C. THERYC.

SLIDING RAILWAY.

APPLICATION FILED APR. 10, 1909.

930,244. Patented Aug. 3, 1909.

3 SHEETS—SHEET 1.

Fig.1

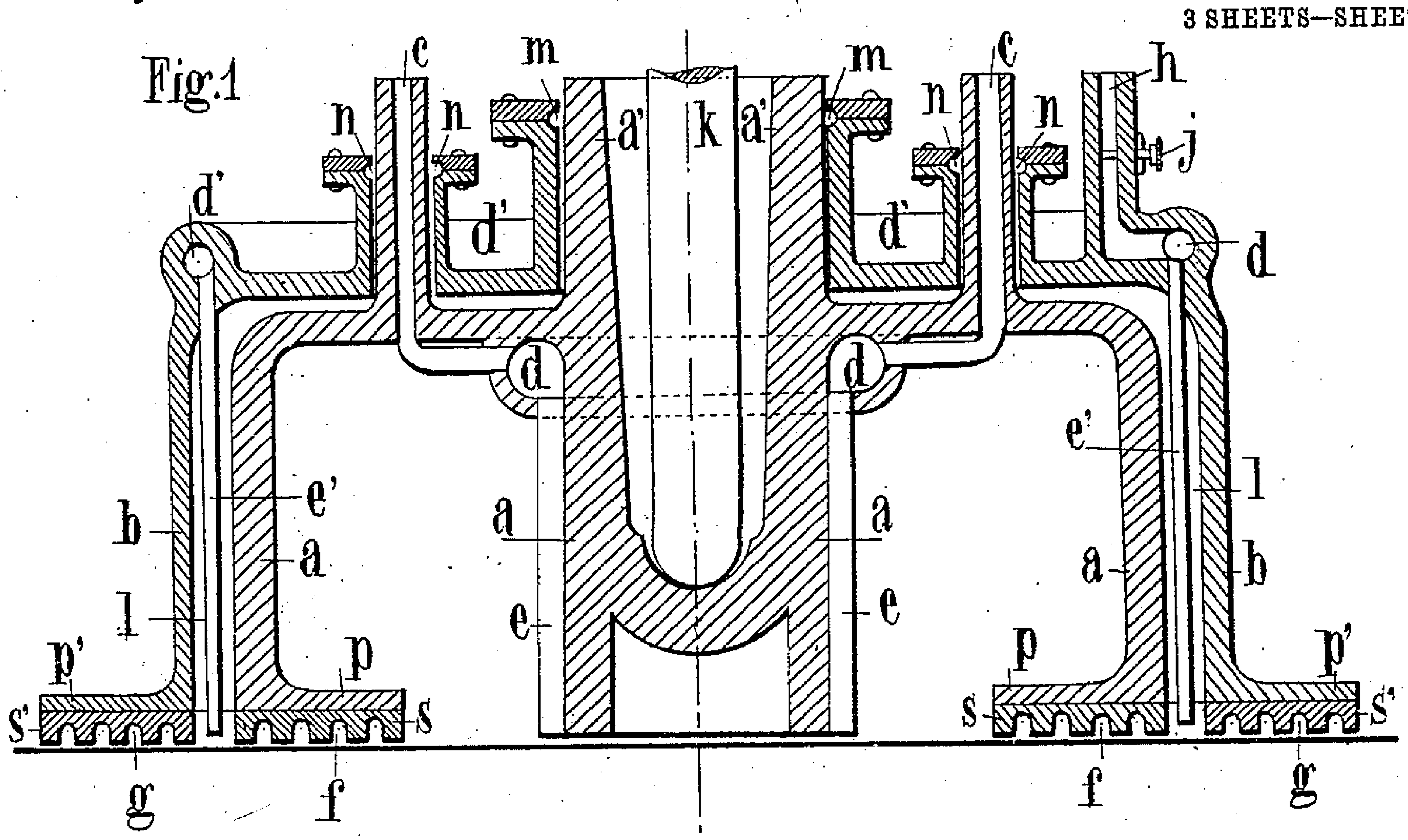
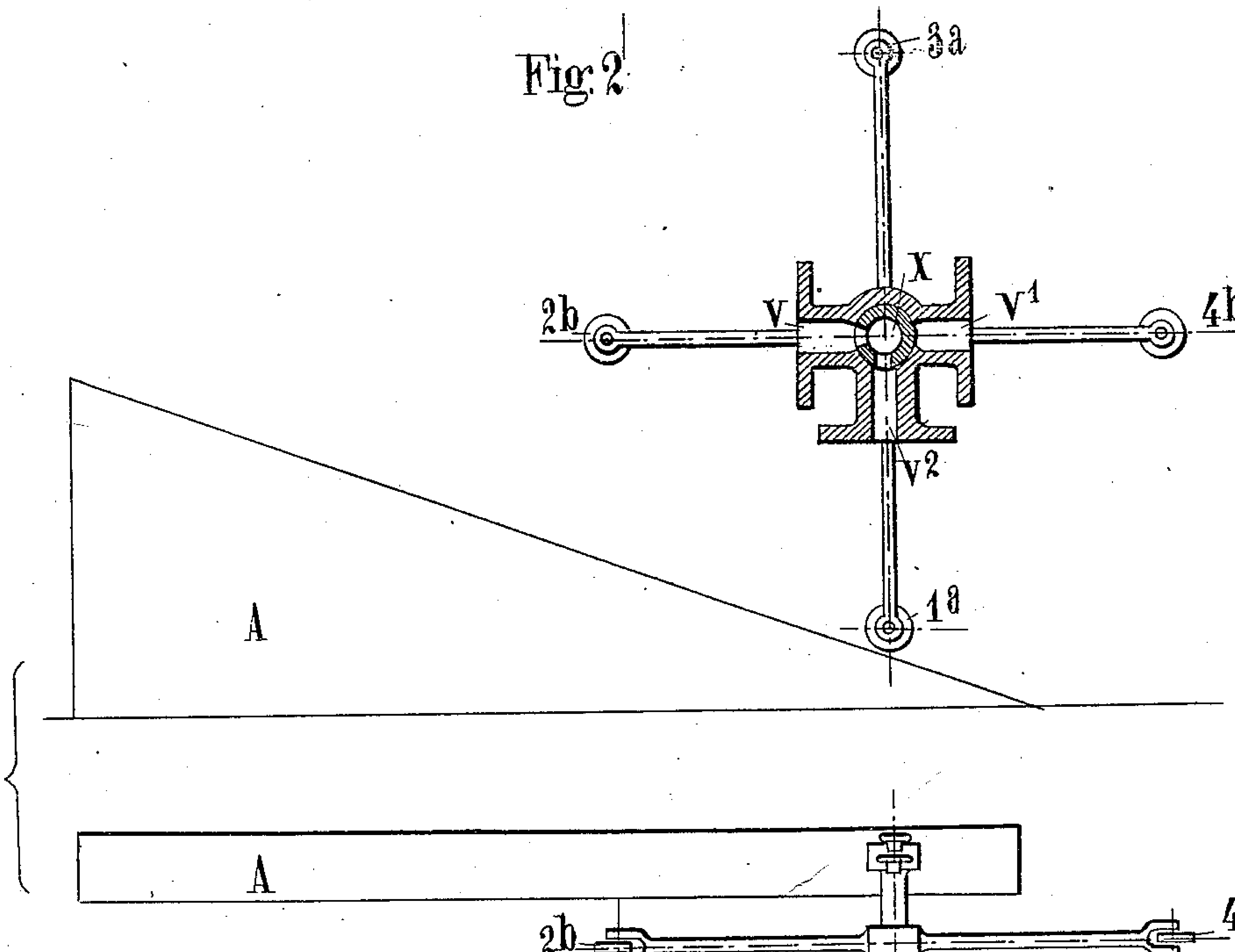


Fig. 2



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3 SHEETS—SHEET 2.

Fig. 3

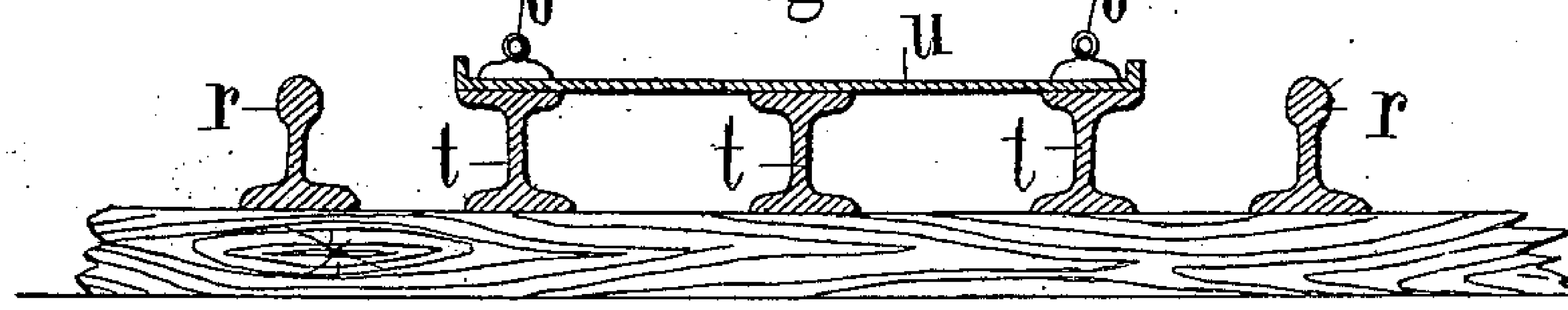


Fig. 4

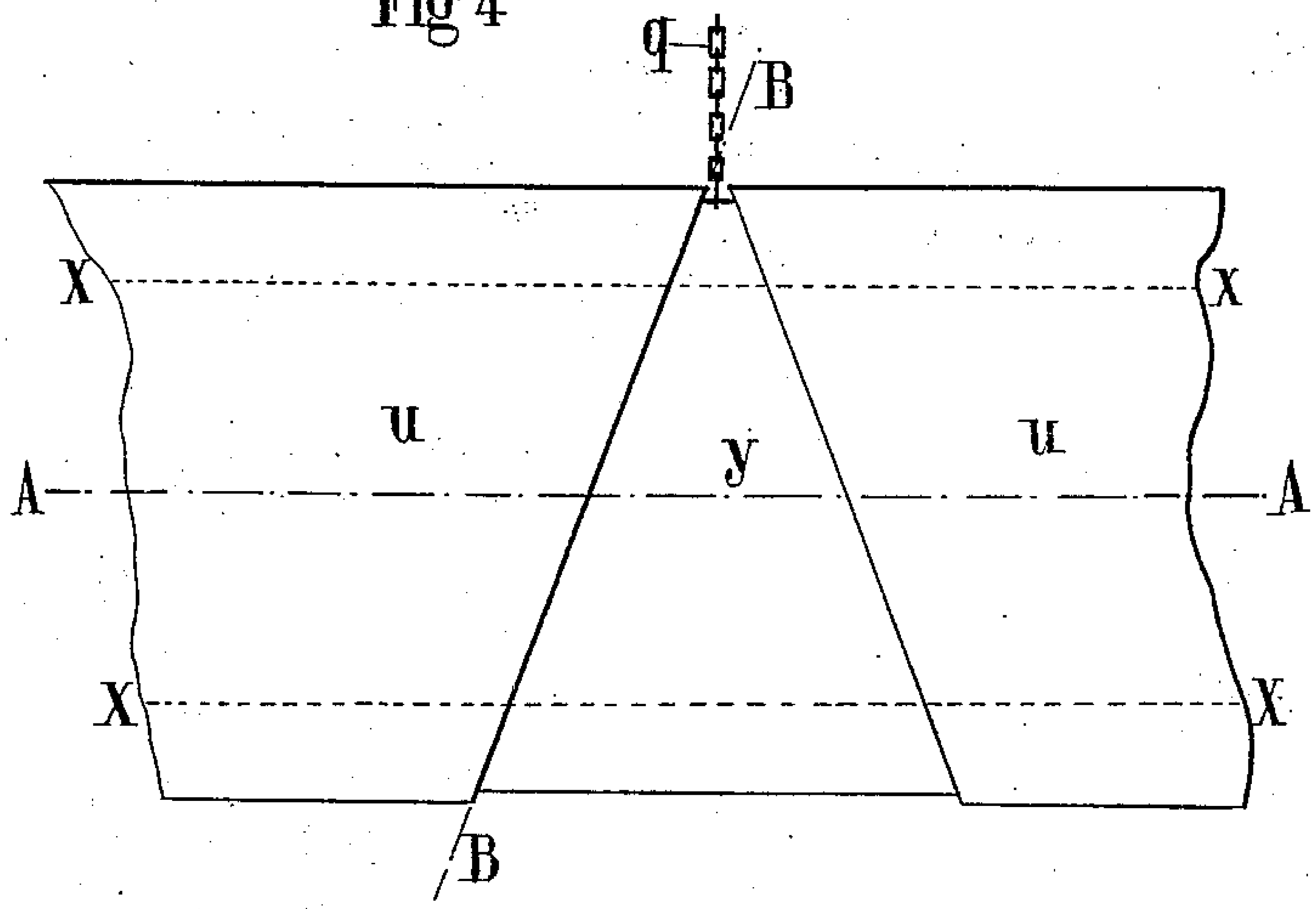


Fig. 5

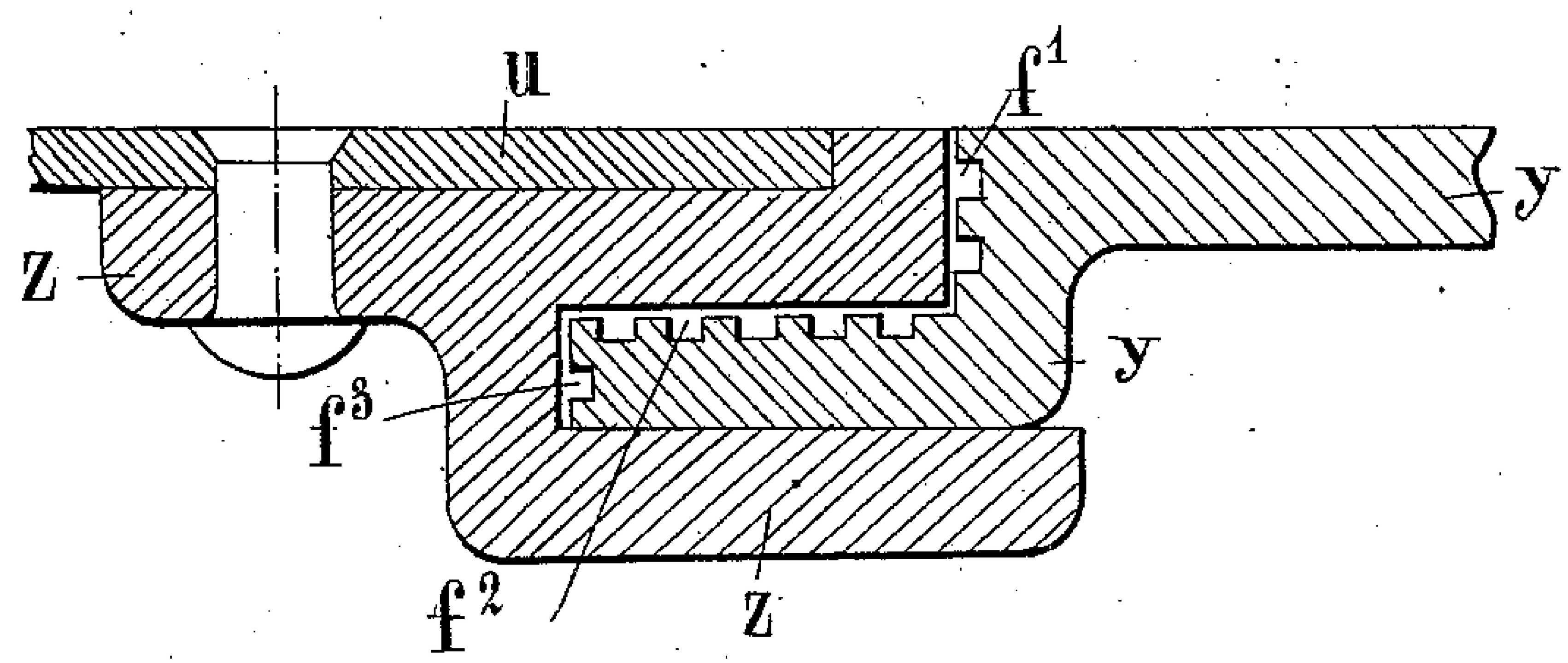
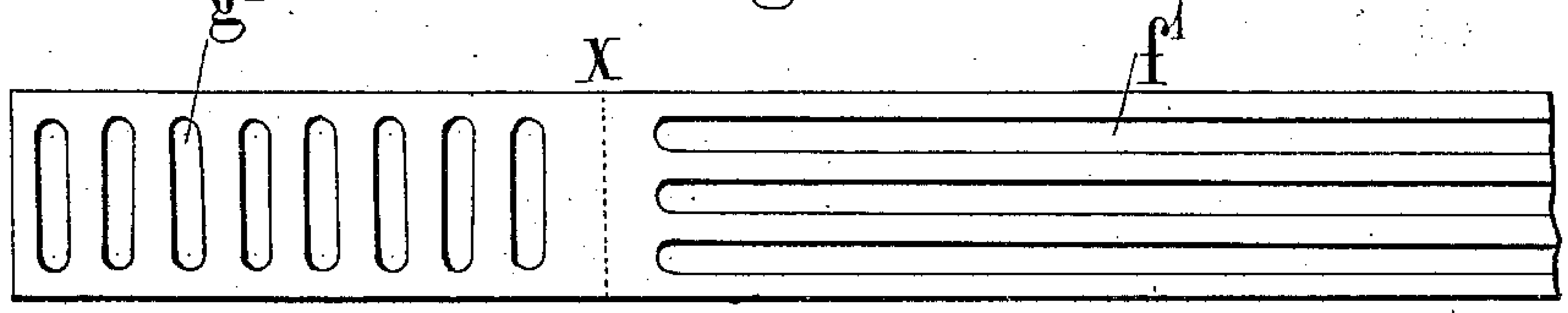


Fig. 6



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3 SHEETS—SHEET 3.

Fig: 7.

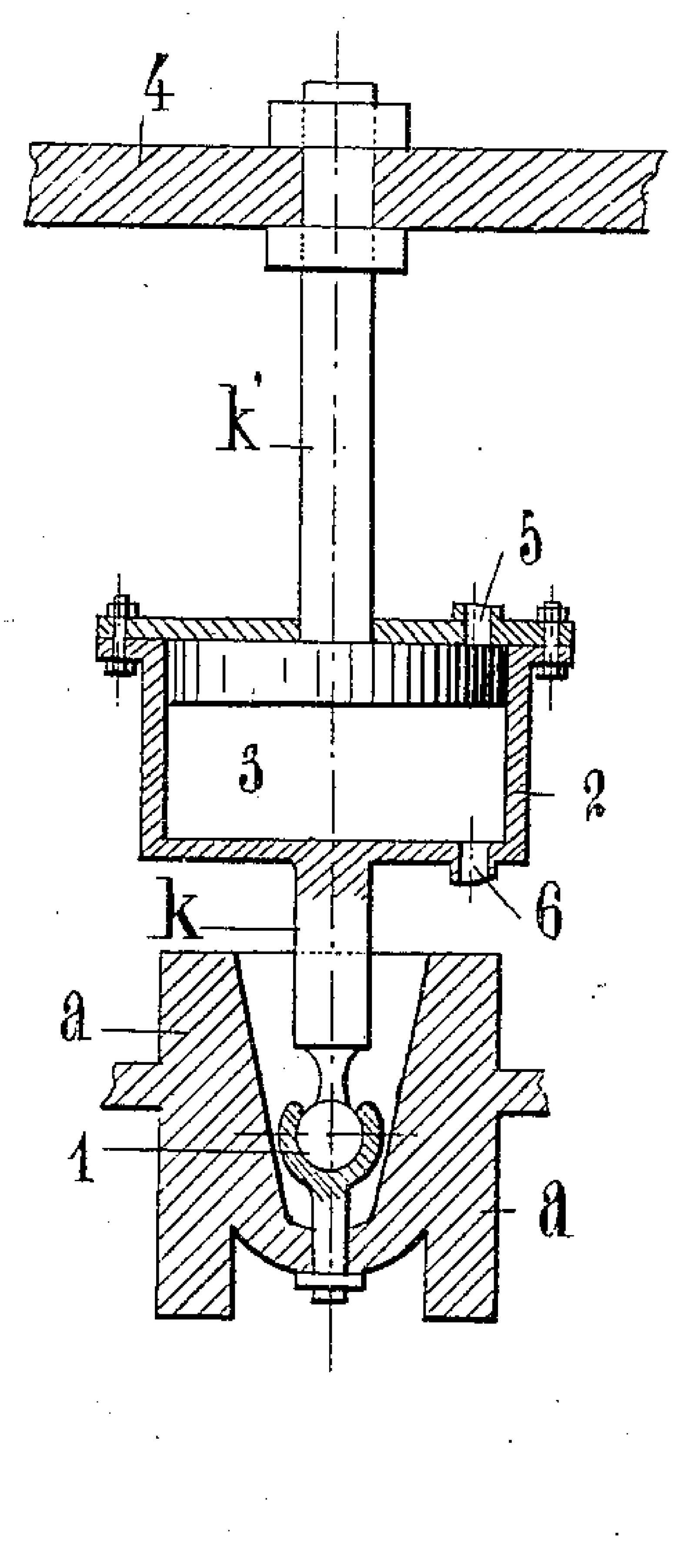


Fig. 8.

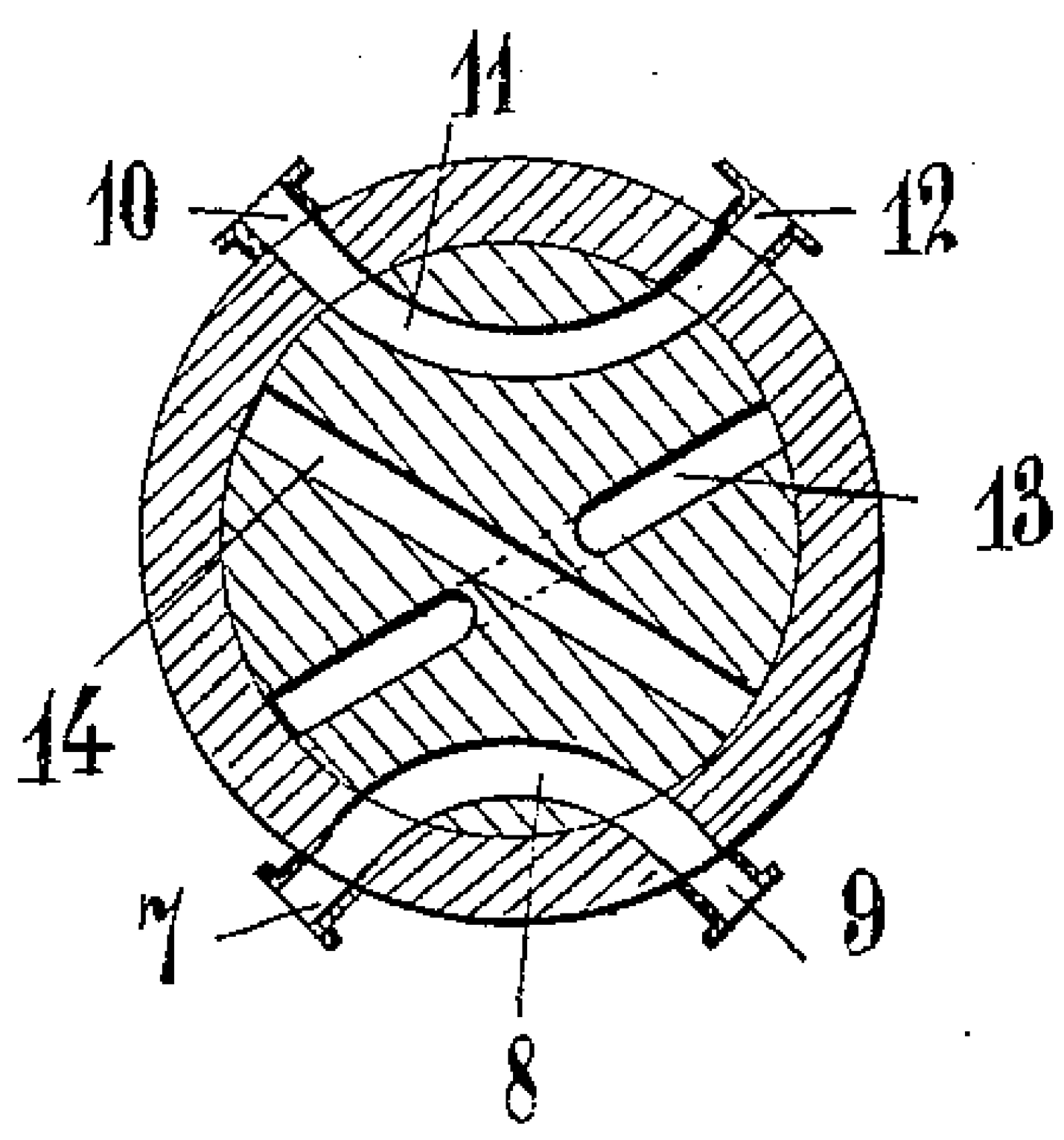
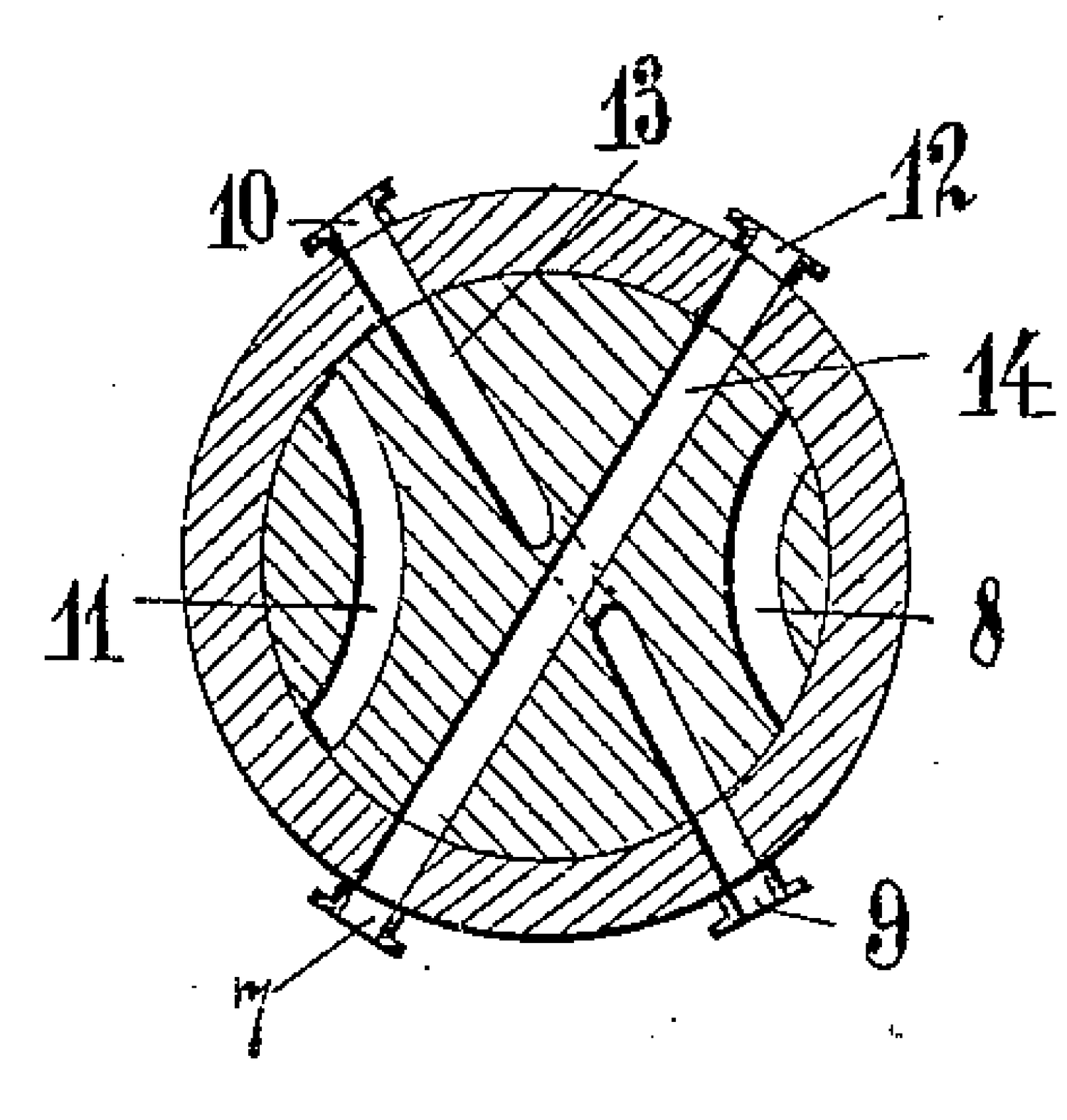


Fig. 8a



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INVENTOR

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UNITED STATES PATENT OFFICE.

CHARLES THERYC, OF MARSEILLE, FRANCE.

SLIDING RAILWAY.

No. 930,244. Specification of Letters Patent. Patented Aug. 3, 1909.

Application filed April 10, 1909. Serial No. 489,169.

To all whom it may concern:

Be it known that I, CHARLES THERYC, a citizen of the Republic of France, and resident of Marseille, France, have invented new and useful Improvements in or Relating to Sliding Railways, which improvements are fully set forth in the following specification.

This invention relates to improvements in sliding railways, the said improvements relating chiefly to a system with double slide shoes and operated either by means of air or water pressure.

Figure 1 is a vertical sectional view of a slide-shoe or slide and counter slide, Figs. 2 and 2ª show respectively a side elevation partly in section of the two-way cock, and top-view of the same, Fig. 3 shows a transverse vertical sectional view of the track, Fig. 4 is a bottom view of the platform shown in Fig. 3, Fig. 5 is an enlarged sectional view taken on the line A—A of Fig. 4, Fig. 6 is an elevation of the grooves of the rail joint at line B—B of Fig. 4, Fig. 7 is a vertical section through one of the hydraulic jacks, and Figs. 8 and 8ª are transverse sections showing different positions of the four-way cock for controlling the jack.

In the type of sliding railway of the system used at the Paris Exhibition of 1889, the slide or slide shoe used was similar to the inner slide *a p s* of Fig. 1 of the accompanying drawings, with this difference that the admission pipe for the water under pressure terminated directly at the upper part of the inner-chamber of the slide, instead of arriving there indirectly through the conduits *d e* from below. With this slide working under a pressure of 1.8 kg., it was found that the consumption of water which would have been 15 liters 117 per second with free output, was reduced to 0 liter 963, that is to say by 94%, owing to the grooves in the form of baffle plates made under the soles *s*. In spite of this reduction, it nevertheless followed that, in order to keep in suspension a ton of train during an hour, the consumption of water amounted to 3.500 liters, which made the practical application of sliding impossible for long journeys, in spite of the advantage of the great reduction to 0.500 kg. per ton and per meter to be traveled in a second of the coefficient of traction effort.

The system of double slide and the devices hereinafter described have for their object and result to render absolutely practical and applicable even to existing lines, the principle of sliding.

It consists first of all in covering the inner slide *a p s* with a cover or counter slide *b p′ s′* fitted and sliding on the cylinders *a′* and *c* and provided at *m* and *n* with a rubber ring which is found to produce sufficient obturation in view of the very small movement of the said counter slide. The function of this cover or counter slide is to recover the great portion of the water which would otherwise be lost. In fact, water escaping from the inner slide under sufficient pressure, will fill the interval *l—l* and return to the tank of the compressor through the pipes *e′ d′* and the outlet conduit *h*, if the latter were completely open, and the counter-slide would thus be dragged on the sliding platform without being raised and would be quickly worn out. But by means of the sluice valve *j* and by reducing the outlet section of the conduit *h* more or less, the volume of water returning to the tank, and the pressure required for the purpose, are regulated in a very simple manner, so as to leave under the light counter-slide only the exact pressure sufficient to raise it. To that end, the necessary pressure is adjusted and maintained by reducing the number of the grooves *f* of the inner slide, if the final pressure corresponding to its water outlet and becoming the initial pressure under the counter-slide, is too weak; or on the contrary by increasing the number of the said grooves in the event of the final pressure being too great. The entire removal of the grooves *f* of the inner slide constitutes a special feature of this invention, the said grooves being transferred as an addition under the counter-slide. The loss of water through the counter-slide, already small with a free output, in view of the low pressure required to raise it, is still further reduced in its turn by 94% by the grooves *g* of the counter-slide calculated in the same proportions as under the inner slide. The loss of water thus be-

comes insignificant and is reduced to a simple leak. This low pressure and this slight loss of water thus being adapted to be regulated and maintained stable whatever be the pressure adopted under the inner slide, the loss of water is reduced to half or a quarter, in proportion to the weight raised, if the pressure under the inner slide is doubled or quadrupled, two to four times the weight of cars thus being raised. This feature constitutes the originality and the essential characteristic feature of the invention, which obtains a result identical with that of a compression in a closed vessel provided with a thin fissure which would give rise to a small loss of fluid which could be easily compensated. The very important fact follows that the use of air instead of water, as intermediate agent of compression and sliding "bolster" becomes absolutely possible and practical, while it was heretofore practically impossible as the loss of air was so considerable that such an arrangement would have been impossible. The invention is therefore characterized by the use of air or of water in the improved double slide. In addition to the multiple advantages of this substitution of air for water, the coefficient of resistance to sliding on water is still further reduced, owing to the greater fluidity of air.

Metallic central platform.—Fig. 3 of the accompanying drawings shows a sliding line on a central metal platform, applicable either to lines under construction, or to existing lines. It comprises a thin metal plate *u*, several meters in length, resting on three sleepers or rails *t* of T iron form secured to the transverse sleepers now supporting the rail *r*. The two ends of each span of plates are connected and held securely at the same level by means of elongated lugs *o* through which a stout rod passes, or by any other suitable means. These plates are secured at given intervals in any desired manner, chiefly by means of points with autogenous welding, to outer sleepers having the shape of a T, in such manner that they can be easily unwelded for the purpose of attending to the ballast or repairing the line. The guiding of the sliding cars can be effected by means of light wheels on light axles rolling on the rails *r*, or without wheels and simply by means of rollers traveling on flanges of the two outer longitudinal iron sleepers of the T-shape. These two means can be used simultaneously for insuring greater safety.

For the application to existing railway lines, the existing cars can be utilized as traveling plant during the period of transition, by securing under their frame simply one or more sliding double runners, relieving the springs of the greater portion of the weight supported, which would change them from the heavy coefficient of rolling to the so small coefficient of sliding on water, and still smaller one on air. The application of sliding on a railway presents, however, two serious difficulties to be solved, without which its working would be practically impossible. There is first of all the considerable loss of water or air to be avoided in crossing the various rail joints required between each section of the platform for the expansion of the metal, and moreover, in passing over points.

Joining of the platform.—Fig. 4 shows a bottom view of the metal platform *u* on which the dotted lines *x x* indicate the width occupied by the double slide during its passage. The two spans showing the interval required for the expansion are cut in the shape of a triangle and connected by a metal cover *y* which can move freely in a groove or guide *z* (Fig. 5) secured to and fitted on each side of the two spans either by means of milled bolts or by autogenous welding. This joint cover is held in place by a chain *q* (Fig. 4) passing into the groove of a pulley and supporting a sufficient balance weight to enable the joint cover to move according to the action of the expansion or contraction of the metal. But, however exact may be the said joint, it would nevertheless leave an interval or crevice of a fraction of a millimeter and would constitute a considerable loss of fluid owing to the very large number of these joints and the more or less high pressures that would have to be used for raising the weights carried by the slides. In order to reduce the said loss of fluid to very infinitesimal proportions, the use has been made in this case of the grooves which complete and accentuate the process forming the fundamental basis of the system. It is, in fact, a modified form of the application of the grooves to the piston without packing for air or liquid pump.

Fig. 5 shows the grooves f' f^2 f^3 which follow the three outlines of the joint cover *y*.

Fig. 6 shows the upper lateral portion of the joint cover showing the said horizontal grooves f' made in the central portion between the dotted lines *x x* of the travel of the double slide. They are continued in the three outlines of the joint cover. Finally, in order to avoid the leakage of the fluid through the sides of the said walls, vertical grooves g' continuing also in the three outlines of the joint cover are arranged outside the lines *x x*. All these grooves result in reducing by more than 94% the natural loss of fluid in view of the possibility of arranging a greater number of the same than under the slide. The contacting surfaces of the movable joints and the guides are kept lubricated, which facilitates the sliding, prevents them from rusting and still further decreases the loss of fluid.

In passing over points, the platform necessarily leaves an interval of a few centi-

meters for the passage of the wheels on the inner side of the said points. It would lead to an enormous loss of fluid through the slides passing over the hollows in question. This difficulty has been solved in a simple, practical and automatic manner by emptying the double slides before they pass the interval, and rendering them operative again as soon as they have passed it. To that end the free work of the expansion of compressed air under the slide is utilized.

On the side of the frame of the wagons is secured a two way cock $v\ v'\ v^2$) (Fig. 2) the opening v of which is connected to a main pipe from the compressor, connected from one wagon to another by flexible unions and distributing water under pressure through the passage $v\ x\ v^2$ to each inner slide. The inlet pipe v^3 is connected by a flexible bifurcated union to tubes $c\ c$ (Fig. 1) whence the water passes into the circular groove d and arrives under the inner slide through the circular pipe e level with the platform at two or three millimeters' interval when the slide rests on it. The air contained under the empty slide, is thus compressed between the water and the cover. To the shaft controlling the plug of the cock, two handles 1^a and 3^a are secured in one and the same plane A and in the vertical direction, and two other handles 2^b and 4^b in one and the same plane B differing from the preceding one, and in the horizontal direction.

At a suitable distance in front of the hollow to be crossed, is arranged an inclined plane A which when the handle 1^a strikes it, forces the said handle back in the horizontal direction, thus closing the water inlet $v\ x\ v^2$ and opening the discharge $v^2\ x\ v'$ connected by a flexible pipe to a main pipe passing under all the wagons and terminating at the feed tank of the compressor. The air compressed between the roof of the inner slide and the water under heavy pressure, expanding immediately, will instantaneously force back the water contained under the slide through the conduits $e\ d\ c\ c\ v^2\ x\ v'$ toward the tank. Moreover a small turbine operated by the locomotive maintains a constant vacuum in order to assist by suction the expulsion of water effected by the expansion of the air. The emptying of the counter-slide takes place at the same time and in the same manner, with the same devices, by means of a similar cock secured at the other edge of the frame of the wagon, the inlet v being done away with as useless and the said cock having only one single way $v^2\ x\ v'$ connected at v^2 to the conduit h and at v' to the return conduit from the tank, into which the water is forced back through the tubes $e'\ d'$. This apparatus working in accordance with that previously described, the double slide falls back on the line and passes empty over the hollow formed between the platform and the crossing rail, with an insignificant loss of water represented by a layer of $\frac{2}{3}$ mm. thickness which escaped during the forcing back. As soon as the hollow has been crossed, the handle 2^b, already brought back in the vertical direction by the first quarter of a turn, is forced back in the horizontal direction by an inclined stop arranged in the plane B; immediately afterward a plane A forces back the handle 3^a and finally a second stop arranged in the plane B forces back the handle 4^b, thus bringing back the cock and its way v^2 into their normal position. The immediate admission of water under pressure again raises the inner slide which resumes its operation, the counter skate having been simultaneously operated in the same manner.

Instead of a central platform two metal platforms of a smaller width can be used. It would be possible also to use in certain cases a concrete reinforced cement or brickwork platform covered with a layer of asphalt, or without it. The traction of the sliding trains is effected by locomotives or any other tractors, preferably electric ones.

According to this invention the double slides may be applied under the tractors or locomotives, in order to lighten the springs of a great portion of the weight thereon so that the economical sliding working would be utilized up to the limit required for preserving a sufficient adhesion of the wheels to the rails for pulling a sliding train.

A further feature of the invention consists in reducing or suppressing this lightening of the springs by any suitable means, such as a system of hydraulic jacks (Fig. 7). The supporting rod connecting the inner slide to the frame of the tractor, is constituted of two distinct parts. The lower part k is movable in every direction in a ball and socket joint 1 secured to the bottom of the bracket of the slide $a\ a$ of Fig. 1, and terminates at the top in the cylinder 2. The upper portion k' secured under the frame of the tractor 4, terminates at the bottom in a piston 3 sliding in the cylinder 2 of dimensions and area suitable to the pressures used.

The openings 5 and 6 of the cylinder are connected by flexible tubes to a compressor, and the driver can compress the slide on the sliding platform at will and altogether by admitting the fluid under any suitable pressure below the piston by opening the opening 6, or raise the slide completely and keep it in suspension by sending the fluid in question through the opening 5 above the piston. He can also regulate in a very exact and in a more or less accentuated manner, the raising or the lightening of the springs by leaving in the upper portion of the cylinders the exact amount of fluid required, and in that way graduate the charge supported by the wheels, and their adhesion to the rails, ac-

cording to the gradients, and in such manner as to limit the weight of tractor strictly to the necessary quantity remaining submitted to the heavy coefficient of ordinary traction.

A further feature of the invention consists in applying this system to carriages, so as to raise the slides automatically and instantaneously after emptying them and to resume the ordinary wheel transit on the rails instantaneously in passing the points or stations. To that end, on the side of the frame, and a little behind the cock v v^1 v^2 (Fig. 2) is arranged a similar four way cock shown in Fig. 8. The piston of Fig. 7 being at the top of its travel in normal working, the fluid under pressure contained in the bottom portion of the cylinder, enters through the opening 6 connected by the conduit 7 8 9 to a main conduit supplying the said fluid from the compressor. The upper portion of the cylinder is connected by the opening 5 to the conduit 10 11 12 connected to a main conduit terminating at the closed feed tank of the same compressor. The spindle controlling the plug of the said cock, is provided with the same handles as the preceding cock, and they are operated by the same inclined plane A of Fig. 2, acting instantaneously after the emptying of the slide. As soon as the first handle of this cock is forced back by the first stop of the plane A, the plug making a quarter of a revolution, the conduits or pipes 13 and 14 which intersect in the center in turning around each other, assume the positions shown in Fig. 8^a. The bottom portion of the cylinder becomes emptied at once, the fluid escaping through the pipes 6, 7, 14, 12 toward the tank of the compressor, while the fluid under pressure coming from the compressor, goes through the pipes 9, 13, 10, 5 above the piston 3 raising the cylinder and the slide which thus remains suspended at a height calculated to release the springs of the wagon. The frame is thus lowered with all its weight on the springs, and the wheels resume the ordinary engagement with the rails. In the second and third quarters of the revolution, the four ways move without outlet and without modifying the position until the fourth turn brings back the two cocks into their normal position, so that their sliding movement is resumed. In order to deaden the shocks due to the forcing back of the piston, the upper and the bottom surfaces of the cylinder are provided with rubber washers of suitable thickness and if necessary Belleville washers or other kinds of springs are added to them.

Another feature of the invention consists in replacing the wheels of the locomotives or tractors by rollers with their point of support on the platform and in that case, the guiding could be effected by means of rollers travelling on the flanges of the two outer T-shaped iron sleepers t (Fig. 3) which could enable the rails r to be done away with.

A further important feature of the invention consists in doing away with the grooves of the inner slide completely subject to their being transferred if desired to the sole s' of the counter slide.

Other features consist: in covering the counter slide with one or more similar slides; in bringing about and regulating the raising of the counter slide in a different manner than by the pressure of the fluid used, and by any suitable means, namely by means of springs or balance weights or rollers travelling on the sliding platform; in providing the circumference of the counter slide with a solid or hollow rubber tube, or with a rubber band or with a thin metal blade or with a brush of any other flexible material.

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

1. In a sliding railway, an inner slide, means to force a liquid under the slide, a counter slide covering the inner slide, and means for extracting the fluid from between the slides.

2. In a sliding railway, an inner slide provided with an internal chamber open at the bottom, and means for forcing a fluid into said chamber near the bottom thereof.

3. In a sliding railway, an inner slide provided with an internal chamber open at the bottom, means for forcing a fluid into said chamber near the bottom thereof, a counter-slide covering said inner slide, and means for extracting the fluid from the space between said slides.

4. In a sliding railway, an inner slide provided with an internal chamber open at the bottom, means for forcing a fluid into said chamber near the bottom thereof, a counter-slide covering said inner slide, and means for extracting the fluid from the space between said slides, the lower edge of both of said slides being provided with grooved faces.

5. In a sliding railway, an inner slide provided with an internal chamber open at the bottom, means for forcing a fluid into said chamber near the bottom thereof, a counter-slide movable vertically with respect to said inner slide, and means for extracting said fluid from the space between said slides.

6. In a sliding railway, a metal platform having V-shaped cut away spaces, and V-shaped covers fitted into said spaces.

7. In a sliding railway, a metal platform, having V-shaped cut away spaces, V-shaped joint covers fitting in said cut away spaces, and means for yieldably pressing said covers into said spaces.

8. In a sliding railway, an inner slide pro-

vided with an internal chamber open at the bottom, means for forcing a fluid into said chamber near the bottom thereof, and means for automatically stopping the inward flow of said fluid.

9. In a sliding railway, a hydraulic jack adapted to be secured at its upper end to a railway carriage, having at its lower end a flexible joint adapted to secure said lower end, means to supply fluid into said jack, and means for intermittently restricting the pressure of said fluid.

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

CHARLES THERYC.

Witnesses:
PAUL H. CRAM,
KENNETH STUART PATTON.