the upper pole piece or field plate *s*, which can be charged by suitable means, while the lower pole or field plate *t* is carried by transverse supports *p*. The face of the upper pole or field plate *s* inclines, transversely to the direction of movement of the conveyer, upwardly toward both sides. As exemplified in the construction shown, the inclined face of the pole or field plate can have a curved form although other forms may be adopted, say a shallow V-shaped form. The lower plane pole face or field plate *t* is either connected to earth as shown in Fig. 3 (by plate *t'*) or is of opposite electrification to that of the upper pole or field plate *s*.

As shown in Fig. 3 the face of the pole or field plate *s* extends above a conveyer band *b* for a distance corresponding approximately to the distance between the conveyer drums *r* and *q*. The band *b*, on being moved by the drums *r* and *q*, travels above and in close proximity to the face of the lower pole or field plate *t* and within the electric field *f*. A feed hopper *a* serves for delivering the commodity upon the conveyer band *b*. A container *d* provided with division walls receives the sorted commodity.

As shown in Figs. 1 and 2 the inclination transversely of the pole face *s*, that is to say in the present instance, the curvature, can be varied, the pole face being constituted by a thin sheet of metal carried by arms *m* capable of adjustment transversely of the apparatus. The arms *m* are held in the adjusted position by set-screws *n* (see Fig. 1). Further, the position of the pole face *s* with respect to the conveyer band *b* can be varied by raising or lowering the two ends of the pole for an equal or an unequal distance through the medium of adjusting devices. As shown the adjusting devices each comprises a handwheel *g* actuating, by means of a pair of bevel wheels *h*, a screw-threaded spindle *i* passing through a nut *k* in the pole-support *l*.

The mode of operation of the separator is

as follows:—The movement of a grain of dielectric substance carried on the conveyer band *b* in being attracted by the pole or field plate *s* in a line of force, becomes accelerated. The grain therefore strikes the face of the pole nearly at right angles with some force and is thereupon thrown back partly by reason of electric repulsion and partly owing to a rebound. The result of the repulsion is that the grain does not return to the position *x* on the conveyer band *b* from where it started, but drops on to a point *y*, at a greater distance from the longitudinal axis of the electrostatic field. As a result of the lateral deviating effect of the concussion, an impact angle is formed at *y*, to which a symmetrical rebound angle corresponds, so that the grain becomes again attracted along a more distant line of force in the electrostatic field to the pole face or field plate *s* whence it is returned to a more distant point *y*¹ on the conveyer band to be again attracted in the same manner and again returned to a still more distant point *y*² until it is finally returned to a point *y*³ for example. Of two grains, lying close together at points *x* (Fig. 6), the one possessing a greater degree of electrical permeability will return to the conveyer band at a point, for example *z*¹, at a greater distance from the axis of the electrostatic field than the point, for example *z*, to which the other grain possessing a lesser degree of permeability will return. Thus, given substances of varying permeability located in the central zone of the electrostatic field, the deviation transversely will be greatest in the case of grains possessing a higher degree of permeability, whereby the grains possessing a lower degree of permeability remain nearer the central zone, while the grains possessing permeability to a higher degree will become transferred to the adjacent outer zones.

As illustrated by dotted lines in Fig. 4 the commodity is distributed from the hopper *a* over the conveyer band so as to occupy approximately a central third portion of the width of the band. The commodity, as it travels beneath the pole face or field plate *s*, becomes gradually separated out in the manner above described, so that the grains having the lowest degree of permeability become located in the central zone *u* of the conveyer band, while the grains having a higher degree of permeability become located in the zones *v* and *w* on either side of the central zone *u*. The thick dotted lines on the left hand of Fig. 4 indicate imaginary limits of the zones while the fine dotted lines indicate the moving grains. The three divisions of the container *d* receive the grains as they leave the band from the several zones.

There are three means of suiting the effect of the process to the substances for treat-

ment. Firstly the curvature of the pole or field plate *s* can be varied while the apparatus is working; further, the speed of the conveyer band *b* can be increased or reduced according to the extent of the relative variation in degree of permeability possessed by the constituent parts of the commodity to be treated; and finally the pole face or field plate *s* can be raised or lowered parallel to, or at an angle with, the conveyer band, in order to strengthen or weaken the effect of the electrostatic field, with respect to the direction of movement, upon the grains which endeavor to remain in the central zone of the field.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. In an electrostatic separator for sorting out the constituent parts of a commodity according to their permeability a frame, conveyer drums supported by said frame, a badly conducting conveyer supported by said drums, a field plate arranged on the frame and above said conveyer, the surface of said field plate being inclined upwardly toward both sides transversely to the direction of the conveyer travel, the length of said field plate corresponding approximately to the distance between said conveyer drums.

2. In an electrostatic separator for sorting out the constituent parts of a commodity according to their permeability a frame, conveyer drums supported by said frame, a badly conducting conveyer supported by said drums, a field plate arranged on the frame and above said conveyer, the surface of said field plate being curved upwardly toward both sides transversely to the direction of the conveyer travel the length of said field plate corresponding approximately to the distance between said conveyer drums.

3. In an electrostatic separator for sorting out the constituent parts of a commodity according to their permeability a frame, conveyer drums supported by said frame, a badly conducting conveyer supported by said drums, a field plate arranged on the frame and above said conveyer, the surface of said field plate being curved upwardly toward both sides transversely to the direction of the conveyer travel, said plate being constituted by a flexible plate carried at its longitudinal edges by arms, said arms being arranged adjustably on a support extending transversely to the longitudinal axis of the apparatus, the length of said field plate corresponding approximately to the distance between said conveyer drums.

4. In an electrostatic separator for sorting out the constituent parts of a com-

modity according to their permeability a frame, conveyer drums supported by said frame, a badly conducting conveyer supported by said drums, a field plate arranged
 5 on a support above the conveyer, said support having a nut at both ends, vertical screw-threaded spindles passing through said nuts and arranged on the frame of the separator, bevel gears arranged on said
 10 spindles and meshing with other bevel gears on horizontal adjusting shafts having hand wheels, the surface of said field plate being inclined upwardly toward both sides transversely to the direction of the conveyer travel, the length of said field plate corresponding approximately to the distance between said conveyer drums.
 15 5. In an electrostatic separator for sorting out the constituent parts of a commodity according to their permeability a frame, conveyer drums supported by said frame, a badly conducting conveyer supported by said drums, a field plate arranged
 20 on a support above the conveyer, said support having a nut at both ends, vertical screw-threaded spindles passing through said nuts and arranged on the frame of the separator, bevel gears arranged on said
 25 spindles and meshing with other bevel gears on horizontal adjusting shafts having hand wheels, the surface of said field plate being curved upwardly toward both sides transversely to the direction of the conveyer travel, the length of said field plate corresponding approximately to the distance between said conveyer drums.
 30

sponding approximately to the distance between said conveyer drums. 35

6. In an electrostatic separator for sorting out the constituent parts of a commodity according to their permeability a frame, conveyer drums supported by said frame, a badly conducting conveyer supported by said drums, a field plate arranged
 40 on a support above the conveyer, said support having a nut at both ends, vertical screw-threaded spindles passing through said nuts and arranged on the frame of the separator, bevel gears arranged on said
 45 spindles and meshing with other bevel gears on horizontal adjusting shafts having hand wheels, the surface of said field plate being curved upwardly toward both sides transversely to the direction of the conveyer travel, the length of said field plate corresponding approximately to the distance between said conveyer drums, said plate being
 50 constituted by a flexible plate carried at its longitudinal edges by arms, said arms being arranged adjustably on a support extending transversely to the longitudinal axis of the apparatus. 55

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses. 60

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Witnesses:

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