

PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Improvements in or relating to Clamps for Cables.

We, UNITRAL (UNION D'ETUDE DES TECHNIQUE DES TRACTION ET DE LEVAGE), a French Body Corporate, of 16, place de la Republique, Paris 10°, in the Republic of France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to clamps for cables.

When it is desired to pull or retain a traction cable or rope by means of a clamp, it is known to use a self-gripping clamp where-
15 in the longitudinal reaction of the cable which is exerted on the pair of clamp jaws is utilized for moving these jaws in relation to a clamp body by causing gripping levers pivoted on said body to simultaneously rotate and thus move said jaws towards each
20 other and increase the grip produced thereby on the traction cable. Thus, the resulting automatic gripping effect is proportional to the cable traction effort.

25 If the clamp body is held against motion the consequence of the self-gripping action is to retain the cable, for example by holding a load suspended from the operative end of the cable. If the clamp body is pulled
30 (in a direction opposite to the direction of pull of the cable) the consequence of the self-gripping effect is to drive the cable which will pull or lift the load attached to its end. If the clamp body is allowed to recede by a
35 controlled movement whereas the cable or the clamp jaws are not otherwise retained, the load is allowed to move back or downwards while being retained by the clamp without being able to override the controlled
40 movement thereof. In the three cases set forth in the foregoing the clamp remains clamped to the cable.

If on the other hand the jaws are moved

in the release direction with respect to the clamp body, whether by means of the cable
45 or through the medium of the aforesaid gripping links, the resulting cable release enables the clamp to move along the cable (or the cable to move through the clamp since the present description obviously refers to relative movements).
50

The various possibilities disclosed herein above have already been combined in a traction and hoisting device utilizing a pair
55 of tandem self-gripping clamps through which a cable is disposed, at least one of said clamps being adapted to reciprocate in the device for either pulling the traction cable therethrough, in order for example to hoist a
60 load attached to the cable (assuming that the device is anchored in a fixed position), or as contrasted thereto allowing the cable to recede, in order for example to lower a load attached to its end. Thus, the traction device receives therethrough the traction cable
65 passing in succession through the pair of self-gripping clamps, these clamps and their gripping links being actuated by control means adapted to perform the different handling operations contemplated.
70

A particularly advantageous form of embodiment of this traction device having a working cable disposed therethrough comprises a pair of self-gripping clamps interconnected by links so as to move in opposite
75 directions, each clamp gripping the cable when the clamp is moved in one of the two directions in accordance with the selection of one of a pair of control mechanisms provided in the device. Thus, by actuating one
80 of these two control mechanisms the load-carrying cable will constantly move in the same direction through the device by being alternately driven from the two clamps. Upon each reversal of the clamp movement
85 the driving and gripping clamp is released

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while the other becomes the driving and gripping clamp to permit the continuation of the cable movement through the device.

5 Traction and hoisting devices of this general character have so far been quite satisfactory; yet the necessary mechanical inter-connections between the body and jaws of each clamp give rise to troubles and so far
10 it has not been possible to combine a perfect operation with reduced over-all dimensions, a low cost and a moderate wear ensuring a long useful life of the device and also of the traction cables used in connection therewith.

15 This invention is applicable to self-gripping clamps of the general type set forth herein above which is adapted to clamp a traction or hoisting cable, and it is a specific object of the present invention to provide a
20 self-gripping clamp adapted to be used in a traction or hoisting apparatus receiving the working or load-handling cable there-through.

25 It is the essential object of this invention to obtain the advantages set forth herein above altogether. In order to afford a clearer understanding of the importance of this invention, the essential requirements to be met by gripping jaws and the control mechanisms, notably the mechanisms for controlling the jaws by means of gripping links or levers, will firstly be briefly summarized.

30 Thus, it is a primary requirement that the gripping or frictional effort exerted on the cable be uniformly distributed. This requirement led in the past to the provision of jaws each formed with a concave gripping face having an arcuate contour corresponding in diameter to the cable to be gripped,
35 and also to apply to these jaws a precise movement of translation in relation to the clamp body in order to keep the jaws parallel to each other during their movements towards and away from the cable. To
40 this end, gripping levers, interposed between the jaws and the side plates or shackles between which these levers are mounted, are adapted to act through cam faces on lateral projections of adequate contour which are
45 carried by the pair of jaws, the device utilizing two pairs of parallel levers of this type, the levers of each pair registering with each other against side flanges or shackles. However, the aforesaid lateral projections must
50 have exactly identical contours and therefore constitute a difficult machining problem having a detrimental influence on cost, and besides the transmission of gripping and tractive efforts through these levers makes it
55 necessary to give substantial dimensions thereto, which prevents any reduction in the over-all dimensions of the clamps.

60 On the other hand, it was deemed advantageous, for avoiding any detrimental distortion and therefore a rapid wear of the

cable clamped between the jaws, to use a U-shaped jaw receiving between its side arms the other jaw of relatively flat configuration. but controlling these jaws was attended
70 serious complications and the lateral projections of the inner, flat jaw, which had necessarily an elongated configuration, was subjected to increased flexure stress, so that
75 in spite of obvious advantageous features deriving from the combination of a flat jaw with a U-shaped jaw this disposal had to be abandoned.

According to the present invention there is provided a clamp for gripping a cable comprising a clamp body, two jaws, one of
80 which is a flat plate member whereas the other is a U-shaped member with its side arms arranged on either side of said flat jaw in order to form, between the inner bottom
85 of the U-shaped jaw and the edge surface of the flat jaw, a passage adapted to receive the cable and closed laterally by the side arms of the U-shaped jaw, two pairs of parallel levers, each pair comprising two
90 levers arranged on either side of said jaws and pivoted on said clamp body, said two levers of each pair being rigid with a single transverse rod-shaped cam presenting along
95 its whole length a contour in the form of two cam surfaces and passing through an opening of said flat jaw and openings in the side arms of said U-shaped jaw, these openings having a contour in the form of cam surfaces which co-operate with the two cam
100 surfaces of the rod-shaped cam in order that the levers, when they pivot, cause the rod-shaped cams to move the gripping surface of one jaw to or away from the gripping surface of the other jaw whereby a cable can
105 be evenly gripped along its whole length between the jaws.

Moreover, it is envisaged that this rod-shaped cam may consist of a section cut from bar stock of adequate cross-sectional
110 contour, without requiring any machining operation once the bar is drawn to the requisite sectional contour and cut to the necessary length, thus affording a substantial cost reduction. The perfect translation of
115 the two jaws is obtained by using two successive pairs of parallel pivoting levers associated with two cams having exactly the same cross-sectional contour.

Since each rod-shaped cam acts upon the jaws by engaging the walls of apertures
120 formed therein, the jaws are actuated directly and since the two cams cut from the same bar stock are strictly identical the jaws cannot be subjected to asymmetric stresses likely to produce an ill-distributed cable gripping
125 effort and to shear the cable. On the other hand, as each rod-shaped cam constitutes at the same time a distance-piece between the pair of levers interconnected thereby, it is not subjected to abnormal stress and the
130

contours formed thereon may have smaller dimensions than the corresponding contours formed on the lateral projections utilized to now. Finally, the fact that the levers of each pair are interconnected by a common cam improves the rigidity of the assembly while promoting a dependable operation and reducing the wear of moving parts. Stress may further be laid on the fact that the uniform gripping action exerted by the jaws on the cable, in combination with the use of a flat jaw disposed between the side arms of a U-shaped jaw, affords a considerable reduction in cable distortion and wear, especially during backing manoeuvres (for example when lowering a load) which are usually the cause of most of the wear and tear, since the cable slides in one of the clamps when the jaws thereof are partially released.

The fact that the jaws are free of any lateral projections is also advantageous in that these parts can be cut from rolled bars or sections, the U-shaped jaw being cut from conventional U-section stock.

The cam contour may consist of the combination of the two different contours formerly utilized on said separate lateral projections of the two jaws in conventional clamps, but this composite contour operates inside the jaws instead of laterally, and can therefore have reduced dimensions in a device intended for producing the same tractive effort. This contour advantageously consists of two opposite and equal half-circles having their centers shifted from each other on a common diameter, this contour being completed by a pair of diametral portions, also coincident with said common diameter, which extend outside one of the half-circles.

According to a further feature of the present invention there is provided a traction apparatus equipped with a pair of clamps constructed in accordance with the present invention, in which the clamp bodies adapted to move in opposite directions are pivoted directly to the two ends of a two-armed lever rigid with a shaft mounted in the case of the apparatus and adapted to be reciprocated, the levers for actuating the two clamps being pivoted respectively to a pivoting control lever and to a pair of links pivoted to said control lever, the floating fulcrum of which is disposed between the pivotal connections with the levers and the links for actuating the two clamps.

When utilizing a clamp according to this invention in a two-clamp traction apparatus wherein the clamps are actuated in opposite directions, each clamp body may be provided on each side with a lateral roller or shoe movable within a cavity consisting of the casing constituting the body of the apparatus whereby the clamps are guided in the

longitudinal direction without any risk of producing an abnormal wear.

In order to afford a clearer understanding of the present invention and of the manner in which the same may be carried out in practice, reference will now be made to the accompanying drawings illustrating diagrammatically by way of example a typical form of embodiment of the device. In the drawings:

Figure 1 is a side elevational view of a cable clamp constructed according to the teachings of the present invention;

Figure 2 is an end view of the same device, as seen in the direction of the arrow II of Figure 1;

Figure 3 is a side elevational view of the flat jaw;

Figure 4 is a side elevational view of the U-shaped jaw;

Figure 5 is a simplified view showing a typical form of embodiment of the internal mechanism of a traction apparatus incorporating two clamps according to this invention which operate in opposite directions, and

Figure 6 is a section taken upon the line VI—VI of figure 5.

In the exemplary form of embodiment of a clamp, shown in figures 1 and 2 of the drawings, the traction cable 1 is gripped between a flat upper jaw 2 and a U-shaped lower jaw 3 of which the side arms extend on either side of the flat jaw 2. The lower edge or surface of jaw 2 has an arcuate concave contour 4 of a radius corresponding to the radius of cable 1, and the inner bottom of the U-shaped jaw 3 has a corresponding half-circular contour 5, whereby the contours 4 and 5 will clamp the cable on the major part of its periphery when the jaws are in their cable gripping position.

Both jaws are movable between the gripping levers pivoted on the clamp body designated by the reference numeral 6. These levers consist of two pairs of parallel levers 7, 8. Levers 7 have the same contour and register with each other on either side of the set of jaws 2 and 3; these levers 7 are pivoted about a common pin 9 rigid with the clamp body 6; similarly, the other pair of levers 8 disposed on either side of the set of jaws 2 and 3 are pivoted on a common pin 10 parallel to the other pin 9 and rigid with the clamp body 6.

Both levers 7 are rigid with a transverse rod-shaped cam 11 extending through adequate apertures formed in both jaws, the other pair of levers 8 being also rigid with a transverse rod-shaped cam 12 extending through other apertures formed in both jaws. The cams 11 and 12 consist of bar sections of same cross-sectional contour consisting of two equal half-circles 13 and 14 having their centers shifted on their common diameter

and being disposed on either side of this diameter, this contour being completed by two straight diametral portions 15 and 16 of said common diameter which lie outside

5 said half-circles.

Both levers 7 have extensions 17 beyond the pivot pin 9 and these extensions 17 carry between each other a cross member 18 pivoting freely in holes formed in said extensions 17. This cross member 18 acts as an abutment to one end of a compression coil spring 19 surrounding a guide rod 20 having one end adapted to slide through a central hole formed in said cross member 18 and its other U-shaped end 21 is adapted to bear against a distance-piece 22 rigid with the clamp body 6. This spring 19, by reacting against the distance-piece 22 and cross-member 18, constantly urges the levers 7 for rotation with respect to the clamp body in the direction to close the jaws, as will be explained presently. This pivotal movement of levers 7 is attended by a corresponding movement of levers 8 which is transmitted through the jaws. The levers 7 and 8, and jaws 2 and 3, constitute together a parallel linkage so that levers 7 and 8 and therefore jaws 2 and 3 remain constantly parallel to each other.

30 The upper flat jaw 2 is formed with identical transverse apertures 23 for both cams, and each aperture 23 has a part-cylindrical lower arcuate portion 24 of a radius equal to that of the aforesaid semi-circular portions 13 and 14. This face 24 is engageable by the lower half-cylinder of the contour 14 of the corresponding cam. The only function of the other portion of aperture 23 is to permit the free movement of the upper half-cylinder 13 of said cam. The position illustrated in figure 3 corresponds to an intermediate clamping position, the position of figure 1 corresponding to the cable release position.

45 The lower U-shaped jaw 3 shown in figure 4 in the position corresponding to a same cam position as in figure 3, comprises identical transverse apertures 25 for the two cams and if desired these apertures may be the same as the apertures 23 of jaw 2, but they are disposed symmetrically with respect to a point 26 located in the middle of the centre line of the cylinders forming the contours 13 and 14. Thus, each aperture 25 has a part-cylindrical upper portion 27 engageable by the half-cylindrical cam portion 13, and the remaining portion of this aperture 25 permits the free movement of the other part-cylindrical portion 14.

60 It will be noted that the upper jaw 2 can be brought into a release position away from the cable and its companion jaw by adequately shaping the contour of each aperture 23 above the part-cylindrical or half-circular portion 14 in order to constitute for each

cam an abutment 28 engageable by the straight portion 16 of this contour in the release position. This arrangement is advantageous in that it permits the free passage of the cable in its inoperative or release position. In practice, the jaw 2 may consist of two superposed elements rigidly assembled to each other, the abutments 28 being carried by the upper element comprising in its hollow portion a recess constituting a reserve of lubricant above each cam.

The bar sections constituting the cams 11 and 12 are cut from bar stock without necessitating any additional machining step, and mounted in the corresponding apertures of levers 7 and 8 which will thus engage the bar sections along the straight portions 15 and 16 thereof, so that the levers are rigid with the cams.

The jaw 2 (or the lower element of this jaw) is cut from drawn bar stock the contour of which comprises the concavity 4 corresponding to the cable contour, the other jaw 3 being cut from U-shaped bar stock.

The clamp operation will be readily understood from the above description and may be summarized as follows: As the spring 19 tends to clamp the jaws on cable 1, if the right-hand end of this cable (figure 1) is attached to a load producing a pull towards the right, the cable will tend to pivot both pairs of levers 7 and 8 in the clockwise direction about the pivot pins 9 and 10 from the position illustrated in figure 1. As a result, the portion 13 of the cam contour will tend to rise with respect to the other portion 14 of this contour, and therefore to raise the lower jaw 3 with respect to the upper jaw 2. This action corresponds to the desired self-gripping effect.

If on the other hand no pull is exerted by the cable (for example because it is retained by another clamp) and if some control means acts upon the levers against the resistance of the compression spring 19 to pivot said levers in the counter-clockwise direction (figure 1), the grip is released and the cable can slide between the jaws.

The mechanism of the traction apparatus shown in diagrammatic side-elevational view in figure 5 comprises a main shaft 31 mounted in the casing of the apparatus (not shown in figure 5) and rigid with a lever 32 comprising two opposite or aligned arms pivotally connected to the ends of two clamp bodies 33 and 34 comprising each a set of jaws and gripping levers according to the general structure described herein above; the assembly 31—32 comprises a central aperture permitting the passage of the cable. The levers 35 and 36 corresponding in both clamps to the levers 7 of the above described form of embodiment are the clamp actuators pivoted respectively by the pins 37 and 38 to the so-called reversing control

lever 39 and also to a pair of links 40 pivoted in turn at 41 to the control lever 39. On the other hand this reversing control lever 39 is pivotally mounted between the pins 37 and 41 on a floating pin 42 adapted to be shifted by means of a so-called clutch-release lever 43 adapted to be held against motion in a projection of said casing when the effect of clutch release, i.e. the opening of both clamps, is desired.

A control lever (not shown) constituting the forward drive control lever is coupled to the shaft 31 and when it is reciprocated the two clamp bodies 33 and 34 are moved in opposite directions. When the two clamps are moved towards each other the reaction of lever 39 tends to pivot the levers of the front clamp 34 in the clockwise direction corresponding to the clamping or gripping action of the clamp and to pivot the levers of the rear clamp 33 in the release direction. Under these conditions, if the cable 1 threaded through the apparatus has a load attached to its right-hand end, as shown in the figure, this load will be pulled by the clamp 34 during the operation just described. When reversing the movement to move the clamps 33 and 34 away from each other, the clamping and release positions are reversed and the load will be again pulled in the same direction but this time by the other clamp 33.

If instead of actuating the shaft 31 the operator actuates the lever 39, it is clear that similar reversals of the gripping and release actions will take place but this time it is the clamp moving to the right that is gripped, so that this manoeuvre will permit the backward movement (towards the right as viewed in the figure) of the load attached to the cable.

Finally, if the control member 43 is pulled to the left as seen in figure 5, the two clamps are opened simultaneously, for example to permit the engagement, disengagement or the free passage of the cable through the apparatus.

The clamp bodies 33 and 34 may consist of lateral plates or shackles between which the gripping levers and the jaws are mounted as already explained herein above, but it may be added that on the pivot pins of the levers corresponding to levers 8 of figures 1 and 2 rollers 44 or shoes may be provided outside the lateral plates, these rollers or shoes travelling in longitudinal grooves formed in the case 45 of the apparatus, thus ensuring a very smooth operation of the apparatus and a perfect alignment of the jaws therein.

WHAT WE CLAIM IS:—

1. A clamp for gripping a cable comprising a clamp body, two jaws, one of which is a flat plate member whereas the other is a

U-shaped member with its side arms arranged on either side of said flat jaw in order to form, between the inner bottom of the U-shaped jaw and the edge surface of the flat jaw, a passage adapted to receive the cable and closed laterally by the side arms of the U-shaped jaw, two pairs of parallel levers, each pair comprising two levers arranged on either side of said jaws and pivoted on said clamp body, said two levers of each pair being rigid with a single transverse rod-shaped cam presenting along its whole length a contour in the form of two cam surfaces and passing through an opening of said flat jaw and openings in the side arms of said U-shaped jaw, these openings having a contour in the form of cam surfaces which co-operate with the two cam surfaces of the rod-shaped cam in order that the levers, when they pivot, cause the rod-shaped cams to move the gripping surface of one jaw to or away from the gripping surface of the other jaw whereby a cable can be evenly gripped along its whole length between the jaws.

2. A clamp as claimed in claim 1, in which said transverse rod-shaped cams are cut from bar stock having a contour consisting of two half-circular portions disposed on either side of their common diameter and straight portions coincident with said common diameter which extend outside said half-circular portions.

3. A clamp as claimed in claim 2, in which the openings formed in said jaws for the passage of each said cam comprise arcuate faces corresponding respectively to said half-circular portions of the rod's cam contours which bear against said arcuate faces for closing said jaws and gripping the cable therebetween.

4. A clamp as claimed in claim 3 in which each opening formed in any one of said jaws to permit the passage of the corresponding rod-shaped cam is so shaped as to provide abutment means for the cam in the release position, in order to hold said jaws in their open position by the action of said abutment means.

5. A clamp as claimed in claim 4 in which said flat jaw consists of two elements, namely a lower element and an upper element, said upper element comprising said abutment means and a hollow portion constituting a recess for retaining a reserve of lubricant for each cam.

6. A traction apparatus equipped with a pair of tandem clamps as claimed in any of the preceding claims, in which the clamp bodies adapted to move in opposite directions are pivoted directly to the two ends of a two-armed lever rigid with a shaft mounted in the case of the apparatus and adapted to be reciprocated, the levers for actuating the two clamps being pivoted re-

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lever 39 and also to a pair of links 40 pivoted in turn at 41 to the control lever 39. On the other hand this reversing control lever 39 is pivotally mounted between the pins 37 and 41 on a floating pin 42 adapted to be shifted by means of a so-called clutch-release lever 43 adapted to be held against motion in a projection of said casing when the effect of clutch release, i.e. the opening of both clamps, is desired.

A control lever (not shown) constituting the forward drive control lever is coupled to the shaft 31 and when it is reciprocated the two clamp bodies 33 and 34 are moved in opposite directions. When the two clamps are moved towards each other the reaction of lever 39 tends to pivot the levers of the front clamp 34 in the clockwise direction corresponding to the clamping or gripping action of the clamp and to pivot the levers of the rear clamp 33 in the release direction. Under these conditions, if the cable 1 threaded through the apparatus has a load attached to its right-hand end, as shown in the figure, this load will be pulled by the clamp 34 during the operation just described. When reversing the movement to move the clamps 33 and 34 away from each other, the clamping and release positions are reversed and the load will be again pulled in the same direction but this time by the other clamp 33.

If instead of actuating the shaft 31 the operator actuates the lever 39, it is clear that similar reversals of the gripping and release actions will take place but this time it is the clamp moving to the right that is gripped, so that this manoeuvre will permit the backward movement (towards the right as viewed in the figure) of the load attached to the cable.

Finally, if the control member 43 is pulled to the left as seen in figure 5, the two clamps are opened simultaneously, for example to permit the engagement, disengagement or the free passage of the cable through the apparatus.

The clamp bodies 33 and 34 may consist of lateral plates or shackles between which the gripping levers and the jaws are mounted as already explained herein above, but it may be added that on the pivot pins of the levers corresponding to levers 8 of figures 1 and 2 rollers 44 or shoes may be provided outside the lateral plates, these rollers or shoes travelling in longitudinal grooves formed in the case 45 of the apparatus, thus ensuring a very smooth operation of the apparatus and a perfect alignment of the jaws therein.

WHAT WE CLAIM IS:—

1. A clamp for gripping a cable comprising a clamp body, two jaws, one of which is a flat plate member whereas the other is a

U-shaped member with its side arms arranged on either side of said flat jaw in order to form, between the inner bottom of the U-shaped jaw and the edge surface of the flat jaw, a passage adapted to receive the cable and closed laterally by the side arms of the U-shaped jaw, two pairs of parallel levers, each pair comprising two levers arranged on either side of said jaws and pivoted on said clamp body, said two levers of each pair being rigid with a single transverse rod-shaped cam presenting along its whole length a contour in the form of two cam surfaces and passing through an opening of said flat jaw and openings in the side arms of said U-shaped jaw, these openings having a contour in the form of cam surfaces which co-operate with the two cam surfaces of the rod-shaped cam in order that the levers, when they pivot, cause the rod-shaped cams to move the gripping surface of one jaw to or away from the gripping surface of the other jaw whereby a cable can be evenly gripped along its whole length between the jaws.

2. A clamp as claimed in claim 1, in which said transverse rod-shaped cams are cut from bar stock having a contour consisting of two half-circular portions disposed on either side of their common diameter and straight portions coincident with said common diameter which extend outside said half-circular portions.

3. A clamp as claimed in claim 2, in which the openings formed in said jaws for the passage of each said cam comprise arcuate faces corresponding respectively to said half-circular portions of the rod's cam contours which bear against said arcuate faces for closing said jaws and gripping the cable therebetween.

4. A clamp as claimed in claim 3 in which each opening formed in any one of said jaws to permit the passage of the corresponding rod-shaped cam is so shaped as to provide abutment means for the cam in the release position, in order to hold said jaws in their open position by the action of said abutment means.

5. A clamp as claimed in claim 4 in which said flat jaw consists of two elements, namely a lower element and an upper element, said upper element comprising said abutment means and a hollow portion constituting a recess for retaining a reserve of lubricant for each cam.

6. A traction apparatus equipped with a pair of tandem clamps as claimed in any of the preceding claims, in which the clamp bodies adapted to move in opposite directions are pivoted directly to the two ends of a two-armed lever rigid with a shaft mounted in the case of the apparatus and adapted to be reciprocated, the levers for actuating the two clamps being pivoted re-



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5 spectively to a pivoting control lever and to a pair of links pivoted to said control lever, the floating fulcrum of which is disposed between the pivotal connections with the levers and the links for actuating the two clamps.

10 7. Apparatus as claimed in claim 6, in which each clamp body carries a pair of lateral opposite rollers or shoes adapted to engage corresponding guide means such as grooves or channels provided in the inner walls of the case of said apparatus.

8. A clamp for gripping a cable constructed and arranged substantially as herein-

before particularly described with reference 15 to and as illustrated in Figs. 1 to 4 of the accompanying drawings.

9. A pair of clamps arranged in tandem to form traction apparatus, constructed and arranged substantially as hereinbefore particularly described with reference to and as 20 illustrated in Figs. 5 and 6 of the accompanying drawings.

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