

(No Model.)

M. A. DE PALACIO.
AERIAL RAILWAY.

2 Sheets—Sheet 1.

No. 602,239.

Patented Apr. 12, 1898.

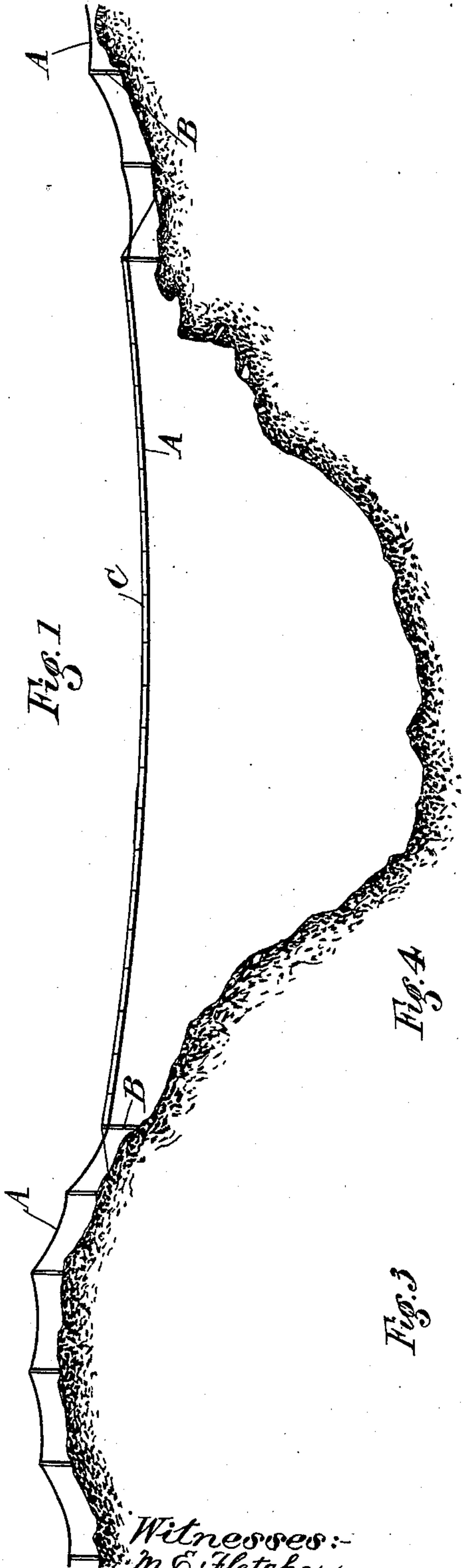


Fig. 1

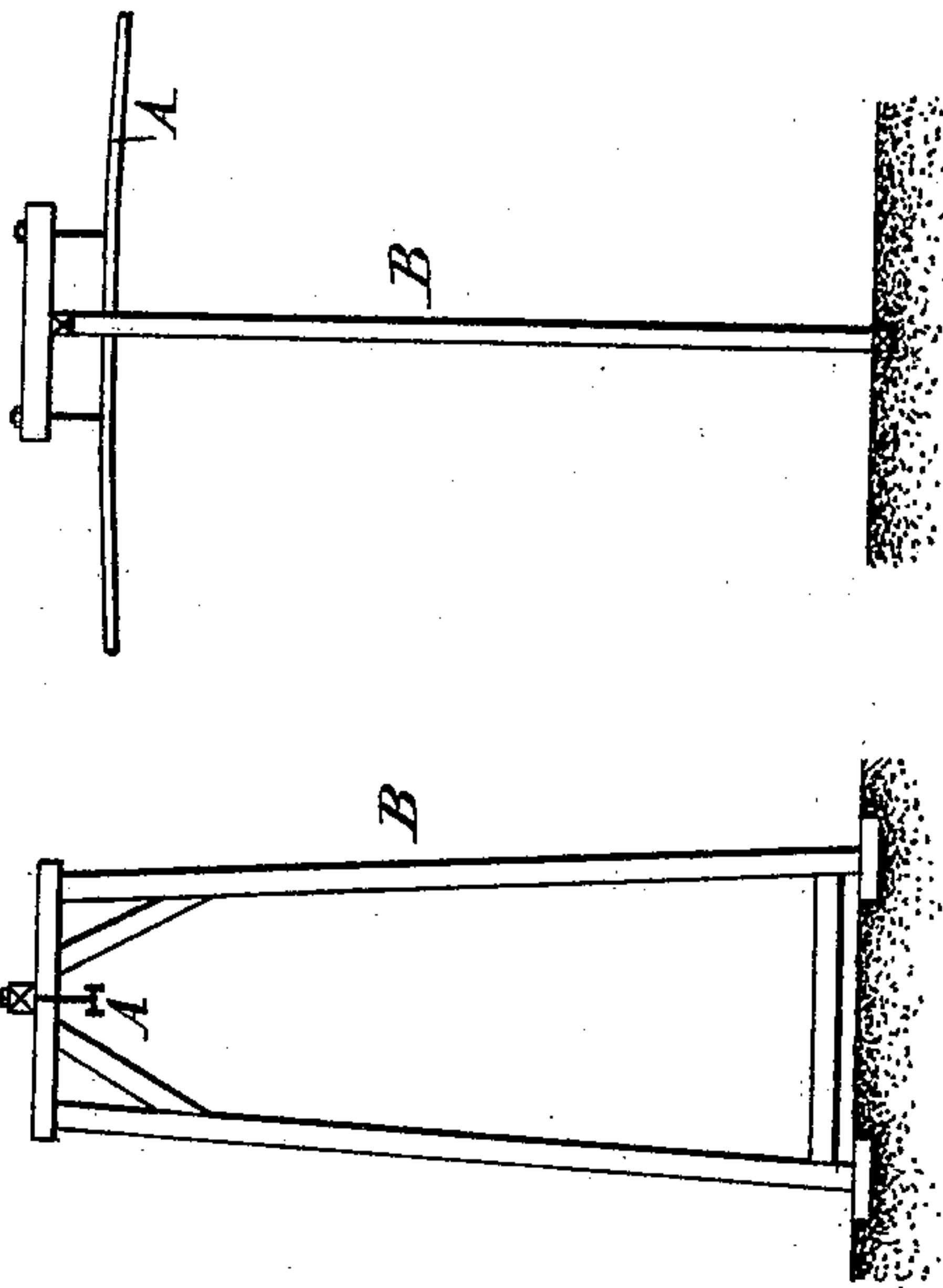


Fig. 3

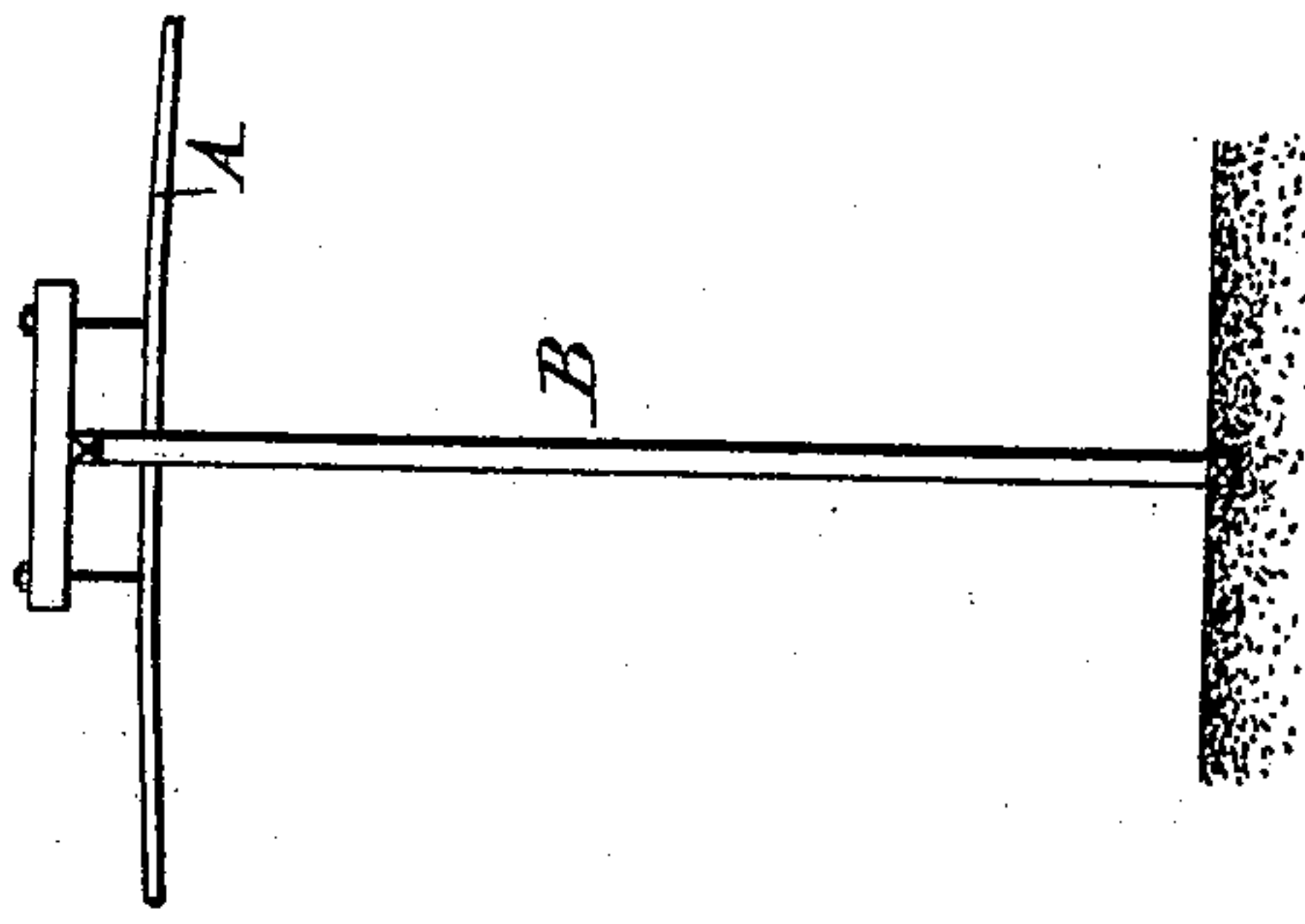


Fig. 4

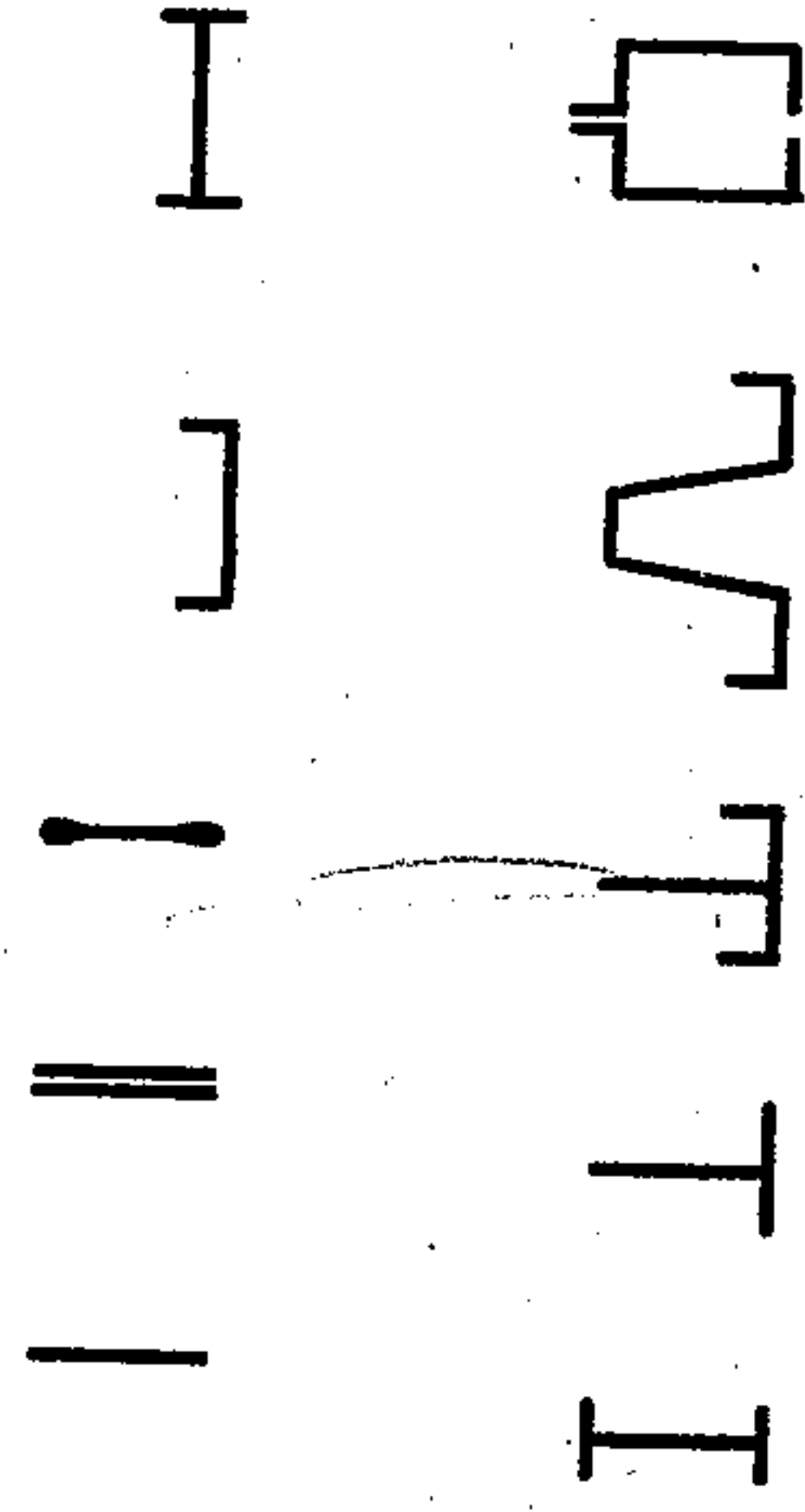


Fig. 2

Witnesses:-
M. C. Fletcher.
Edward Wieser.

Inventor:
MARTIN ALBERTO DE PALACIO
By attorneys
Pronot Veward

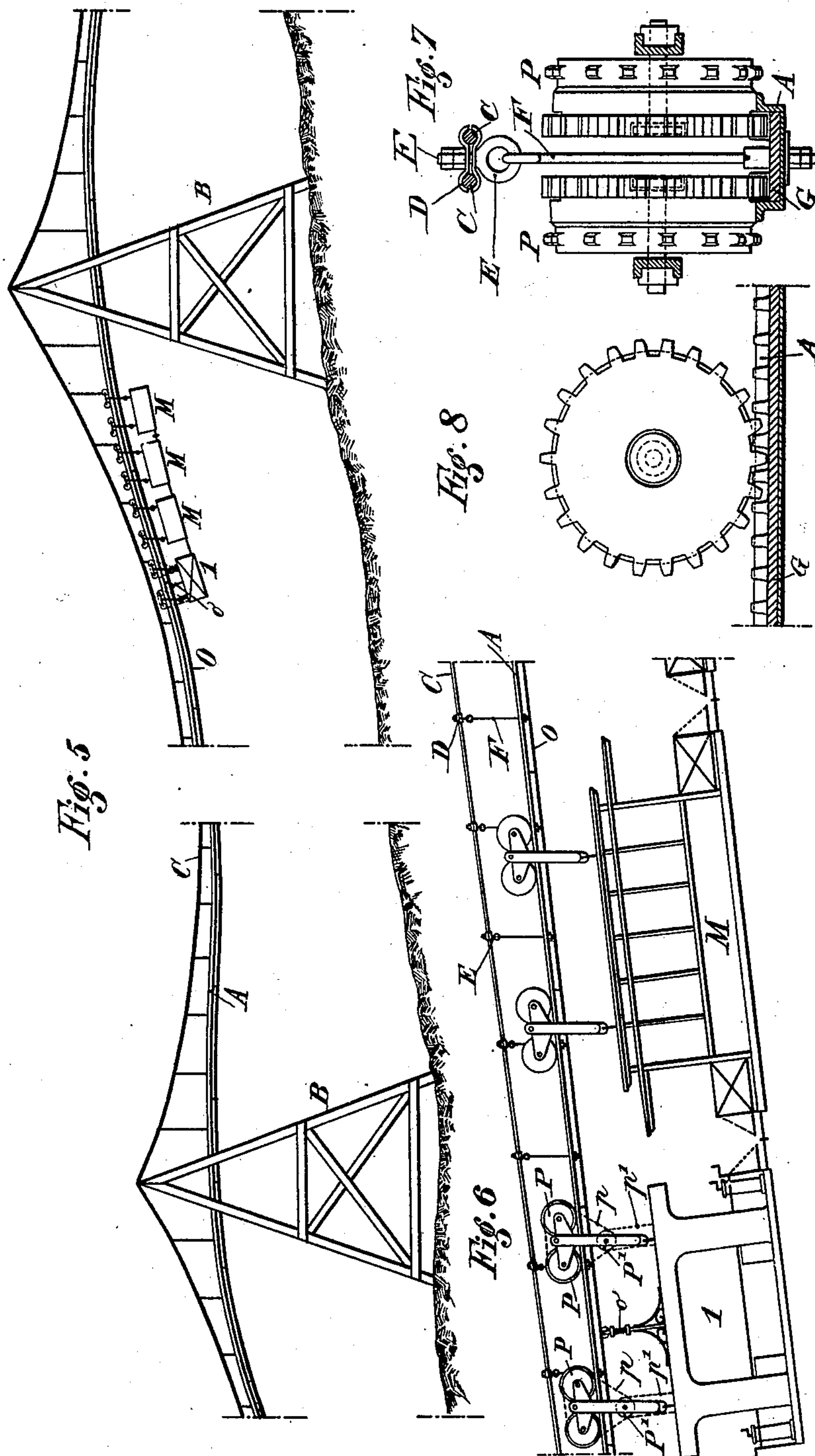
(No Model.)

2 Sheets—Sheet 2.

M. A. DE PALACIO.
AERIAL RAILWAY.

No. 602,239.

Patented Apr. 12, 1898.



Witnesses:-
M. E. Fletcher.
Edward Vieder.

Inventor:
Martin Alberto de Palacio
By attorneys
Brown & Howard

UNITED STATES PATENT OFFICE.

MARTIN ALBERTO DE PALACIO, OF MADRID, SPAIN.

AERIAL RAILWAY.

SPECIFICATION forming part of Letters Patent No. 602,239, dated April 12, 1898.

Application filed December 20, 1897. Serial No. 662,530. (No model.) Patented in Spain July 6, 1895, No. 17,485; in France August 22, 1895, No. 249,812; in Belgium August 22, 1895, No. 117,108; in Switzerland August 22, 1895, No. 10,987; in Germany August 26, 1895, No. 91,356, and in Sweden September 19, 1895, No. 8,056.

To all whom it may concern:

Be it known that I, MARTIN ALBERTO DE PALACIO, of Michel Angel, Madrid, Spain, have invented a new and useful Improvement in Aerial Railways, of which the following is a specification, and for which patents have been obtained in France, No. 249,812, dated August 22, 1895; in Belgium, No. 117,108, dated August 22, 1895; in Germany, No. 91,356, dated August 26, 1895; in Switzerland, No. 10,987, dated August 22, 1895; in Spain, No. 17,485, dated July 6, 1895, and in Sweden, No. 8,056, dated September 19, 1895.

This improvement consists in the combinations of rails and suspension-cables therefor, supports for said cables and rails, means for suspending the cars from said rails, and means for driving the suspended cars, hereinafter described and claimed, whereby I obtain an aerial railway of very simple and inexpensive construction and capable of being maintained and operated economically.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 represents a side view of an aerial railway embodying my invention. Fig. 2 represents a transverse sectional view of different types of bars which may be employed for the rails. Figs. 3 and 4 represent, respectively, a face view and a side view of one of the supporting-pillars of the railway. Fig. 5 represents a side view of a portion of the railway with a train running upon it. Fig. 6 is a side view, on a larger scale than Fig. 5, of a portion of the railway and the train. Fig. 7 represents a transverse section of the railway on a still larger scale, and Fig. 8 a longitudinal section.

A designates the "way," properly so called, constituted by a line of rigid rails, spliced end to end.

B designates the supporting-pillars, and C the suspension-cables which I employ to assist in supporting the way when the spacing of the pillars is very considerable or when special circumstances require that the undulations of the line should not be too pronounced.

Fig. 1 shows how the several chains formed by the line of rails between the supports are

joined end to end to constitute together a rigid undulating and continuous metal way or track.

The rails, spliced end to end, which compose the way or track, may be of any transverse sectional form. Fig. 2 shows several forms which may be employed. The form of the supporting-pillars may naturally be varied considerably. It depends notably on the nature of the ground and its inclination.

The pillars should in all cases support the vertical pressure due, first, to the weight of the line itself; second, to the vertical pressure of the tensions to which the line is subject; third, to the rolling load, and, fourth, to the effects of winds and other accidental influences. The said pillars may have great variety of form, according to circumstances. I have represented as an example in Figs. 3 and 4 a simple pillar which supports a line set up on horizontal ground. It may be seen that this pillar is capable of oscillating about its base in the direction of the length of the track in order to equalize automatically the differences of tensions between the sections of the track situated on one side and the other.

As to the mode of suspension of the track from the pillars it may be varied according to the transverse sectional form adapted for the rails, Figs. 3 and 4 showing an example of it.

I have stated that in certain cases it was desirable and even indispensable to suspend the track by suspension-cables C. Figs. 6 and 7 show a mode of suspension which may then be employed with advantage.

It may be seen that at suitable points in their length the suspension-cables are clamped between two iron or steel plates D, in which are secured eyebolts E, to which are hooked by their upper extremities suspension-rods F, which are attached at their lower extremities to the track A. This construction permits the track to be inclined and to so oscillate transversely as to yield to the action exercised by the wind upon the track and upon the rolling load. When this system of railway is only employed for light traffic, the traction of the vehicles which are to run upon it may be effected, as in other cases, by means

of an endless traction-cable, which has a constant motion imparted to it and to which the vehicles are attached when it is desired to run them; but this mode of traction will not be practicable when the traffic is heavier and the length of the line is considerable. In this case it is necessary to provide for the running on the track of real trains independent of each other, and consequently each furnished with its own motor. That would not present any difficulty if the track were horizontal; but it is not so in this track, which comprises a series of more or less pronounced upward and downward slopes. This necessitates the use for my suspended railway of a mode of traction which forms an indispensable complement to it. In order to carry out this, I employ to constitute the track rails of special **U**-form transverse section. The wheels of the carriages from which the vehicles are suspended run upon the upper faces of the two branches of the **U**, as shown in Fig. 7, and the hubs of these wheels are toothed to engage with a rack which extends the whole length of the track and which is situated in the throat of the **U**-rail. The wheels of the locomotive of the train are furnished, besides, with sprocket-wheels, which are driven through chains by an electric motor, with which the locomotive is furnished and which receives the current by means of a trolley from a cable arranged along the track, but isolated therefrom. This arrangement is illustrated in Fig. 6 of the drawings.

M designates one of the vehicles which compose the train, at the head of which is the electric locomotive L.

O designates the insulated electric conductor, which extends along the track and furnishes the current of the electric locomotive by means of a trolley o.

As may be understood by the drawings, the rails constituting the track have the **U**-shaped transverse section, and each of the vehicles is suspended from two trains of wheels, composed each of two pairs, which run upon the upper faces of the vertical branches of the **U**. These wheels have hubs which are toothed and constitute gears engaging with a double rack G, secured in the throat of the **U**. The wheels of the locomotive are each furnished with a sprocket-wheel P, and the two sprocket-wheels of each pair are geared by a chain p with a sprocket-wheel P', mounted above the locomotive and of which the shaft is operated through a second chain p' by the electric motor of the locomotive. This mode of traction permits the climbing of very steep inclines. It is particularly suitable for long railways, for which endless cable traction would hardly be practicable.

As to the stations which may be established along the line of the railway, they present nothing special and may be of any suitable construction.

My improved aerial railway constructed as above described presents from an economical

point of view important advantages. The construction is very easy, rapid, and comparatively inexpensive. It shortens the distances by being permitted to run always in straight lines. The expenses of working it are very slight, because the permanent track and the rolling-stock are simple and light and the working staff required will not be numerous. It permits the running of great speeds, because of there being no fear of collisions or of derailment.

What I claim as my invention is—

1. An aerial railway comprising in combination a line of rails spliced end to end, parallel suspension-cables, pairs of clamping-plates clamping these cables at intervals, eyebolts secured to the two plates of each pair, suspension-rods hooked to the eyebolts and secured to the rails, and pillars supporting at intervals the suspension-cables and the line of rails which take between the said pillars their respective curves of equilibrium, substantially as herein described.

2. An aerial railway comprising in combination a line of rails spliced end to end, and pillars which rest upon the ground in transverse lines about which they may oscillate and which serve to support at intervals the line of rails which takes between the said pillars its curve of equilibrium, substantially as herein described.

3. An aerial railway comprising in combination a line of rails spliced end to end, one or more suspension-cables, means for suspending the line of rails from said cables, and pillars which rest upon the ground in transverse lines about which they may oscillate and which support at intervals the suspension-cables and the line of rails which take between the said pillars their respective curves of equilibrium, substantially as herein described.

4. An aerial railway comprising in combination a line of rails of **U**-shaped transverse section spliced end to end, a rack located in the throat of the **U** of the rail, and pillars supporting at intervals the line of rails which takes between said pillars its curve of equilibrium, substantially as herein described.

5. An aerial railway comprising in combination a line of rails of **U** form spliced end to end, a rack located in the throat of the **U** of the rail, one or more suspension-cables, means for suspending the line of rails from said cables, and pillars for supporting at intervals the suspension-cables and the line of rails which take between said pillars their respective curves of equilibrium, substantially as herein described.

6. An aerial railway comprising in combination a line of rails of **U**-shaped transverse section spliced end to end, a rack located in the channel of said rails, pillars for supporting at intervals the line of rails which takes between said pillars its curve of equilibrium, carriages the wheels of which run upon the vertical branches of the **U**-shaped rails and

are furnished with teeth engaging with said rack, and vehicles suspended from these carriages, substantially as herein described.

5 7. An aerial railway comprising in combination a line of rails of U-shaped transverse section spliced end to end, a rack located in the channel of the U-shaped rail, an electric conductor following the line of rails, and insulated therefrom, pillars for supporting at intervals the line of rails which takes between
10 them its curve of equilibrium, carriages the wheels of which run upon the vertical branches of the U-shaped rail and are furnished with teeth engaging with the rack, a vehicle suspended from these carriages, an electric motor in the said vehicle, a trolley for furnishing to the said motor the current which circulates in said electric conductor, and means
15 for transmitting motion from the motor to the wheels above mentioned, substantially as described.

25 8. An aerial railway comprising in combination a line of rails of U-shaped transverse section spliced end to end, a rack located in the channel of the U-shaped rail, one or more suspension-cables, means for suspending the line of rails from said cables, pillars for supporting at intervals said cables and the line of rails which take between the pillars their
30 respective curves of equilibrium, carriages

the wheels of which run upon the vertical branches of the U-shaped rails and are furnished with teeth engaging with said rack, and vehicles suspended from these carriages, substantially as herein described.

35 9. An aerial railway comprising in combination a line of rails of U-shaped transverse section spliced end to end, a rack located in the channel of the U of the rail, one or more suspension-cables, means for suspending the
40 line of rails from said cables, pillars for supporting at intervals the suspension-cables and the line of rails which take between said pillars their respective curves of equilibrium, an electric conductor following the line of
45 rails and insulated therefrom, carriages the wheels of which run upon the vertical branches of the U of the rails and are furnished with teeth engaging with the rack, a vehicle suspended from these carriages, an electric motor in the vehicle, a trolley for furnishing to
50 the motor the current which circulates in said electric conductor, and means for transmitting motion from the said motor to the above-mentioned wheels for the purpose of driving
55 them, all substantially as herein described.

MARTIN ALBERTO DE PALACIO.

Witnesses:

RAFAEL MUÑOZ Y ESTEBAN,
ENRIQUE MUÑOZ Y MARTINEZ.