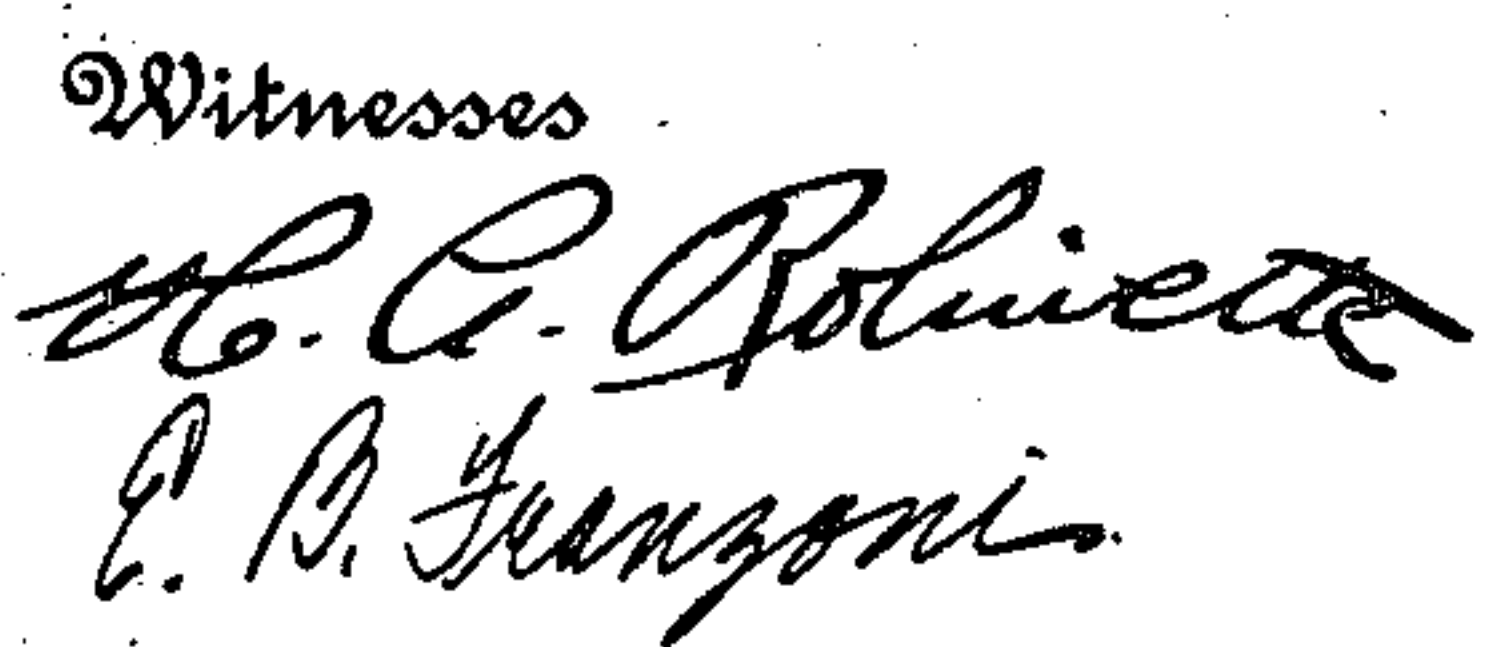


APPLICATION FILED AUG. 10, 1910.

Patented July 4, 1911.

3 SHEETS—SHEET 1.



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996,624.

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3 SHEETS—SHEET 2.

Fig. 5.

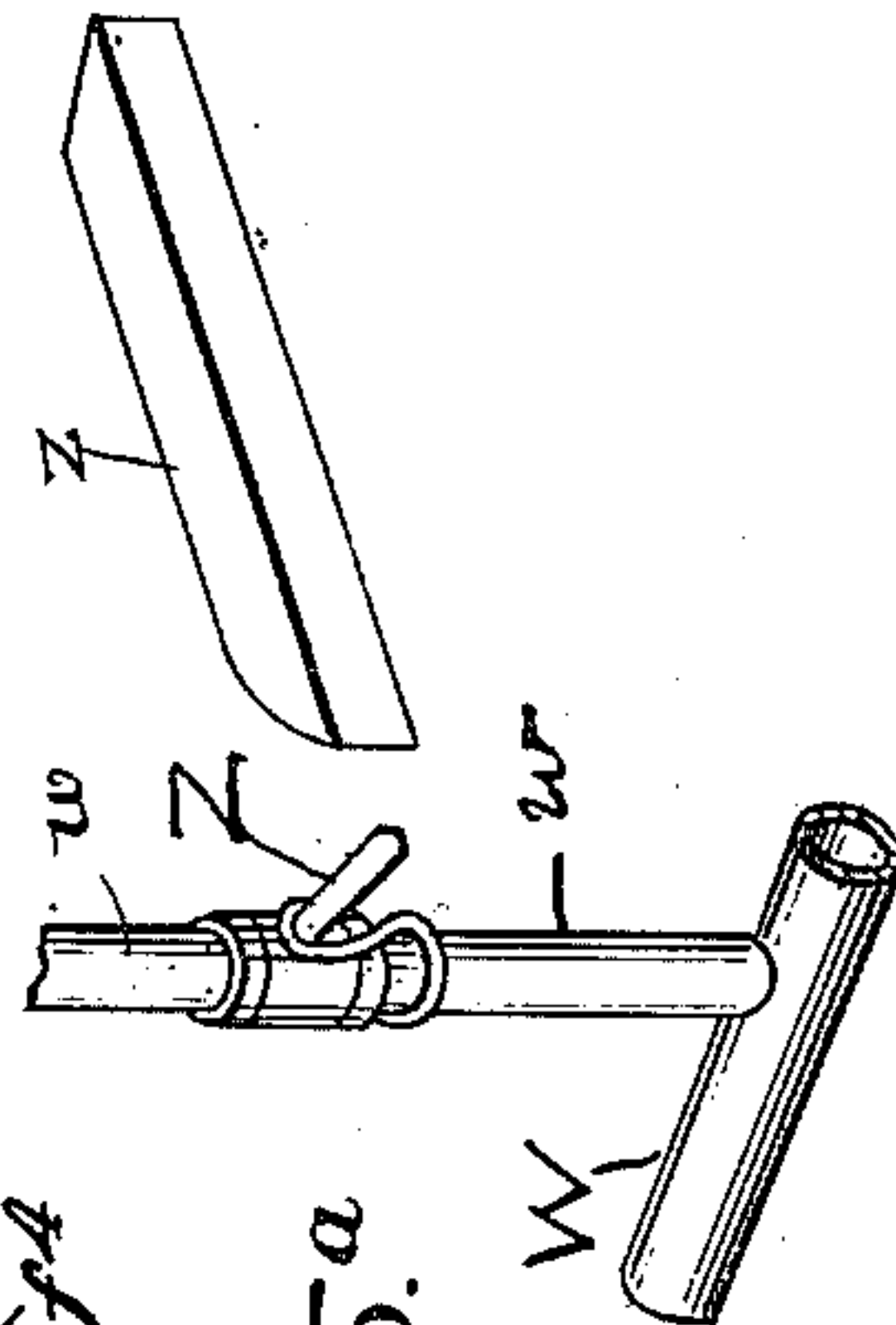
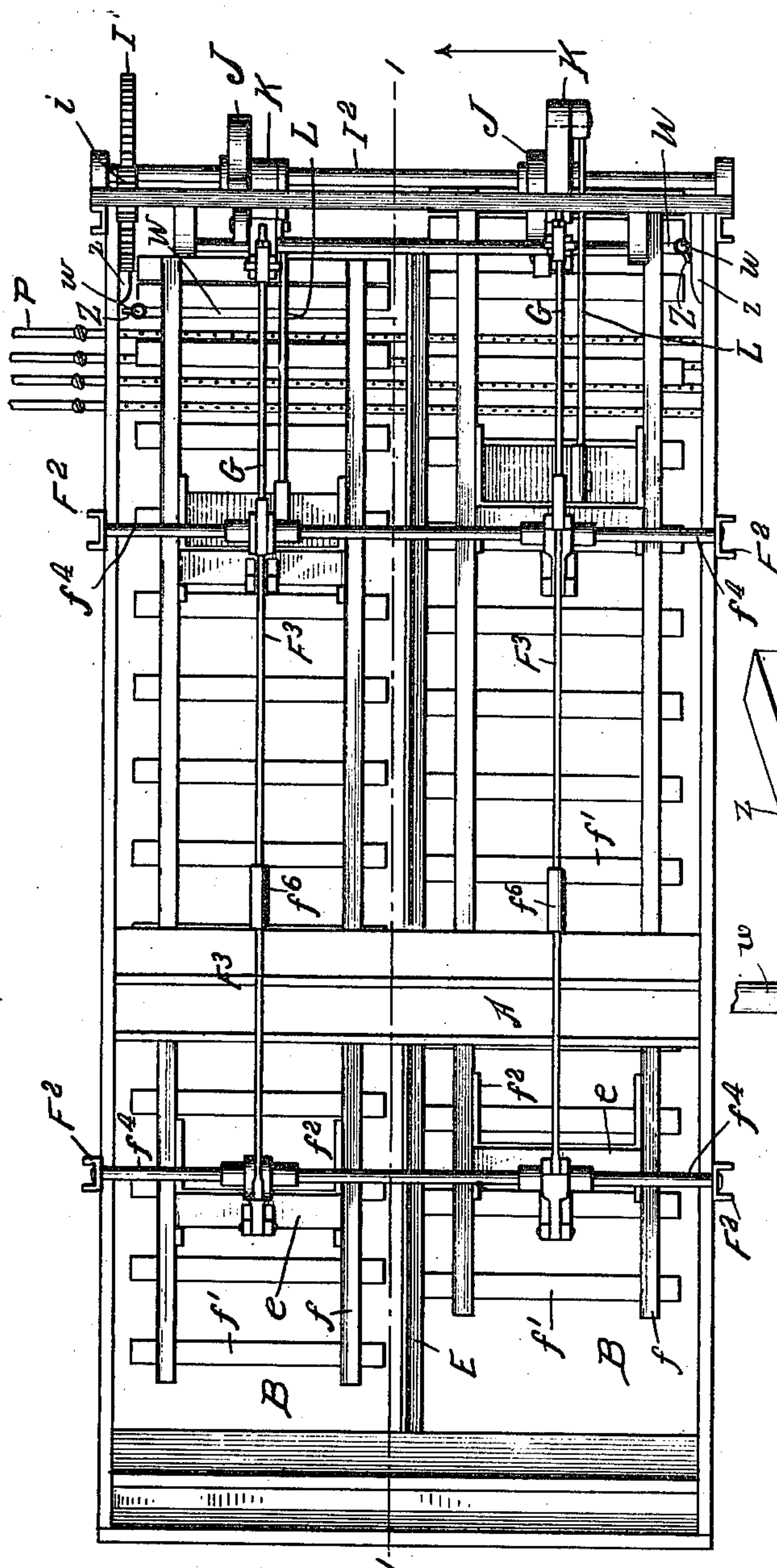


Fig. 5a.

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3 SHEETS—SHEET 3.

Fig. 6.

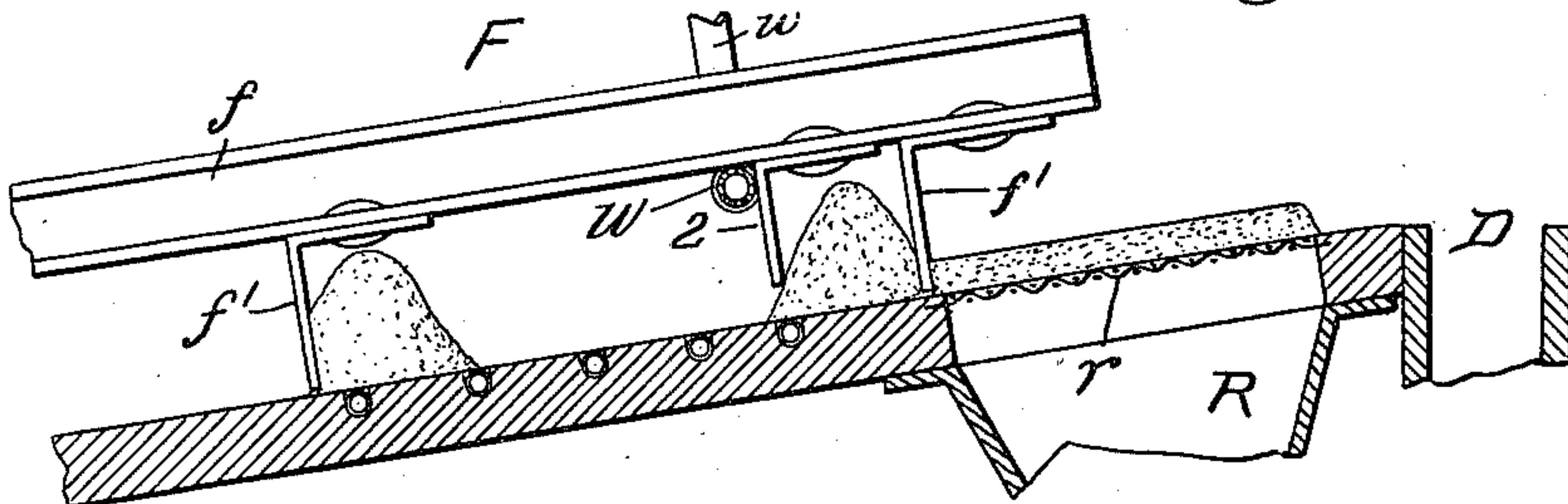


Fig. 7.

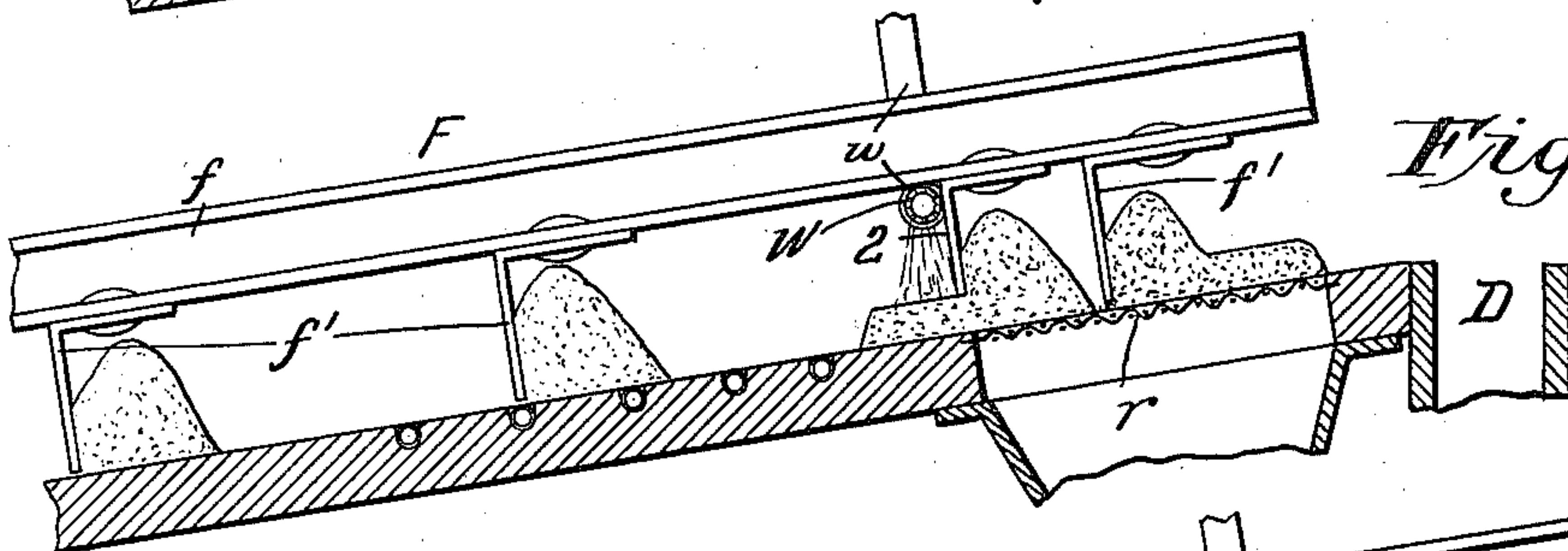


Fig. 8.

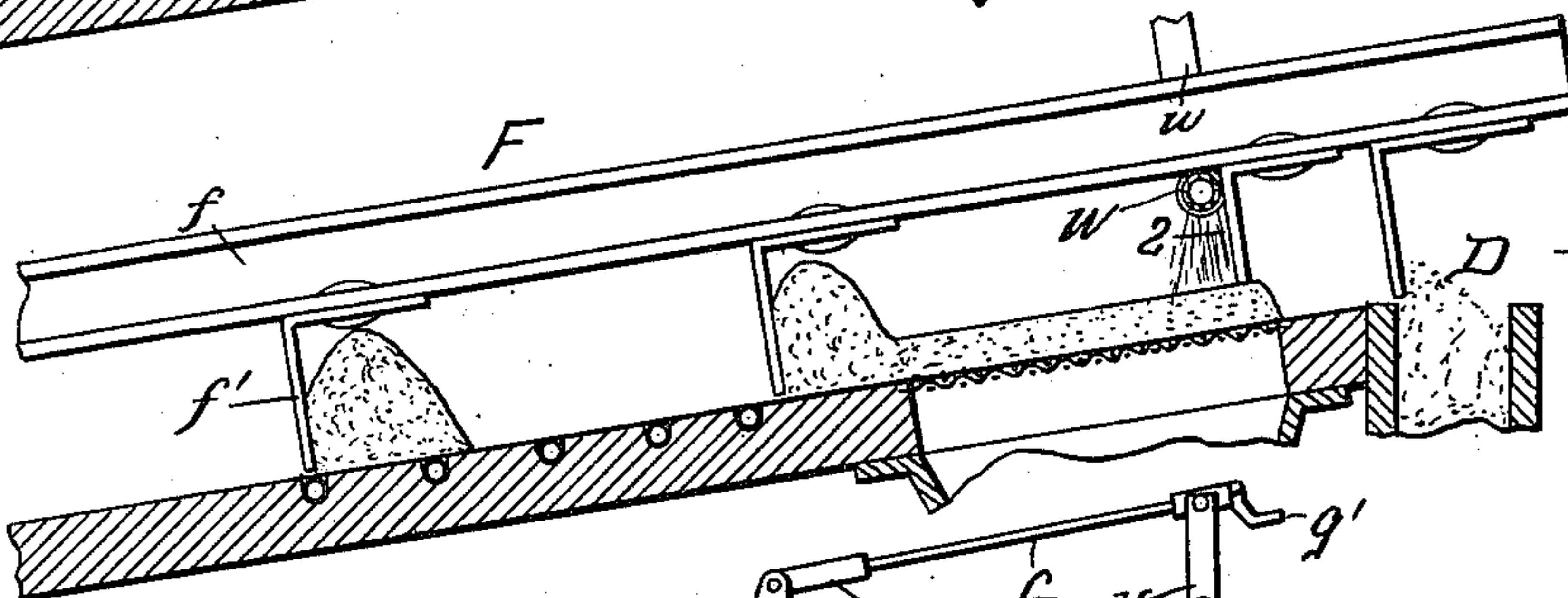
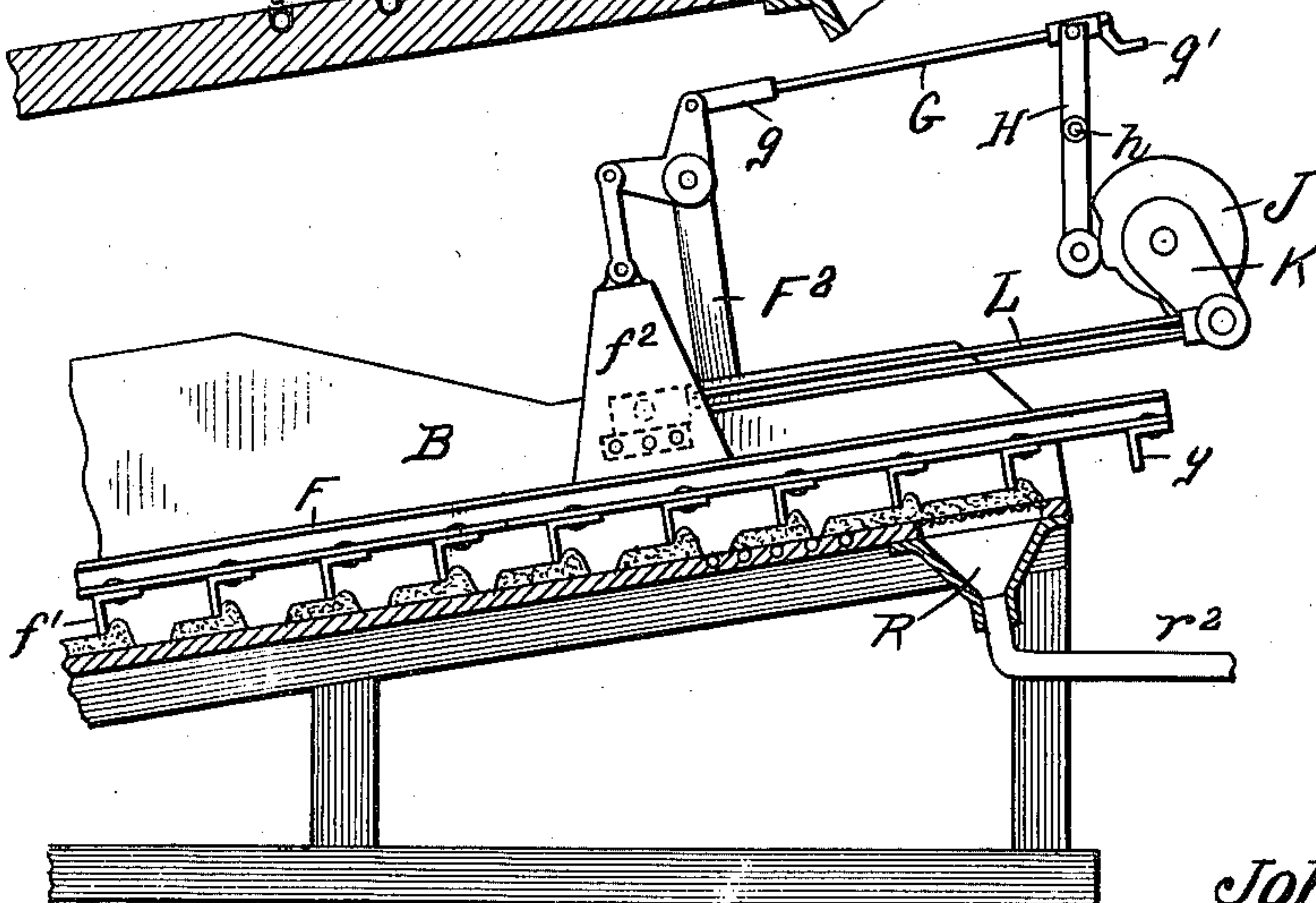


Fig. 9.



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# UNITED STATES PATENT OFFICE.

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ORE-CLASSIFIER.

996,624.

Specification of Letters Patent.

Patented July 4, 1911.

Application filed August 10, 1910. Serial No. 576,513.

*To all whom it may concern:*

Be it known that I, JOHN VAN NOSTRAND DORR, a citizen of the United States, residing in Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Ore-Classifiers, of which the following is a specification.

My present invention relates particularly to apparatus of the kind shown in my U. S. Patent No. 849,379, of April 9, 1907. This patent shows an apparatus especially designed for classifying the sands and slimes in wet crushed pulp for cyaniding, and the apparatus consists of a settling box or trough to which the wet pulp is continuously conveyed and where the sands settle to the bottom by gravity while the slimes remain in suspension in the liquid. The slimes flow over into a launder which conveys them away to a suitable receptacle removed from the classifier, while the sands are moved upwardly along the inclined bottom of the box or trough, and are delivered to another launder which conveys them to suitable receptacles. For the purpose of moving the sands out of the trough, rakes or scrapers are employed which are reciprocated back and forth above the bottom of the trough in such manner as to move the sands toward the upper end of the trough on the out-stroke but which are lifted above the plane of the sands on their in-stroke. The operation results in keeping the most of the slimes in suspension and allowing the sands to settle and to be removed from the trough by the rakes. Said patent also shows means for washing the settled sands to remove traces of slime therefrom after they emerge from the settling bath and just before their delivery to the launder which conveys them away.

While the apparatus shown in my prior patent was especially intended for operating on wet crushed pulp in cyanid processes, it is also useful in operating upon other materials. Ordinarily in the use of my patented apparatus the sand is discharged with about 6 per cent. moisture. When operating upon some materials it is desirable that this percentage of moisture should be materially reduced, to say 9 or 10 per cent., and by my present invention I am enabled to do this and thus the apparatus is made capable of operating upon a wide range of materials and part of my improvements may be employed in apparatus differing in many respects from that shown in my prior patent.

In carrying out my present invention, I preferably employ a classifying apparatus of the same general character as that shown in my prior patent, but I embody in such apparatus means for draining, drying or withdrawing moisture from the material just before its delivery. For this purpose I preferably provide a screen, grating, reticulated diaphragm, porous rock or other filtering medium at the delivery end of the apparatus and connect this with an exhaust pump. The rakes or scrapers are so operated as to spread the material operated upon over the screen to allow the moisture to be withdrawn therefrom and to then scrape the material off from the screen and allow more material to be moved upon it. The details of construction will be hereinafter fully described.

In the accompanying drawings:—Figure 1 shows a vertical section of my improved apparatus on the line 1—1 of Fig. 5. Fig. 2 is a detail view, showing how one of the scrapers may be adjusted vertically. Figs. 3 and 4 are detail views, showing another way of adjusting one of the scrapers. Fig. 5 is a plan view of the apparatus. Fig. 5<sup>a</sup> is a perspective view of the devices for spraying the material while the latter is spread over the suction box. Figs. 6, 7 and 8 are views illustrating the manner in which the material operated upon is moved along the bottom of the trough over the draining, drying or suction apparatus and discharged therefrom. Fig. 9 illustrates a modified way of operating the scrapers.

The material to be operated upon may be conveyed by a feed launder, A, to the settling box or trough, B, which is inclined as shown, the liquid level in the trough being indicated by the dotted line, *x*. A launder, C, for carrying away the slimes and a launder, D, provided with a conveyer, D', for carrying off the sands or like material, are usually employed, preferably the trough is divided into two parts by a partition, E, which is high enough merely to prevent the sands or deposited material from spreading from one part or division of the trough to the other. In each division of the trough is located a rake or scraper, F, comprising longitudinal bars, *f*, and a series of transverse plates, *f'*, attached to the bars in any suitable way. The longitudinal bars, *f*, are connected with vertical plates, *f*<sup>2</sup>, which are connected by cross pieces, *e*, in turn con-



nected by links,  $f^3$ , with bell crank levers,  $F'$ , attached to shafts,  $f^4$ , mounted on suitable standards,  $F^2$ . The vertical arms,  $f^5$ , of the bell crank levers on each side of the apparatus, are connected by rods,  $F^3$ , having adjusting devices,  $f^6$ , by means of which they may be lengthened or shortened to so adjust the rakes or scrapers that the plates,  $f'$ , will be disposed perpendicular to the bottom of the trough. On each side of the apparatus the bell crank levers are connected by a rod,  $G$ , with a lever,  $H$ , pivoted at  $h$  to the main frame of the apparatus. Each rod,  $G$ , may be provided with adjusting devices,  $g, g'$ , of well known construction whereby the distance between the vertical arm,  $f^5$ , of the upper bell crank lever and the lever,  $H$ , may be adjusted, whereby when the trough is clogged with sand the rakes may be raised to a higher plane while the sand is being raked off. The rakes or scrapers and the operating mechanism thus far described in the two divisions of the trough are the same, but the arrangement is such that as the rake or scrapers in one division of the trough moves upward or outward the rake or scrapers in the other division of the trough moves inward and downward. This arrangement is similar to that shown in my patent before-mentioned and it serves to counterbalance the weight of the moving parts and to make the overflow into the launder,  $C$ , more steady and uniform.

The rakes or scrapers are operated as follows: The belt pulley,  $I$ , may be connected with any suitable motor and this pulley operates a pinion,  $i$ , gearing with a larger spur wheel,  $I'$ , on a shaft,  $I^2$ , carrying two cams,  $J$ , which operate upon the levers,  $H$ . The shaft,  $I^2$ , also carries two cranks,  $K$ , which are connected by rods,  $L$ , with the rakes or scrapers, as shown. As the shaft,  $I^2$ , revolves, the rakes or scrapers are reciprocated in opposite directions, the cranks being suitably disposed for this purpose, while the cams,  $J$ , operate the levers,  $H$ , to cause the rakes or scrapers to be lifted above the bottom of the trough upon the backward or downward stroke so as not to touch the sands on the bottom of the trough. On the upward or outward stroke of each lever the rake teeth or scrapers engage the sands and operate upon them.

$P$  indicates the pipes of the kind shown in my prior patent, used for cleaning the settled sands after their emergence from the liquid and just before their delivery from the apparatus.

$R$  indicates what I call a suction box which is employed for the purpose of removing moisture from the sands. There is a suction box in each division of the trough. This may be constructed in various ways, but preferably it has a reticulated cover,  $r$ , arranged over a box or casing,  $r'$ , provided

with a pipe,  $r^2$ , which may be connected with an exhaust pump. The rakes or scrapers are operated to move the material over the top of the suction box and as it is thus moved over the suction box moisture is withdrawn therefrom.

It is desirable that the material should be spread out over the top of the suction box and allowed to remain in this condition for a short time, in order to obtain the best results, and to then be discharged. I have devised means by which this can be done. The simplest and best way now known to me for doing this is to make one of the scrapers or rake teeth somewhat shorter than the others. As shown the tooth marked, 2, near the upper end of the series of scrapers is considerably shorter than any of the others while the others may be of the same length or depth and the tooth No. 2 is preferably placed between the first and third teeth in the series at the upper end thereof as shown. When thus constructed the rake will operate in the manner indicated in Figs. 6, 7 and 8.

In Fig. 6 the rake is shown at the lower end of its stroke after the material has been arranged as shown by a former upward movement of a rake. It will be observed that some of the material is spread over the top of the suction box, while to the left of this the material is arranged in piles.

In Fig. 7 the rake is shown in the position it would occupy when at half stroke upward. The piles of material in the lower end of the apparatus have been moved along while the material spread over the suction box, as shown in Fig. 6, is being scraped off of it by the first tooth in the series, while tooth No. 2 is spreading out the adjacent pile of material.

In Fig. 8 the rake is shown at the end of its up stroke and the material, shown in Fig. 6 spread out over the suction box, has been discharged while the first pile of material, shown in Fig. 6 at the upper end of the apparatus, has been spread over the suction box and the next pile in the series has been moved upward. The rakes thus operate to form piles of material on the bottom of the trough, to progressively move these piles upward and outward, to spread out the material over the suction box, and to then remove it. The operation of spreading out a pile of material over the suction box and then removing it therefrom requires two outward strokes of the rake when constructed as above described. I may accomplish this in one upward or outward stroke of the rake by means of the devices shown in Fig. 9 where all of the rake teeth or scrapers are of the same length or depth, but the cam,  $J$ , is so constructed as to give to the rake a compound movement on its out stroke which is such as to first hold the teeth or scrapers close to the bot-



tom of the trough so as to form piles therein, to then raise the teeth or scrapers above the bottom and to level off the material in the manner shown in Fig. 9. The cam is also so shaped as to raise the rakes clear of the sands on the back stroke. It will be understood that the first tooth marked *y* in the series when down or close to the bottom of the trough will remove the material previously spread over the top of the suction box.

The apparatus thus organized can be made to operate continuously on material fed to the trough and to discharge it with the desired amount of moisture removed so that the delivered material shall contain a relatively small amount of moisture rendering it more easy to handle and more suitable for some subsequent treatment.

It is desirable that the short scraper or rake tooth marked 2 in the drawings shall be made vertically adjustable in order to regulate the depth of the material spread over the suction box. This may be done in various ways. In Fig. 2, the plate or scraper, *f'*, is attached to brackets, *S*, which are slotted as shown at *s* and through these slots extend bolts, *s'*, which are connected with the bars, *f*. By this means the scraper No. 2 may be given the desired vertical adjustment. In Figs. 3 and 4 another way is shown of accomplishing this result. A bracket, *T*, is secured by means of set screws, *t*, to the scraper bar, *f*, and through this bracket extends a rod, *t<sup>2</sup>*, which is threaded at its upper end where it extends through the top of the bracket and carries nuts, *t<sup>3</sup>*, by means of which the rod, *t<sup>2</sup>*, may be clamped to the bracket. Any desired vertical adjustment may be given to scraper No. 2 in this way and by means of the set screws, *t*, the scraper may be adjusted horizontally to vary its position between the two adjacent scrapers in the series. I may also employ a spray pipe, *W*, operating above the sand while it is passing over the suction box. This pipe is preferably carried by the rake, as indicated in the drawings, and may be so arranged that it will spray the sands over the suction box on the up-stroke of the rake, and devices may be employed for cutting off the supply of the liquid during the return stroke of the rake or the supply of liquid may be automatically regulated in any other suitable way. In the drawings the spray pipe, *W*, which is arranged horizontally, is connected with a vertical pipe, *w*, which extends above the top of the rake and is connected with a flexible pipe or hose, *X*, which latter is connected with any suitable source of supply. The vertical pipe, *w*, may be provided with a valve or cock, *Z*, the handle or arm of which may be made to extend into the path of a cam, *z*, shown in Figs.

1 and 5, which is so arranged as to engage the arm, *Z*, when the front end of the rake approaches and is traversing the suction box so as to supply liquid above the sands and the arrangement may be such that when the rake is raised for its return stroke, the arm, *Z*, will rise above the cam and may be automatically turned to the closed position by a spring. By the use of the top spray referred to the liquid or moisture in the sands above the suction box may be displaced by the liquid supplied by the spray pipe, *W*. In this way the sands are thoroughly washed while the suction box removes the desired amount of liquid or moisture. Preferably only enough liquid is sprayed by the pipe, *W*, as will be sufficient to replace the moisture otherwise remaining in the sands or other material operated upon.

I have shown and described a practical way in which my invention may be embodied, but my improvements may be used in connection with apparatus differing from that herein shown and described, in which materials of various kinds are separated from the liquid containing them and in which the separated material is drained or has its moisture removed in the manner before described.

I claim as my invention:—

1. The herein described apparatus, comprising a settling trough on the bottom of which material to be separated from the liquid accumulates; a moisture extractor operating below the material after its emergence from the liquid in the trough, scrapers for moving the settled material along the bottom of the trough and for progressively and intermittently moving it out of the liquid in the trough, and means outside the liquid operating in conjunction with the scrapers for spreading the material in a thin layer over the extractor and adapted to remove the material from the extractor after it has been allowed to remain at rest long enough to permit the removal of moisture therefrom.

2. The herein described apparatus, comprising a settling trough on the bottom of which the material separated from the liquid accumulates, a moisture extractor operating below the material after its emergence from the liquid in the trough, scrapers for forming piles of the settled material outside the bath, devices operating in conjunction with the scrapers for spreading out these piles of settled material in a thin layer over the moisture extractor, and means for removing this layer of material after it has been allowed to remain stationary for a time over the moisture extractor.

3. The herein described apparatus, comprising a settling trough on the bottom of which the material to be separated from the



liquid accumulates, scrapers operating to raise the material into separate piles in the trough and outside the liquid therein, and to spread the outermost pile in a thin layer, a  
5 moisture extractor in the bottom of the trough outside the liquid therein operating on the layer of material after it is thus spread, and means adapted to allow said layer to remain at rest long enough to per-  
10 mit the removal of moisture therefrom and to remove the layer after its moisture has been withdrawn.

4. The herein described apparatus, comprising a settling trough, a suction box in  
15 the bottom of the trough outside the liquid therein, scrapers for forming the settled material into piles on the bottom of the trough, and devices operating in conjunction with the scrapers for spreading the piles of material  
20 over the suction box to form layers of uniform thickness and adapted to allow said layers to remain at rest long enough to permit the removal of moisture therefrom.

5. The herein described apparatus, comprising a settling trough, and a reciprocating rake therein having transversely arranged scrapers, one of which is shallower  
25 than the others, and a suction box over which the shorter scraper operates.

30 6. The herein described apparatus, comprising a settling box, a reciprocating rake therein provided with transversely arranged scrapers or teeth, means for vertically adjusting one of said scrapers, and a suction  
35 box over which said adjustable scraper operates.

7. The herein described apparatus, comprising a settling trough, a reciprocating rake therein provided with transversely arranged scrapers or teeth, means for adjusting  
40 one of said scrapers horizontally toward and from the adjacent scrapers in the series, and a suction box over which said adjustable scraper operates.

45 8. The herein described apparatus, comprising a settling trough, scrapers for removing the material settling in the trough

and for discharging it therefrom, a pneumatic extractor in the bottom of the trough for withdrawing moisture from the material  
50 after it has emerged from the liquid in the trough, and means carried by and movable back and forth with the scrapers operating simultaneously with the moisture withdrawing means for supplying another liquid to  
55 the material while moisture is being withdrawn therefrom.

9. The herein described apparatus, comprising a settling trough, scrapers for removing the material settling in the trough  
60 and for discharging it therefrom, a suction box on the bottom of the trough outside the liquid therein over which the material is moved by the scrapers and which withdraws moisture from the material after the latter  
65 has emerged from the liquid contained in the trough, and means carried by and movable back and forth with the scrapers immediately above the suction box and operating simultaneously with said suction box  
70 for supplying another liquid to the material as fast as the original liquid is withdrawn from it.

10. The herein described apparatus, comprising a settling trough, means for removing  
75 the material settling in the trough and for discharging it therefrom, a suction box on the bottom of the trough over which the material is moved and which withdraws moisture from the material after the latter  
80 has emerged from the liquid contained in the trough, a spray pipe for spraying liquid on the material while the latter is resting over the suction box, and means operated on the out-stroke of the scrapers for automatically  
85 starting and stopping the distribution of liquid through said spray pipe.

In testimony whereof, I have hereunto subscribed my name.

JOHN VAN NOSTRAND DORR.

Witnesses:

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ANNA R. BEATTY.