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PROVISIONAL SPECIFICATION.

Improvements in and connected with Gripping Devices for Suspended Cable or Rope Railways.

I, ADOLF BLEICHERT of Leipzig-Gohlis, in the Empire of Germany, Manufacturer do hereby declare the nature of this invention to be as follows :—

Coupling arrangements for locking cable railway carriages or cars, by coupling them to the traction cable, are not unknown, the arrangements of that class, which have hitherto been introduced, being devised on the principle that the locking or gripping cheeks or jaws are compressed by the weight of the load, the weight of the vehicle acting upon the jaws direct. The compressing or gripping effect thus produced is so slight, however, that somewhat steep gradients cannot thereby be overcome, nay, that even along a substantially horizontal road, having no other slopes or inclines but those formed by the curves or bendings of the supporting cable, these arrangements prove ineffective.

Now the subject of this invention is a coupling device for wire-cable railways, wherein the weight of the carriage is transferred to the gripping or locking cheeks through the medium of levers, screws, wedges or the like, in such a manner that the pressure produced represents a multiple of the weight of the carriage; owing to which arrangement the required coupling may be effectively carried out on slopes or gradients of no matter what angle of inclination.

The rolling mechanism of the carriage consists of the two side frames or cheeks, held together by spacing rods or bolts and carrying pivots or axles whereon are mounted the wheels,—at their ends.

Between the side frames or cheeks there is located a sliding body which is guided in the vertical direction by the guide-rails secured to the said cheeks. The sliding body, at its lower end, carries a suspension bolt or rod for the suspended frame which supports the body of the vehicle; while at the upper end of the sliding body is situated the point of engagement for the longer arm of a double-armed pivoted lever, acting not unlike tongs, the shorter arm of which, assuming the shape of a gripping jaw is pressed against a second, similar, gripping jaw, rigidly attached to the cheek or side piece of the rolling mechanism of the car; so that the traction cable extending through the pair of gripping jaws is adapted to be tightly compressed between them. The point or part at which the sliding body is to actuate the double-armed lever is regulated by a set screw. This screw has a recess or notch, of suitable shape, for the reception of one of the arms of the double-armed lever. By raising or lowering this adjusting screw, the situation of the point of action or operation of the said double-armed lever may be varied, the space between the gripping jaws being reduced or enlarged accordingly, so as to suit the diameter of the traction cable.

In one form of apparatus, the transmission of the strain or pressure from the point of engagement of the sliding body, or from the set screw on the double armed or tong-shaped lever, to the gripping jaw, is supposed to take place at the ratio of 1 : 3, so that, assuming the carriage to weigh, say, 500 kilogrammes, the traction-cable will be gripped at a pressure or weight of $3 \times 500 = 1500$ kilogrammes. Now if, with a greased cable, the coefficient of friction be set down at ·1, then the

[Price 8d.]

cable, on being gripped or locked as stated, will withstand a "pull" of 150 kilogrammes; or, in other words, the vehicle weighing 500 kilogrammes will be fit,—if provided with the present coupling device,—to be used for gradients $\frac{500}{150} = 1 : 3\frac{1}{3}$.

In a modified form of this apparatus this transmission of lever action may be expressed as 1 : 5. In this case, taking the weight of the vehicle to be also 500 kilogrammes, the cable will be gripped at a weight or strain of 2500 kilogrammes, so that this carriage might travel over gradients of $\frac{500}{250} = 1 : 2$, without any slipping of the traction-cable in the gripping jaws being likely to occur. Hence it follows that this coupling mechanism may be employed with absolute safety on the steepest inclines ever occurring in practice, provided their ratio of transmission or pressure between the sliding body or support, sustaining the weight of the carriage, and the gripping jaws is pre-determined or adjusted accordingly.

One particularly important feature may be here called attention to in connection with the apparatus above referred to and that is, that the gripping jaws are situated entirely above the rolling mechanism. A carriage, provided with this coupling apparatus, may, therefore, travel along the track-line over curves of no matter what dimensions or amplitude, in a perfectly automatic manner, and without its being necessary to loosen or detach it from the traction-cable. There are provided, for this purpose, above the vehicle, within the gripping jaws, horizontal guiding rollers for the traction-cable, so that, as the vehicle moves past, the said gripping jaws locate themselves against or in contact with those rollers. According as the curve to be described by the carriage in motion is a concave or convex one, these guide rollers should be arranged either on one or the other side of the gripping jaw. It will be understood, moreover, that the position of the supporting cable, or the guiding rail, along or against which the carriages run, must also, at such places, exactly correspond to the direction of the curve followed by the traction cable, under the guidance of the guide rollers.

The means for opening and closing the gripping jaws acting like tongs,—or for throwing them, or the carriage, in and out of gear with the traction cable,—consist of the guiding rings situated at the lower end of the sliding body and on either side of the same, and adapted to turn about correspondingly rounded projections on the sliding body or support, and to move along a number of steel rollers (this for the purpose of rendering them more readily movable), such steel rollers being interposed between the rings and the round projections. Upon entering a station, the cable railway carriage takes up its position upon a suspended rail connected with the supporting cables by means of tongues. On both sides of this suspended rail, there are arranged angle-iron rails whereon, at a given moment, the guiding rings, and also, consequently, the sliding body, with the carriage suspended from it, find their support. The vehicle reaches a point where the suspended rail descends, while the two angle iron rails retain their horizontal position. The vehicle, accordingly, descends the slight gradient formed by the said suspended rail; the guiding rings locate themselves and press upon the angle iron rails, and the sliding body, with the carriage suspended therefrom, is successively or gradually raised, thereby releasing the gripping jaws. In this position, the traction cable is lifted out of engagement with the gripping jaws, and the carriage becomes entirely free. From a certain point, the angle iron rails will now descend, or be depressed, while the suspended rail of the suspension line, continues to extend horizontally. Hence it follows that the sliding body, together with the carriage, descends to its lowest position; the gripping jaws close again, and the carriage is now conducted along the rails of the suspended line, at the station, up to the spot where the charging and discharging take place; after which, it reaches the starting point leading to the other supporting cable.

The carriage arrives at a certain point, the suspended rail of the suspension line is lowered ; the guide-rings take up their positions upon the horizontal angle iron rails, whereby the sliding support or frame is raised, together with the carriage, and the gripping jaws are opened. In this position, the traction cable is inserted between the gripping jaws from the top ; the carriage now reaches the position whence the angle iron rails begin to be lowered, thereby causing also the sliding frame to descend, the consequence being that the gripping jaws are closed. At this juncture, the carriage is firmly coupled with the traction cable, and now, being pulled by this cable, takes up its position upon the supporting cable. The whole process of coupling the vehicle in and out of engagement with the traction cable thus takes place automatically, as the foregoing part of the specification clearly explains. The attendant at the station has merely to receive the carriage as it enters the station and, after having loaded or unloaded it, as the case may be, to move it to the other supporting cable, taking no heed of anything else.

In another modification of this coupling device, the gripping jaws are situated on the opposite side of the rolling mechanism of the vehicle, the consequence being that the traction cable, when in operation, assumes a lower position upon the free portion of the track or line ; whereas in the forms of apparatus hereinbefore described the traction cable is supported by the guide rollers provided upon the carriers of the supporting structure.

In order to open and close the gripping jaws, or in other words to throw them in and out of gear, rollers are provided at both ends of the suspension rod. These rollers at the stations, rest on the angle iron rails, as already explained, whereby the sliding frame, together with its suspension rod, and the carriage suspended therefrom, is raised, releasing or opening the gripping jaws.

In another form of this improved coupling apparatus, the gripping jaws are located below the supporting cable and are co-axial with the vertical axis of the same. Between the two cheeks or side pieces of the rolling mechanism there is, here also, a sliding body which carries the guiding rings at its lower end ; which rings serve for engaging and releasing the gripping jaws acting like tongs as before stated. One of the said cheeks is extended downwardly and terminates at its lower end in a gripping jaw, with a hinge for the pivot or bolt on which the double-armed lever is adapted to turn ; which lever presses with its shorter arm, formed in the shape of a gripping jaw, against the other stationary gripping jaw, thereby locking the traction cable in position. The connection of the suspension rod with the double-armed lever is formed by a bar or rod, which transmits the weight of the carriage, suspended from the said rod, direct, to the said double-armed lever and also, therefore, to the gripping jaws. The rod consists of two parts connected by a nut tapped with a right-and-left screw-thread, whereby, according to the diameter of the traction cable, the space between the gripping jaws may be increased or decreased.

When the carriage suspended from the rod moves along a sloping track, inclined at an angle of about 30° it occupies, a perfectly vertical position, whereas the rolling mechanism thereof, together with the coupling mechanism directly connected therewith, is in an oblique position corresponding to the inclination of the supporting cable.

The traction cable, in the arrangement above described is situated entirely below the supporting cables and,—save to the extent to which it is carried by the vehicle itself,—it is supported by the guide rollers attached to the supports or stays.

Instead of lever transmission, such as is herein described, transmission gearing consisting of screws, wedges, or the like, may be employed.

Dated this 3rd day of June 1896.

HASELTINE, LAKE & Co.,
45 Southampton Buildings, London, W.C., Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in and connected with Gripping Devices for Suspended Cable or Rope Railways.

I, ADOLF BLEICHERT, of Leipzig-Gohlis, in the Empire of Germany, Manufacturer, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement :—

Coupling arrangements for locking cable railway carriages or cars, by coupling them to the traction cable, are not unknown, the arrangements of that class, which have hitherto been introduced, being devised on the principle that the locking or gripping cheeks or jaws are compressed by the weight of the load, the weight of the vehicle, acting upon the jaws direct. The compressing or gripping effect thus produced is so slight, however, that somewhat steep gradients cannot thereby be overcome, nay, that even along a substantially horizontal road, having no other slopes or inclines but those formed by the curves or bendings of the supporting cable, these arrangements prove ineffective.

Now the subject of this invention is a coupling device for wire-cable railways, wherein the weight of the carriage is transferred to the gripping or locking cheeks through the medium of levers, screws, wedges or the like, in such a manner that the pressure produced represents a multiple of the weight of the carriage; owing to which arrangement the required coupling may be effectively carried out in slopes or gradients of no matter what angle of inclination.

The accompanying drawings represent several different forms or modifications of apparatus in which this invention is embodied.

Figure 1 is a transverse section of the carriage, the gripping jaws being in gear.

Figure 2 is a sectional view on line *x y z u* Figure 1.

Figure 3 is a plan view of Figure 2.

Figures 4 and 5 are details to be hereinafter referred to.

Figure 6 is a sectional view illustrating a modification of Figure 1.

Figure 7 is a transverse section shewing the apparatus with the gripping jaws open, the carriage being at a station.

Figures 8 and 9 illustrate the arrangement of the suspended rail at a station.

Figure 10 is a transverse section illustrating another modification of the coupling.

Figure 11 is a diagrammatic view shewing the traction cable when it assumes the lower position as hereinafter referred to.

Figure 12 is a diagrammatic view shewing the traction cable supported by the guide rollers.

Figures 13 to 17 are views illustrating the use of the coupling apparatus when situated below the supporting cable.

The rolling mechanism of the carriage consists of the two side frames or cheeks A A^1 held together by spacing rods or bolts *d d* Figure 2 and carrying pivots or axles *z*, *z*, whereon are mounted the wheels,—at their ends.

Between the side frames or cheeks A A^1 there is located a sliding body B which is guided in the vertical direction by the guide-rails C C Figure 3 secured to the said cheeks A A^1. The sliding body B, at its lower end, carries a suspension bolt or rod D, for the suspended frame E which supports the body of the vehicle; while at the upper end of the sliding body B is situated the point of engagement for the longer arm of a double-armed lever F pivoted at G, acting not unlike tongs, the shorter arm of which, assuming the shape of a gripping jaw H

(Figures 1 and 5), is pressed against a second, similar, gripping jaw H^1, Figure 6, rigidly attached to the cheek or side piece of the rolling mechanism of the car; so that the traction cable extending through the pair of gripping jaws is adapted to be tightly compressed between them. The point or part at which the sliding body B is to actuate the double-armed lever F is regulated by a set screw J, Figures 1, 4 and 6. This screw has a recess or notch at K (Figures 1 and 4), of suitable shape, for the reception of one of the arms of the double-armed lever F. By raising or lowering this adjusting screw J, the situation of the point of action or operation of the said double-armed lever may be varied, the space between the gripping jaws being reduced or enlarged accordingly, so as to suit the diameter of the traction cable.

In the apparatus, of which Figure 1 is a cross section, the transmission of the strain or pressure from the point of engagement of the sliding body B, or from the set screw J on the double armed or tong-shaped lever F, to the gripping jaw H, is supposed to take place at the ratio of 1 : 3, so that, assuming the carriage to weight, say, 500 kilogrammes, the traction-cable will be gripped at a pressure or weight of $3 \times 500 = 1500$ kilogrammes. Now if, with a greased cable, the co-efficient of friction be set down at 0·1, then the cable, on being gripped or locked as stated, will withstand a "pull" of 150 kilogrammes; or, in other words, the vehicle weighing 500 kilogrammes will be fit,—if provided with the present coupling device,—to be used for gradients $\frac{500}{150} = 1 : 3\frac{1}{3}$.

Figure 6 shows a modification of this apparatus in which this transmission of lever action may be expressed as 1 : 5. In this case, taking the weight of the vehicle to be also 500 kilogrammes, the cable will be gripped at a weight or strain of 2500 kilogrammes, so that this carriage might travel over gradients of $\frac{500}{250} = 1 : 2$, without any slipping of the traction-cable in the gripping jaws being likely to occur. Hence it follows that this coupling mechanism may be employed with absolute safety on the steepest inclines ever occurring in practice, provided their ratio of transmission or pressure between the sliding body or support B, sustaining the weight of the carriage, and the gripping jaws H H^1 is pre-determined or adjusted accordingly.

One particularly important feature may be here called attention to in connection with the apparatus illustrated in Figures 1 to 6 of the accompanying drawings; and that is, that the gripping jaws H H^1 are situated entirely above the rolling mechanism. A carriage, provided with this coupling apparatus, may, therefore, travel along the track-line over curves of no matter what dimensions or amplitude, in a perfectly automatic manner, and without its being necessary to loosen or detach it from the traction-cable. As illustrated in Figures 1 and 6, there are provided, for this purpose, above the vehicle, at a height corresponding to the gripping jaws H H^1, horizontal guiding rollers L for the traction-cable, so that, as the vehicle moves past, the said gripping jaws locate themselves against or in contact with those rollers. According as the curve to be described by the carriage in motion is a concave or convex one, these guide rollers L should be arranged either on one or the other side of the gripping jaw. It will be understood, moreover, that the position of the supporting cable or the guiding rail, along or against which the carriages run, must also, at such places, exactly correspond to the direction of the curve followed by the traction cable, under the guidance of the guide rollers L.

The means for opening and closing the gripping jaws H H^1 acting like tongs,—or for throwing them, or the carriage, in and out of gear with the traction cable,—consist of the guiding rings M situated at the lower end of the sliding body and on either side of the same, and adapted to turn about correspondingly rounded projections N on the sliding body or support B, and to move along a number of steel rollers O O (this for the purpose of rendering them more readily

movable), such steel rollers being interposed between the rings M and the round projections N (Figures 1, 2 and 6). Upon entering a station, the cable railway carriage takes up its position upon a suspended rail P connected with the supporting cables by means of tongues (Figures 7 and 8). On both sides of this suspended rail, there are arranged angle-iron rails Q Q whereon, at a given moment, the guiding rings M, and also, consequently, the sliding body B, with the carriage suspended from it, find their support. The vehicle reaches a point x—x, Figure 8, where the suspended rail P descends, while the two angle iron rails Q retain their horizontal position. The vehicle, accordingly, descends the slight gradient formed by the said suspended rail P; the guiding rings M locate themselves and press upon the angle iron rails Q, and the sliding body B, with the carriage suspended therefrom, is successively or gradually raised, thereby releasing the gripping jaws. In this position, the traction cable is lifted out of engagement with the gripping jaws, and the carriage becomes entirely free. From a certain point y—y, the angle iron rails Q Q will now descend, or be depressed, while the suspended rail P of the suspension line, continues to extend horizontally. Hence it follows that the sliding body B, together with the carriage, descends to its lowest position; the gripping jaws close again, and the carriage is now conducted along the rails of the suspended line, at the station, up to the spot where the charging and discharging take place; after which, it reaches the starting point leading to the other supporting cable.

The operation just described is illustrated in Figure 9. The carriage arrives as indicated by the arrow, at the point x^1, x^1, the suspended rail P of the suspension line is lowered; the guide-rings M take up their position upon the horizontal angle iron rails Q Q, whereby the sliding support or frame B is raised, together with the carriage, and the gripping jaws are opened. In this position, the traction cable is inserted between the gripping jaws from the top; the carriage now reaches the position y^1 y^1 whence the angle iron rails Q Q begin to be lowered, thereby causing also the sliding frame B to descend, the consequence being that the gripping jaws are closed. At this juncture, the carriage is firmly coupled with the traction cable, and now, being pulled by this cable, takes up its position upon the supporting cable. The whole process of coupling the vehicle in and out of engagement with the traction cable thus takes place automatically, as the foregoing part of the specification clearly explains. The attendant at the station has merely to receive the carriage as it enters the station and, after having loaded or unloaded it, as the case may be, to move it to the other supporting cable, taking no heed of anything else.

In Figures 1 and 6 the gripping jaws H H^1 are shewn in gear, that is to say with the traction cable gripped or locked in position; whereas Figure 7 represents the apparatus with the gripping jaws open or out of gear, and with the sliding frame B raised by the action of the guiding rings M.

Figure 10 represents another modifications of this coupling device, wherein the gripping jaws H H^1 are situated on the opposite side of the rolling mechanism of the vehicle the consequence being that the traction cable, when in operation, assumes a lower position shown in Figure 11 upon the free portion of the track or line, supported on guide rollers u u; whereas in the forms of apparatus represented in Figures 1, 6 and 7, the traction cable is supported by the guide rollers S provided upon the carriers R of the supporting structure as illustrated in Figures 1 and 12.

In order to open and close the gripping jaws H H^1 or in other words to throw them in and out of gear, rollers T T^1 are provided at both ends of the suspension rod D, as shown in Figure 10. These rollers, at the stations, rest on the angle iron rails Q Q, as already explained, and as illustrated in Figures 8 and 9, whereby the sliding frame B together with its suspension rod D, and the carriage suspended therefrom, is raised, releasing or opening the gripping jaws.

Figures 13 to 17 represent a form of this improved coupling apparatus, in which the gripping jaws H H^1 are located below the supporting cable and are co-axial

with the vertical axis of the same. Between the two cheeks or side pieces of the rolling mechanism A A^1 there is, here also, a sliding body B which carries the guiding rings M M at its lower end ; which rings serve for engaging and releasing the gripping jaws H H^1, acting like tongs as before stated. One of the said cheeks A^1 is extended downwardly and terminates at its lower end in a gripping jaw H^1, with a hinge for the pivot or bolt G on which the double-armed lever F is adapted to turn : which lever presses with its shorter arm, formed in the shape of a gripping jaw H, against the other stationary gripping jaw H^1, thereby locking the traction cable in position. The connection of the suspension rod D with the double-armed lever F is formed by a bar or rod V, which transmits the weight of the carriage, suspended from the said rod D, direct, to the said double-armed lever F and also, therefore, to the gripping jaws H H^1. The rod V consists of two parts connected by a nut W tapped with a right-and-left screw-thread, whereby, according to the diameter of the traction cable, the space between the gripping jaws H H^1 may be increased or decreased.

Figure 16 represents a cable railway carriage, fitted with a coupling arrangement such as this, and supposed to be moving along a sloping track, inclined at an angle of about 30°. The carriage suspended from the rod D occupies, as shown, a perfectly vertical position, whereas the rolling mechanism thereof, together with the coupling mechanism directly connected therewith, is in an oblique position corresponding to the inclination of the supporting cable.

Figure 17 represents the free section of the cable railway line, where the carriages are used with the last described coupling device. The traction cable, in this arrangement, therefore, is situated entirely below the supporting cables, and,—say to the extent to which it is carried by the vehicle itself,—it is supported by the guide rollers *u u* attached to the supports or stays.

Instead of lever transmission, such as is herein described, transmission gearing consisting of screws, wedges, or the like, may be employed.

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. A coupling mechanism or gear for locking or for pressing the vehicle against the traction cable, in wire-cable or suspension railways ; its main feature being, that the weight of the vehicle is transmitted to gripping jaws for the purpose of enhancing the locking or gripping effect, through the medium of a lever, wedge, screw or the like ; when the said gripping jaws will compress or grip the cable between them with a preseure representing a multiple of the weight of the carriage.

2. A coupling such as is referred to in the first claim the main feature of which is a sliding body or frame such as B, guided by the structure or frame-work of the rolling mechanism of the vehicle, and supporting the said vehicle, and adapted to move into engagement with a lever F, which consequently with the gripping jaw H is brought into contact with a corresponding gripping jaw H^1, firmly connected to the frame of the rolling mechanism of the vehicle thereby locking the cable, inserted between the two jaws, securely in position.

3. In the form of mechanism referred to in the second claim, the arrangement of an adjusting or set screw, such as J, within the sliding body or frame B, wherein one end of the double-armed or tong-shaped lever F rests, in such a manner that by adjusting the said screw, the gripping jaws H H^1 may be adjusted according to varying thicknesses of cable.

4. In the coupling referred to in the first claim, the arrangement of the gripping jaws above the rolling frame work of the carriage, for the purpose of enabling such carriage to travel over concave as well as over convex curves without the necessity of disconnecting it from the traction cable.

5. A device for engaging and releasing the coupling referred to in the first claim, consisting of guiding rings such as M, attached to the sliding body of frames,

such as B and adapted, as the carriage enters or departs from a station, to run up against, or off from, rails such as Q, thereby causing the vehicle to be raised or lowered as the case may be, together with its sliding frame, and also therefore, throwing the gripping jaws into or out of engagement with the cable.

6. A modification of the apparatus referred to in the fifth claim, wherein rollers, such as T T^1, Figure 10, which serve to raise the sliding piece or frame B, are secured to the ends of the rod, such as D from which the carriage is suspended.

7. In the coupling mechanism characterized in the first claim, the arrangement of the gripping jaws, such as H H^1, upon that side of the rolling mechanism which is turned outwards, or away from the traction cable carriers, for the purpose of supporting the traction cable by guide rollers such as *u*, *u*, arranged at a corresponding depth, as shown in Figure 11.

8. A modification of the coupling gear referred to in the first claim, wherein the gripping jaws are arranged below and co-axial with the vertical axis of the supporting cable, and in which the sliding body or frame B comes into engagement with the long arm of the tong shaped lever F through the medium of a rod, such as V, of adjustable length, so that the shorter arm, of such lever, formed in the shape of a gripping jaw H, becomes pressed against another, similar gripping jaw, H^1, attached to the downwardly extended rolling frame work of the carriage.

Dated this 24th day of February 1897.

HASELTINE, LAKE & Co.,
45 Southampton Buildings, W.C., Agents for the Applicant.

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Fig. 13.

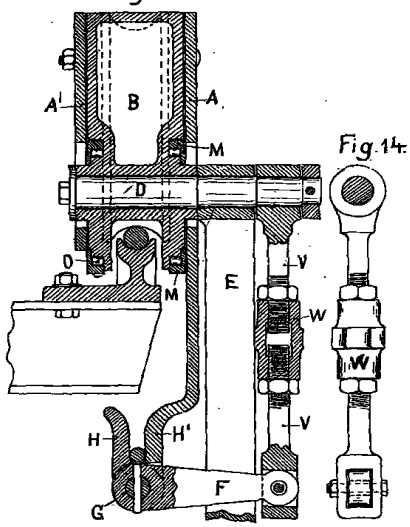

Fig. 14.

Fig. 15.

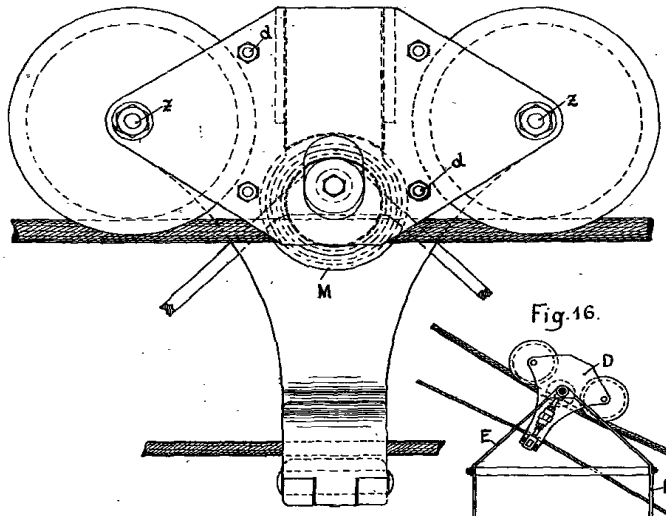

Fig. 16.

Fig. 17.

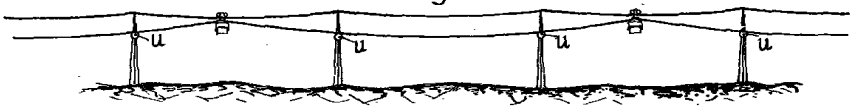

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Fig. 13.

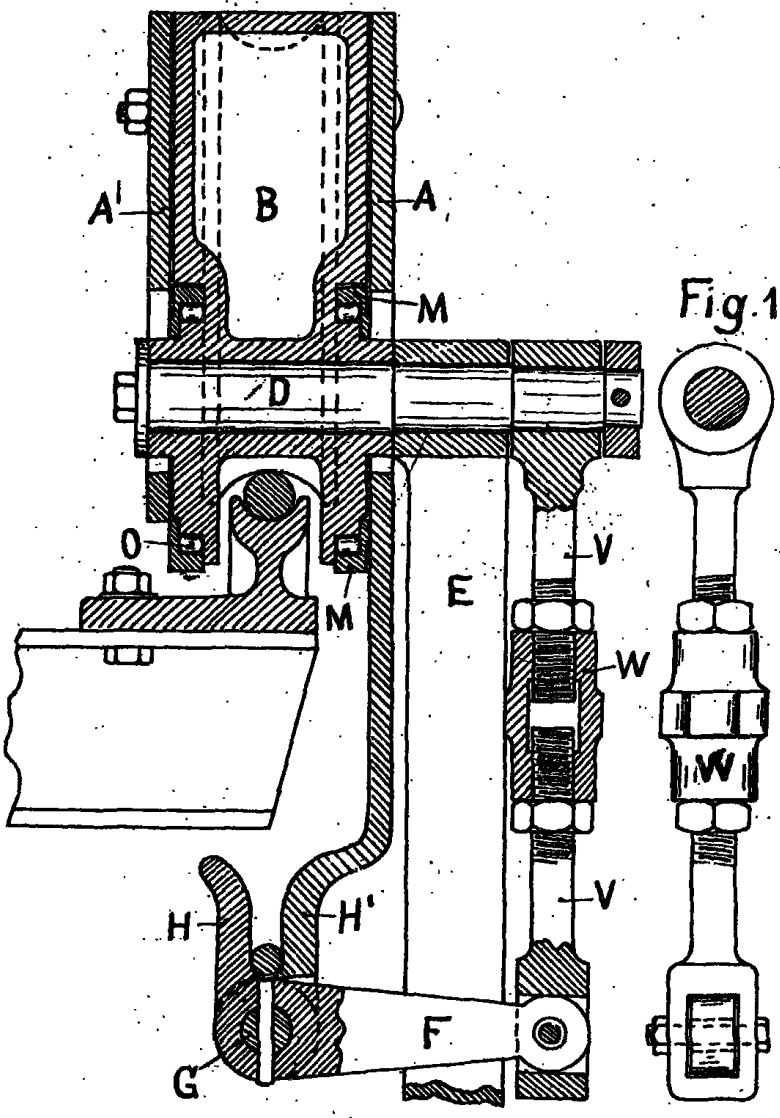

Fig. 14.

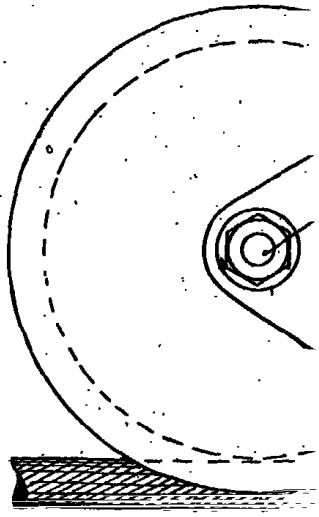

Fig. 17.

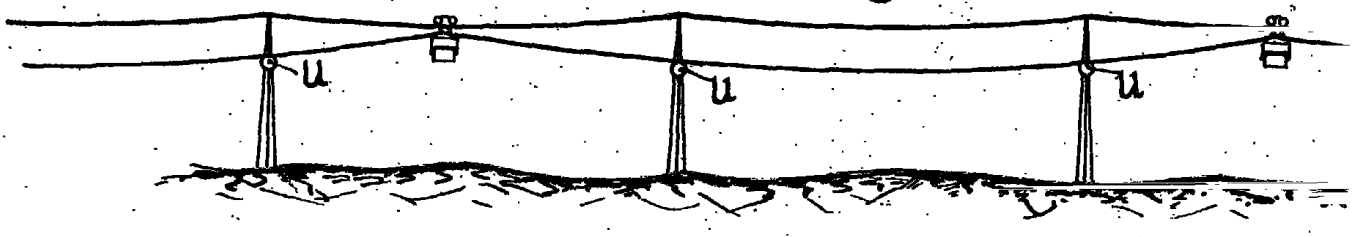

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Fig. 15.

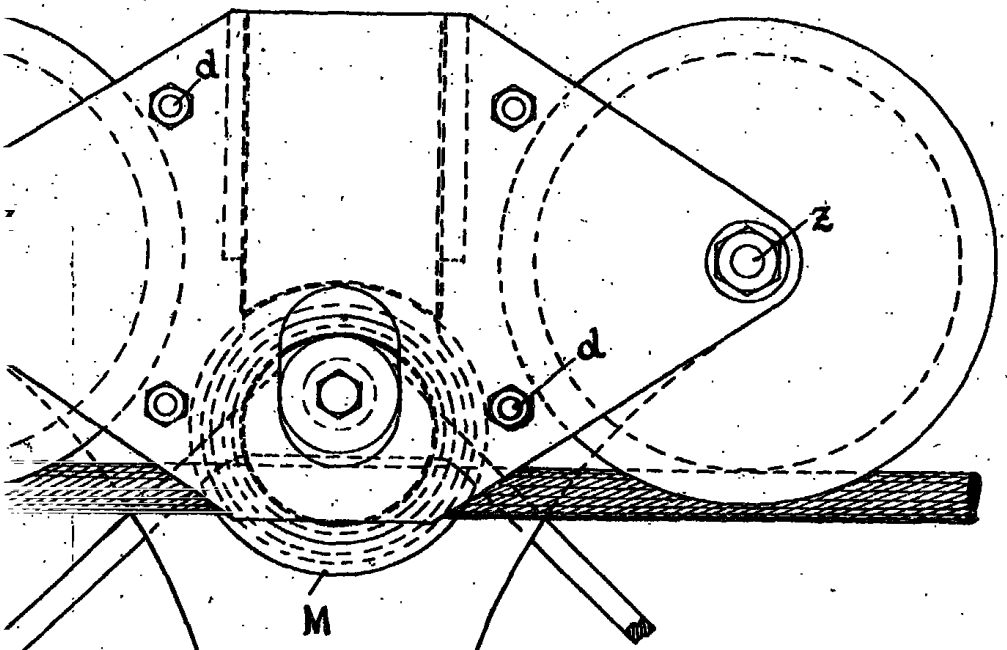
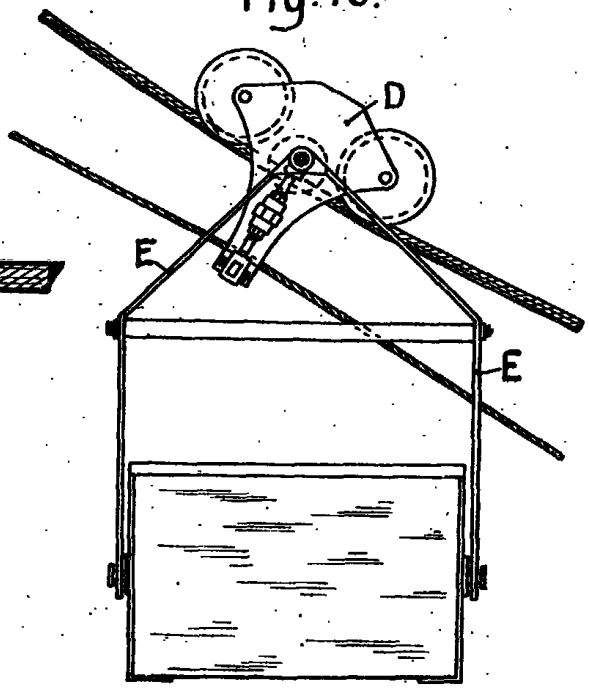
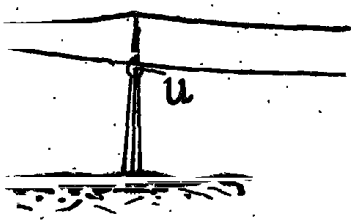


Fig. 16.





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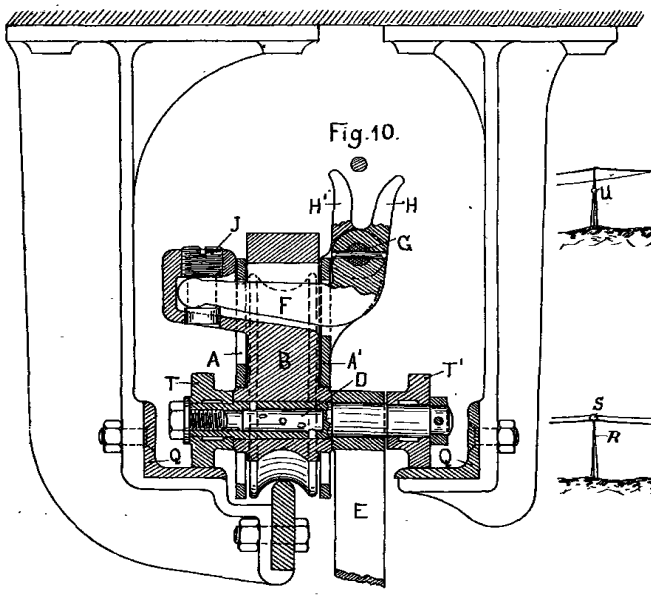

Fig.10.

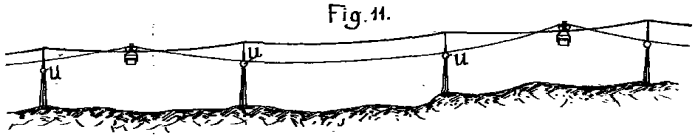

Fig.11.

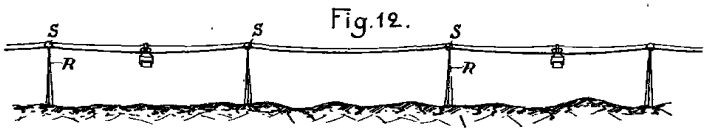

Fig.12.

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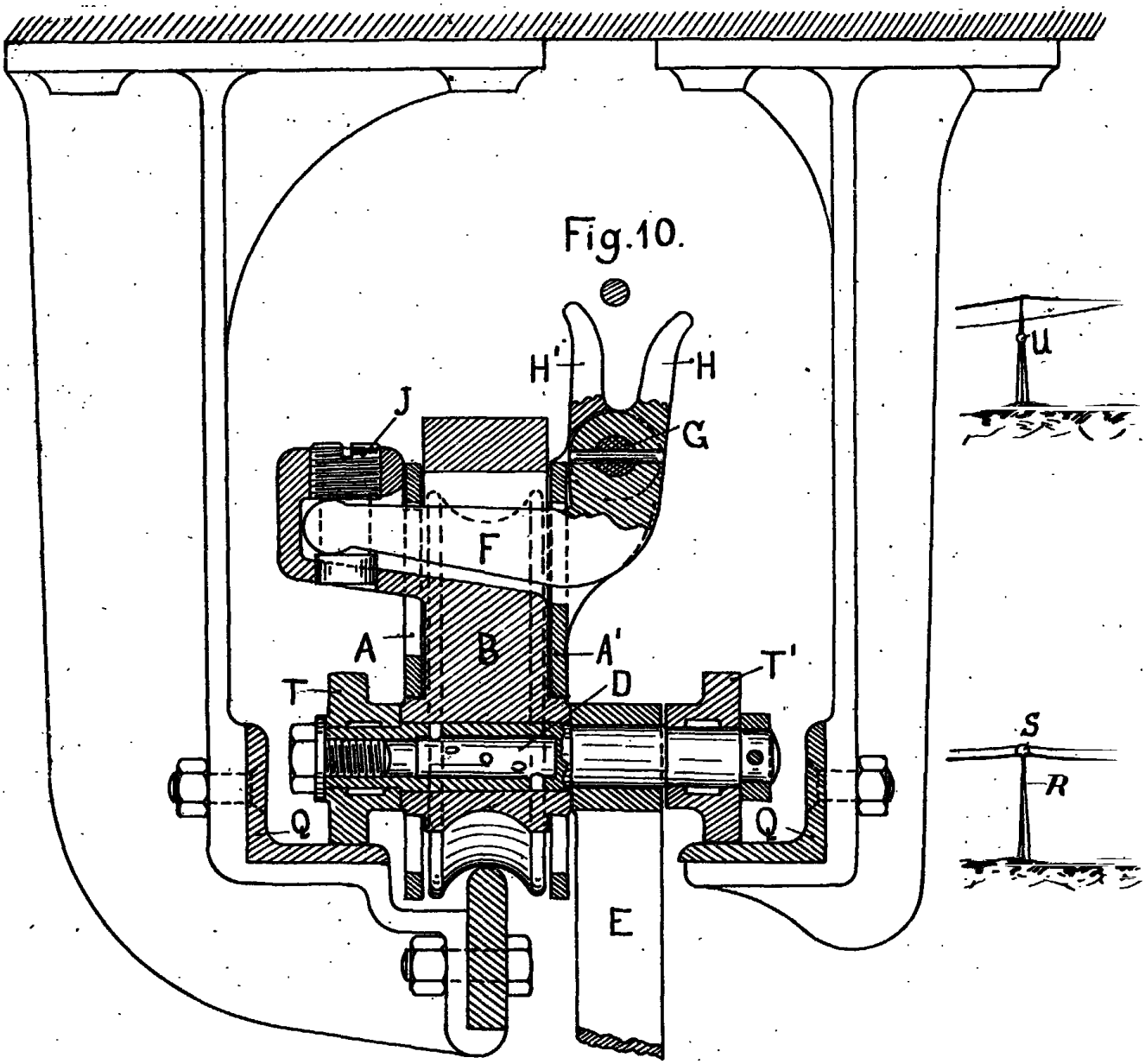

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Fig. 11.

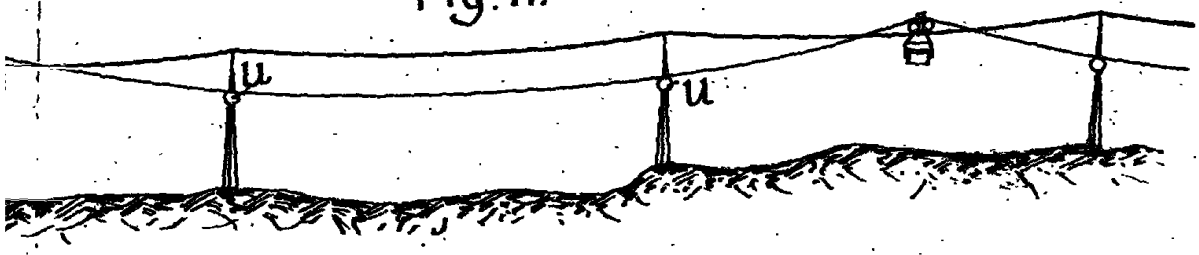

Fig. 12.

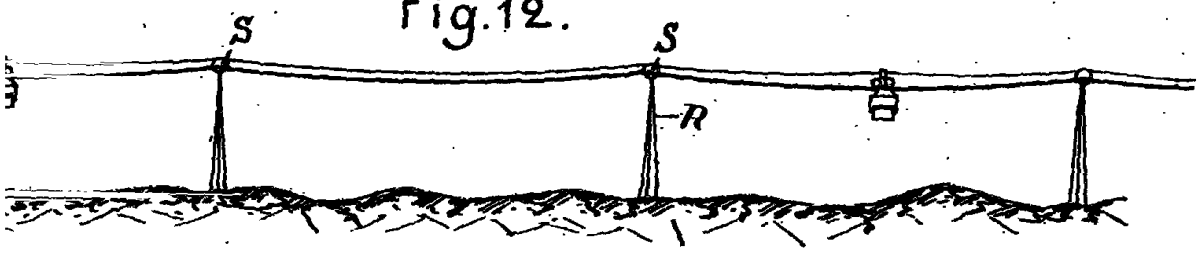

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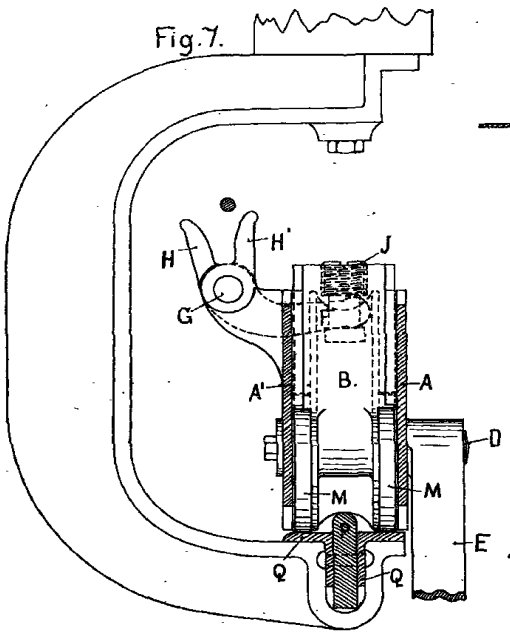
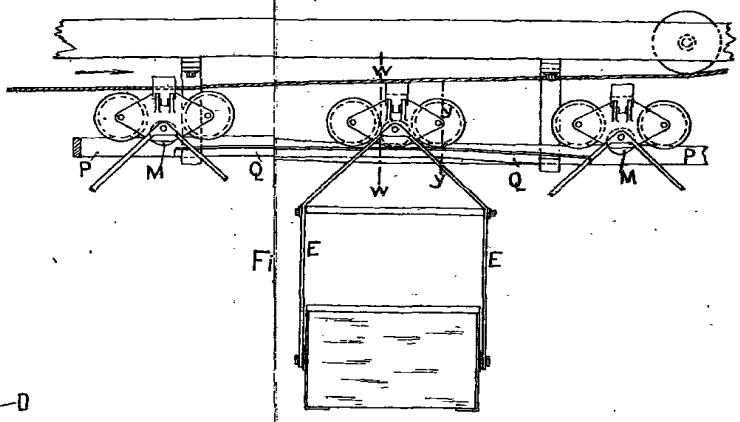
Fig.7.





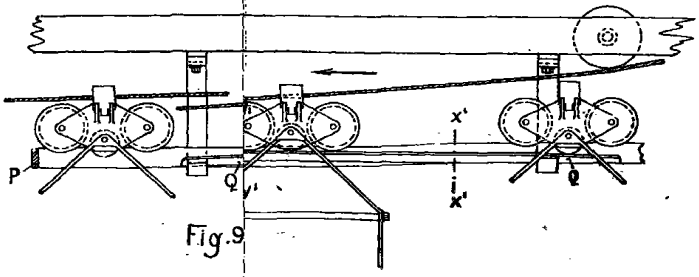


Fig.9

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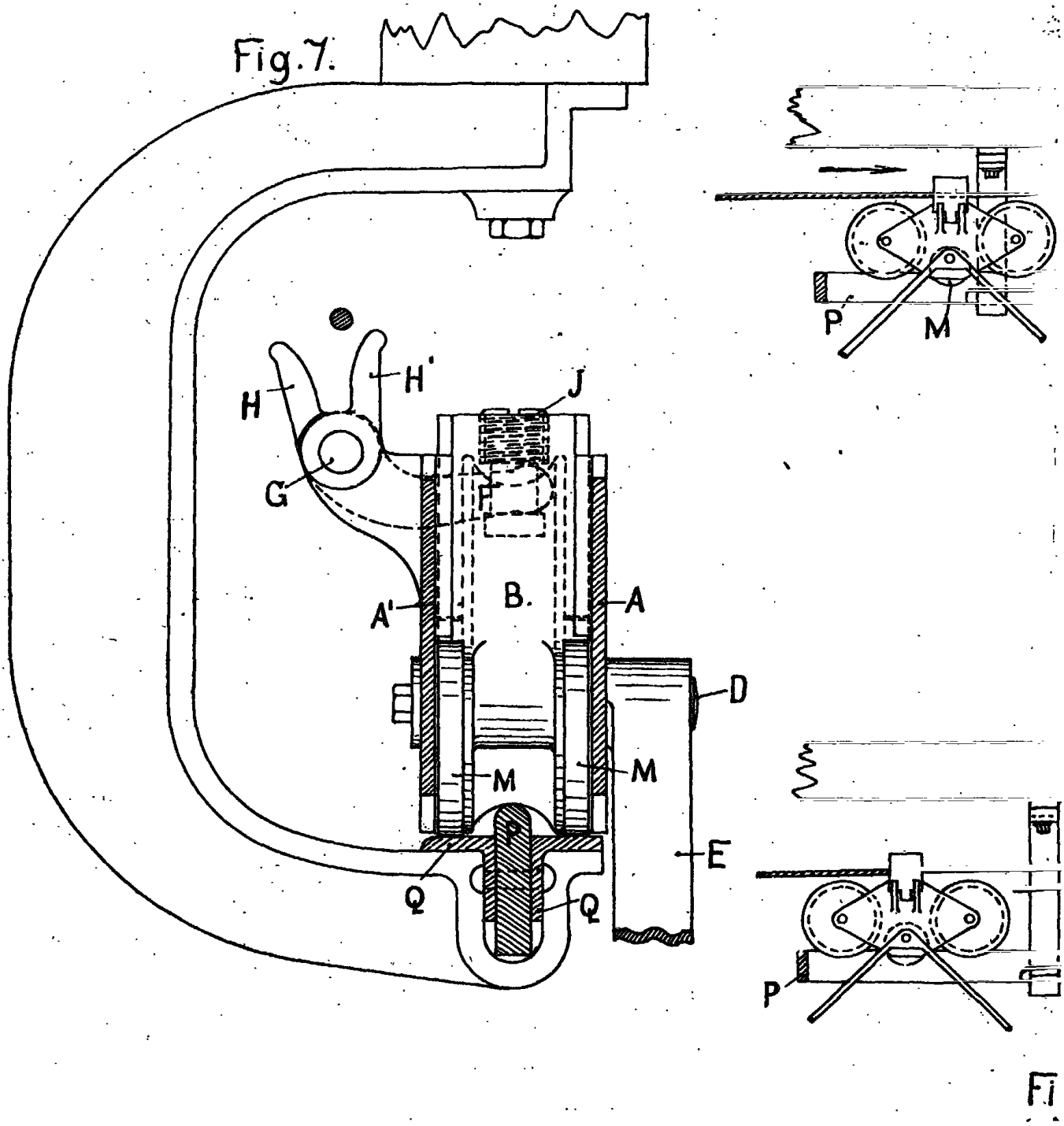
Fig. 7.



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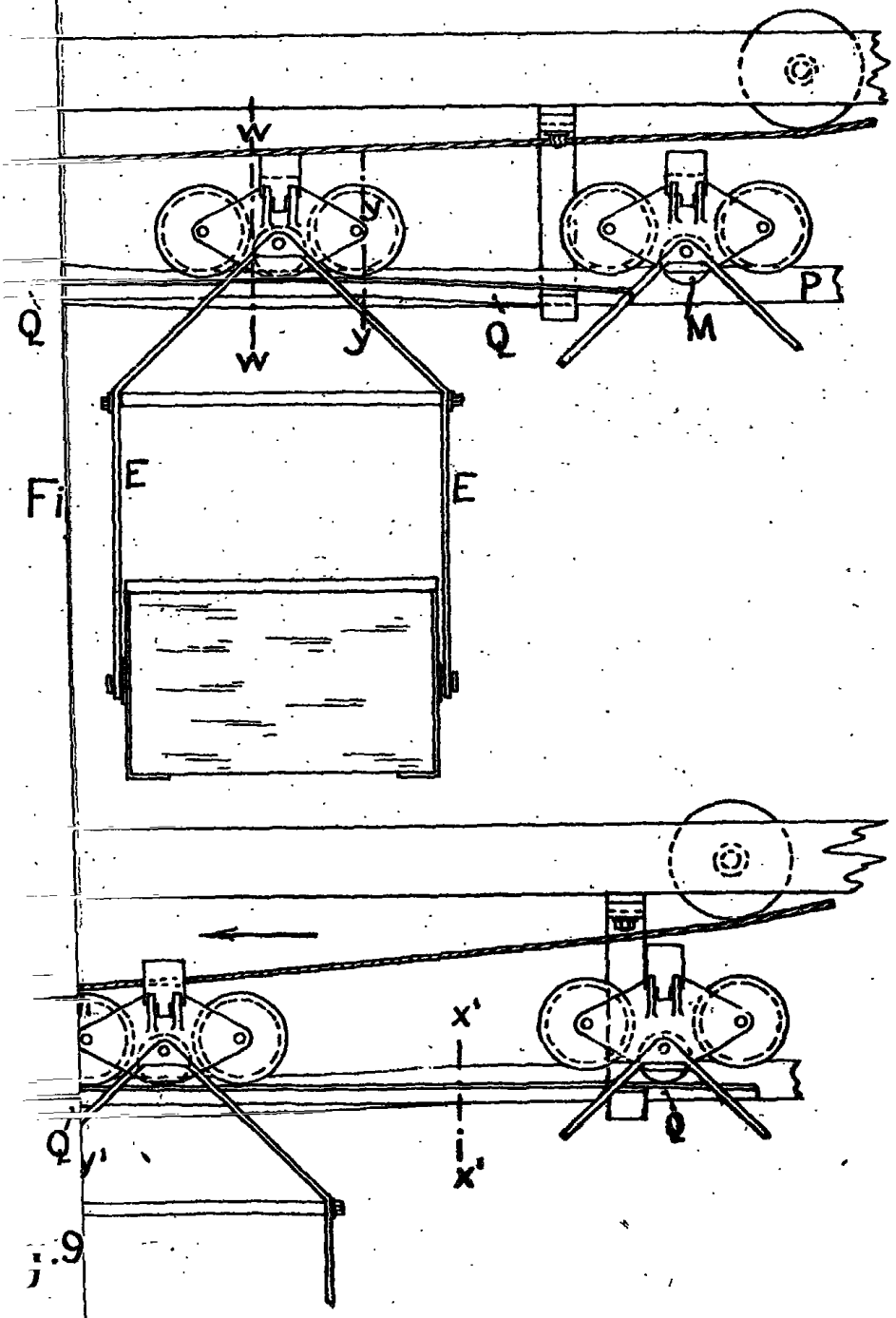

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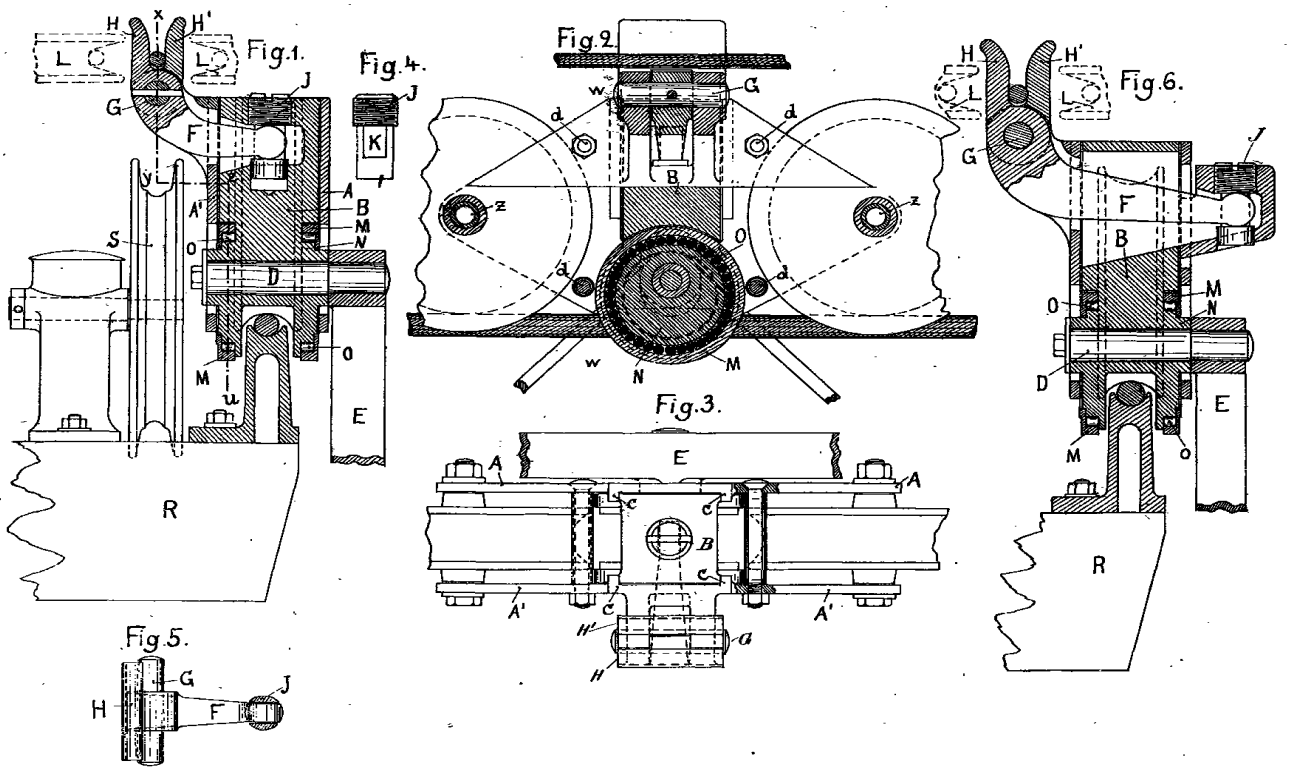

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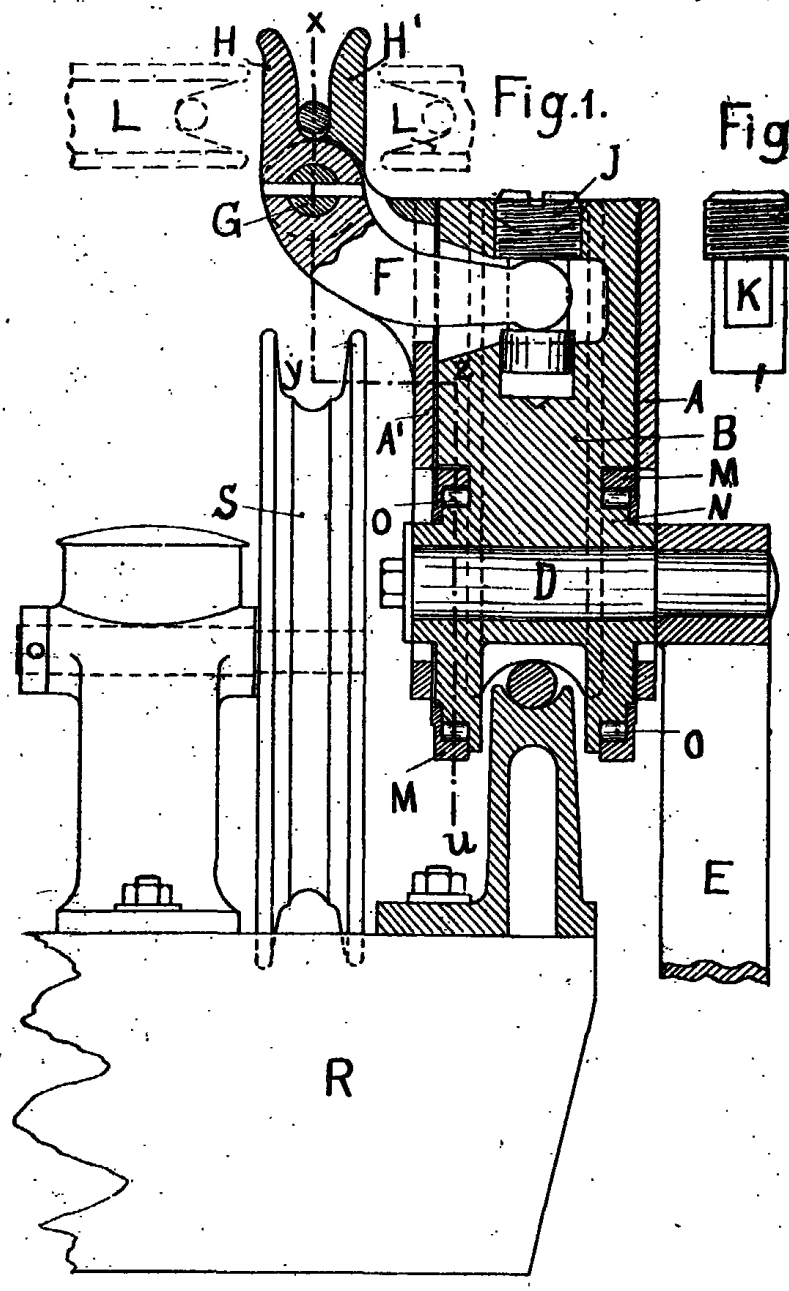

Fig.1.

Fig.4.

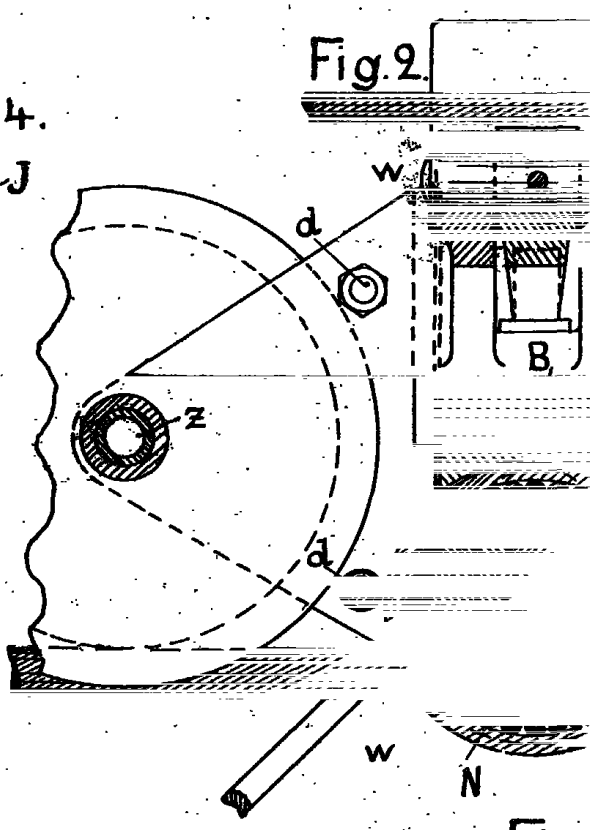

Fig.2.

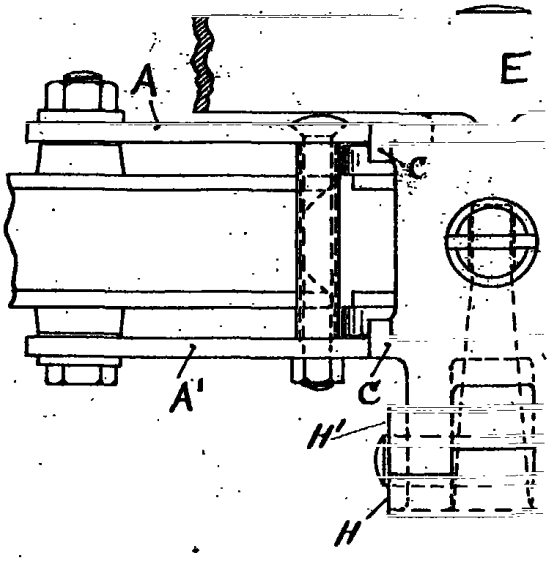

Fig.

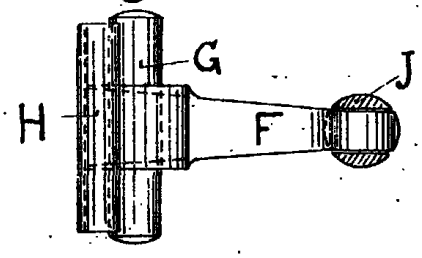

Fig.5.

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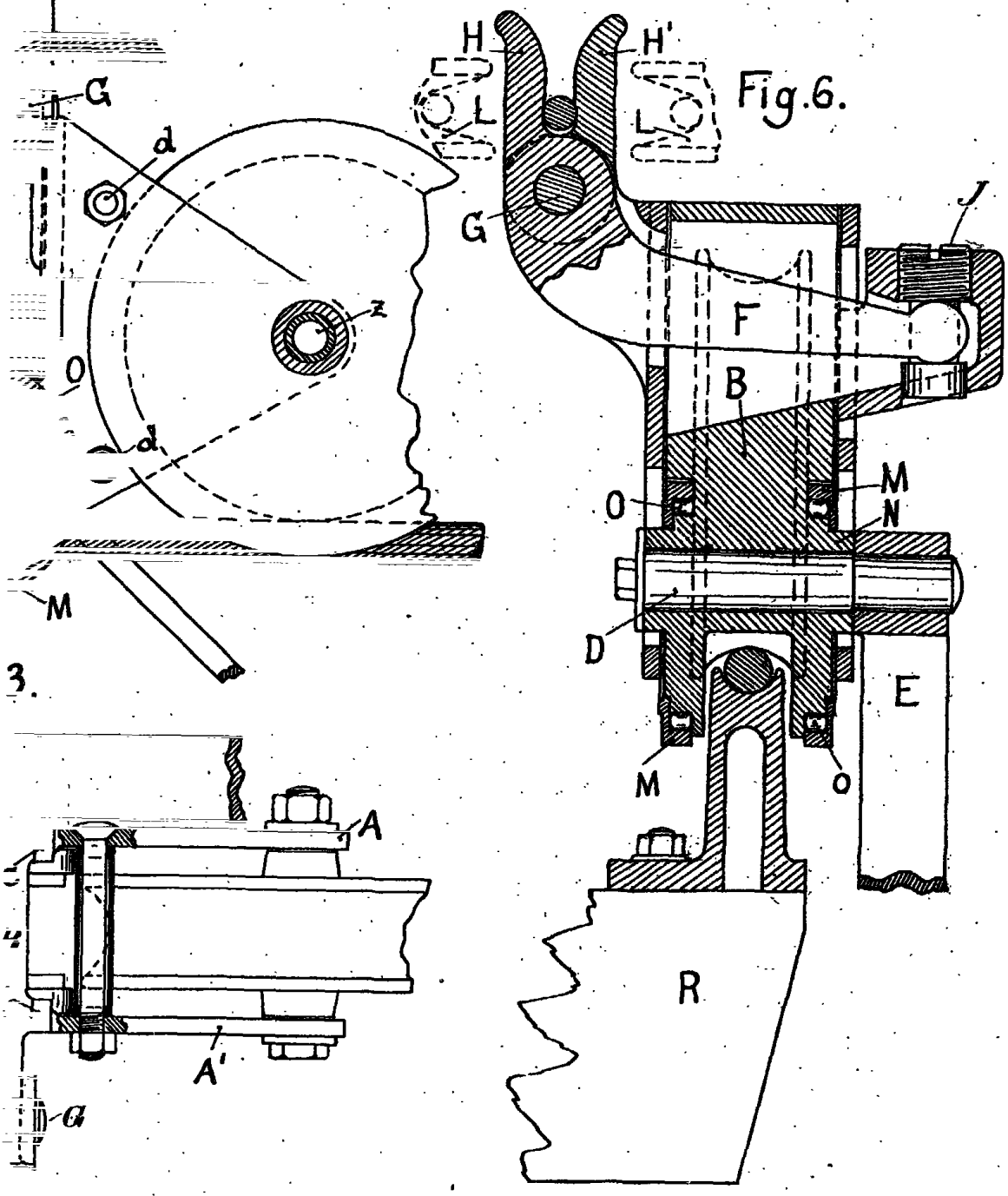

Fig.6.

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