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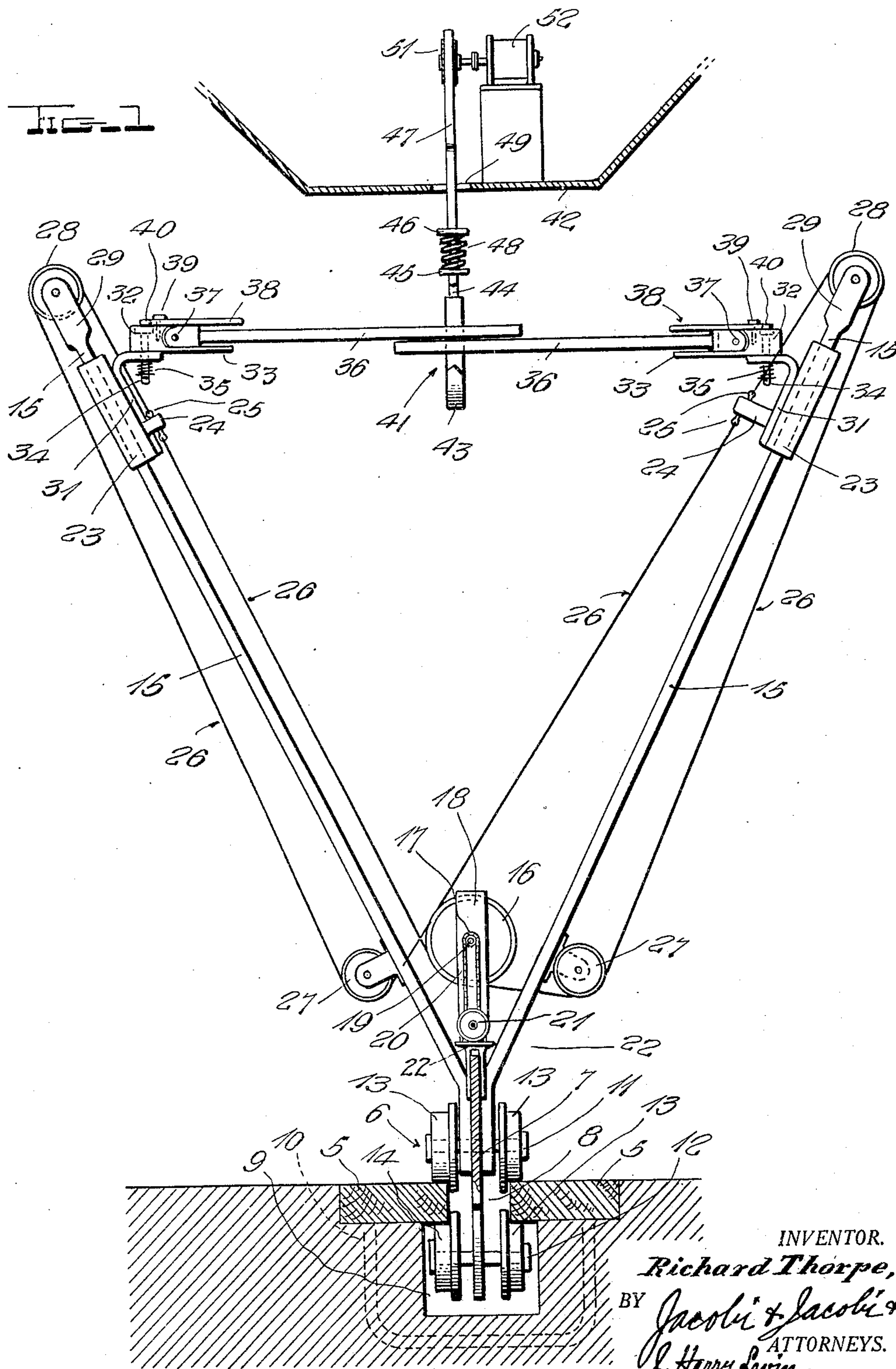
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LANDING GEAR FOR DIRIGIBLES

Filed Oct. 23, 1931

3 Sheets-Sheet 1



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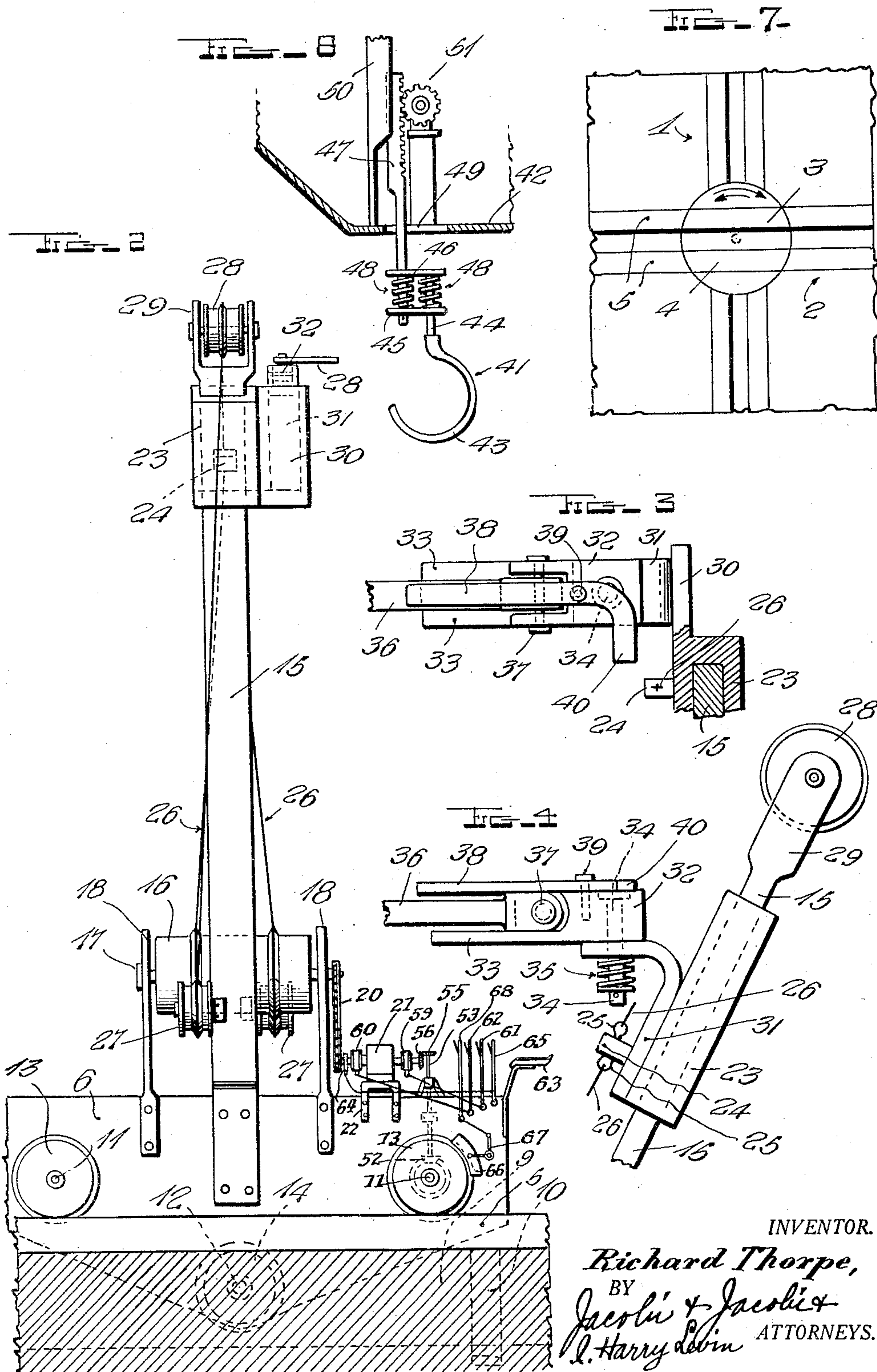
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LANDING GEAR FOR DIRIGIBLES

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3 Sheets-Sheet 2



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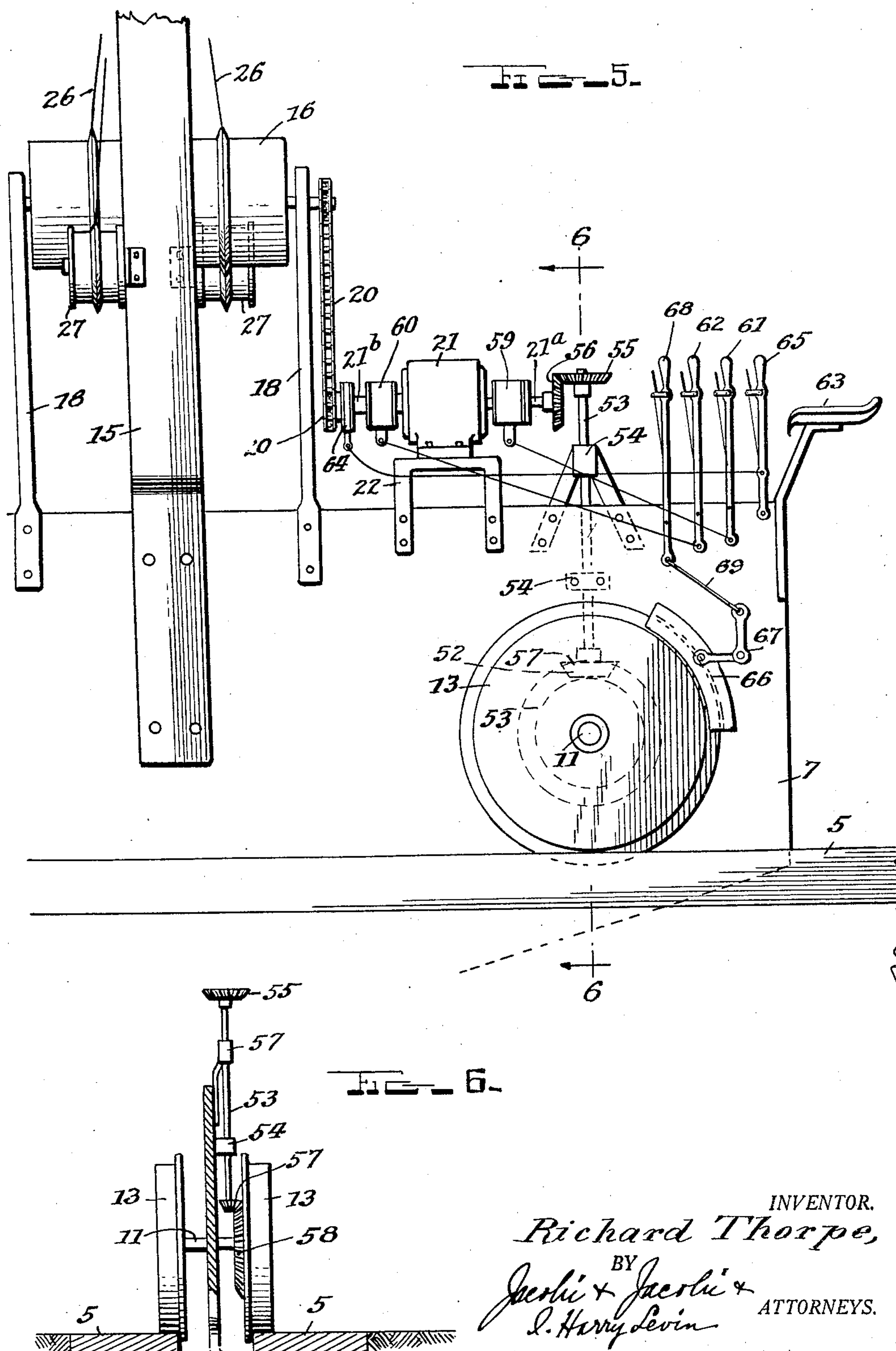
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LANDING GEAR FOR DIRIGIBLES

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3 Sheets-Sheet 3



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LANDING GEAR FOR DIRIGIBLES

Application filed October 26, 1931. Serial No. 571,207.

This invention relates to a landing gear for aircraft and more particularly to a landing gear intended for use in connection with lighter than air type of aircraft known as dirigibles.

At the present time it is customary when landing a dirigible to drop tow ropes which are to be grasped by the ground crew and the dirigible then held by these tow ropes and led into a hangar or to a mooring mast to which the dirigible is to be anchored. This has been found unsatisfactory as often the speed and momentum of the dirigible makes it difficult for the ground crew to bring the dirigible to a stop and also it often happens that even after the dirigible has been brought to a stop its buoyancy or wind of sufficient strength will cause the dirigible to break loose from the ground crew and in some cases carry members of the ground crew upwardly while holding to the tow rope to such a height before they can let go that they are liable to be killed or seriously injured when they drop to the ground.

Therefore, one object of the invention is to provide a landing gear which may be moved to a suitable position upon a landing field for engagement by a grapple extending downwardly from the gondola of the dirigible and will not only serve to bring the dirigible to a stop when engaged by the grapple but also permit the dirigible to be moved into a hangar or to a mooring mast without danger of the dirigible breaking loose.

Another object of the invention is to provide a landing gear of this type including a carriage movable along tracks laid in the landing field and having inter-communicating portions whereby the landing gear may be moved longitudinally or transversely of a landing field until it is in the best position for engagement by the grapple of the dirigible according to the direction in which wind is blowing.

Another object of the invention is to pro-

vide the landing gear with grapple-engaging means so mounted that they will normally remain in proper position for engagement by the grapple of the dirigible but have sufficient give to permit the grapple to be released in case the dirigible is moving forwardly at too high a rate of speed when the grapple engages the grapple-engaging means of the landing gear and thereby prevent breakage of the landing gear or grapple.

Another object of the invention is to so mount the grapple-engaging means of the landing gear that arms forming part of the same may be held against upward movement when engaged by a grapple and thereby prevent the dirigible from ascending but at the same time permit these arms to be released and moved upwardly to a grapple-releasing position when the dirigible is to be launched.

Another object of the invention is to provide a device of this character wherein the grapple-engaging means of the landing gear may be vertically adjusted, thereby permitting the dirigible to be drawn downwardly to such a position that passengers and crew of the dirigible may easily leave or enter a gondola.

The invention is illustrated in the accompanying drawings wherein:

Figure 1 is a view showing the landing gear in front elevation and engaged by the grapple of a dirigible, the gondola of which is partially shown in section;

Figure 2 is a side elevation of the landing gear;

Figure 3 is a fragmentary top plan view of the grapple-engaging means forming part of the landing gear;

Figure 4 is a view in elevation of the grapple-engaging means shown in Figure 3;

Figure 5 is an enlarged view showing a portion of the landing gear in side elevation;

Figure 6 is a section taken along the line 6—6 of Figure 5;

Figure 7 is a plan view of a portion of the track; and

Figure 8 is a view of the grapple with a portion of the gondola shown in section.

5 This improved landing gear is for use upon a landing field of an airport or military reservation and in order that it may be moved about the field to the most desirable position there has been provided tracks which
10 may extend longitudinally or transversely of the field. These tracks may be of any length desired and referring to Figure 5 it will be seen that the tracks which are indicated in general by the numerals 1 and
15 2 are disposed transversely of each other and intersect. At their intersection there is provided a turn-table 3 which is circular in shape and may be rotatably mounted in any desired manner in order that it may be turned
20 and cause its arcuate section 4 to extend longitudinally of the rails 5 of a selected track.

It will thus be seen that the landing gear may be moved along one track and on to the turn-table after which the turn-table may be
25 rotated until its sections 4 are disposed in operative relation to rails of the intersecting track and the landing gear then moved along the second track. Any number of tracks having intersecting portions and turn-tables
30 for the same may be provided and one track will extend into a hangar so that the dirigible may be moved into the hangar.

The landing gear includes a carriage indicated in general by the numeral 6 and having
35 a longitudinally extending main plate or body 7 which projects through the slot 8 between the rails 5 with its upper portion extending above the track and its lower portion which is tapered as shown in Figure 2, extending downwardly into the pit 9 dug in
40 the ground when laying the track. The rails 5 project toward each other from opposite sides of the pit as shown in Figure 1 and may be supported by U-shaped yokes 10 or
45 in any other desired manner: Axles 11 and 12 extend through the plate 7 and carry wheels 13 and 14 which are flanged as shown clearly in Figures 1 and 2 and bear against the rails 5, the wheels 13 resting upon the
50 upper faces of the rails and the wheels 14 having engagement with the under faces thereof. It will thus be seen that the carriage will be well supported for movement along the tracks and at the same time will be prevented
55 from moving upwardly.

Arms 15 which are formed of strong metal and diverge upwardly have their lower ends secured against opposite side faces of the plate 7 intermediate the length thereof and
60 between lower portions of these arms is disposed a drum 16 having a shaft or axle 17 rotatably mounted in brackets 18 and at one end being extended and carrying a sprocket or equivalent element 19 about which is
65 trained a sprocket chain 20 in order that

rotary motion may be transmitted to the drum from a motor 21 mounted upon a shelf or platform 22. While it has been stated that rotary motion is transmitted to the drum from the motor by means of a sprocket chain
70 and sprocket wheels it will be appreciated that any equivalent means may be substituted and also that if so desired hand operated means may be provided for rotating the drum. Each arm 15 carries a sleeve or mounting
75 23 which is slidable along the arm and carries a block 24 provided with eyes to which are attached ends of a cable 26. The cables 26 are engaged about the drum 16 and each has one end portion extending upwardly and
80 secured to the lower eye of a block 24 and its other end portion extended outwardly in engagement with a pulley or sprocket 27 and then extended upwardly to engage a pulley or sprocket 28 mounted in a harp 29 at the top
85 of the arms 15 after which the cable is extended downwardly and secured to the upper eye of the block 24. By this arrangement the sleeves or mountings 23 may be simultaneously slid along the arms 15 when the drum is
90 rotated and moved to vertically adjusted positions. Either steel cables engaged with pulleys or chains engaged with sprockets may be used and since they are flexible they will have sufficient give to permit the sleeves
95 to be slid longitudinally upon the arms without binding taking place which would prevent their movement.

Each sleeve 23 is provided with a side extension 30 to which is secured a bearing
100 bracket 31 having a horizontal portion projecting inwardly from the sleeve and arm toward each other. A block 32 having an extension 33 in the form of a flat tongue rests upon the horizontally extending portion of
105 each bracket 31 where it is held by a pivot pin 34 which passes through the block and bearing bracket and has its projecting lower portion encircled by a spring 35 serving to yieldably resist rotation of the block in
110 one direction. It will thus be seen that the block and their extensions 33 will be normally held in facing relation to each other but may be swung from a position transversely of the carriage towards a position
115 longitudinally thereof. Grapple-engaging arms 36 have their outer ends pivoted to the blocks as shown at 37 so that they may swing vertically from a horizontal position in which they rest upon the extensions 33 toward a
120 raised position and these arms are of such length that their free inner end portions extend in overlapping relation to each other. In order to retain the arms 36 in a horizontal position there has been provided latches 38
125 which are pivoted to the blocks 32 as shown at 39 and each consist of a short bar having its outer end portion bent to form a handle 40 which projects transversely from one side of the block as shown in Figure 3. By grasp- 130

ing the handle the latch may be swung about its pivot out of overlying relation to the grapple-engaging bar 36 with which it co-operates and by so doing the two grapple-engaging bars will be released and may be moved upwardly to a grapple-releasing position.

In order that a dirigible may be engaged with the landing gear there has been provided a grapple 41 carried by the gondola 42. This grapple includes a hook 43 having its shank 44 engaged through plates 45 and 46 which also receive the lower end portion of a rack bar 47 and springs 48 are disposed between the plates 45 and 46 about the shank 44 and lower portion of the rack bar in order to absorb shock when the hook engages the overlapped inner end portions of the grapple-engaging arms 36. The rack bar 47 extends vertically through an opening 49 formed in the bottom of the gondola and has its toothed upper portion slidably engaged with a guide 50 and its teeth meshing with a gear or pinion 51 carried by the shaft of a motor 52 although the pinion may be mounted upon a shaft having any suitable means for rotating it in order that the rack bar may be shifted vertically and thereby adjust the distance between the gondola and the hook 43. Therefore the hook of the grapple may be disposed a desired distance beneath the gondola and it may be vertically adjusted as the dirigible approaches the landing device and engagement of the hook with the grapple-engaging bars facilitated.

The carriage is to be propelled along the track by the motor 21 and in order to do so there has been provided a shaft 53 disposed vertically and rotatably mounted in bearings 54 with its upper end extending upwardly and carrying a pinion 55 meshing with a pinion 56 upon the shaft of the motor. The lower end of the shaft 53 carries a pinion or gear 57 meshing with a gear ring or disk 58 fixed to the adjacent axle 11 and therefore, rotary motion may be transmitted to this axle and the landing gear moved along the track.

The shaft of the motor has freely rotatable end sections 21a and 21b carrying the gear 56 and the lower sprocket 20a for the chain 20 and in order to control rotation of these shaft sections and the direction in which they rotate, there has been provided clutches 59 and 60 which are movable from a neutral position to a position to effect rotation of the shaft sections in either direction desired by means of latch levers 61 and 62 and pivoted to the plate 7 in front of the driver's seat 63. By this arrangement, the landing gear may be moved either forwardly or rearwardly along a track and the drum 16 may be rotated to shift the sleeves 23 either upwardly or downwardly upon the arms 15. A brake 64 controlled by a lever 65 is provided in order

to prevent rotation of the shaft section 21b and drum 16 and hold the sleeves 23 in a lowered position when a dirigible has been landed and in order to retain the landing gear stationary upon the track there has been provided a brake shoe 66 carried by a bell crank 67, one arm of which is connected to an operating lever 68 by a link 69. Electric energy for the motor will be supplied from any source desired or the motor may be of the internal combustion type.

When this landing gear is in use it is moved along the track to a position in which a dirigible may be conveniently landed and care should be taken to have the carriage upon a track extending substantially longitudinally of the direction in which wind is blowing. The sleeves 23 are moved upwardly to a raised position as shown in Figure 1 and the grapple-engaging arms 36 extend towards each other with their free ends overlapping. When the dirigible makes its landing it heads into the wind and power is shut-off so that it moves forwardly at a relatively slow rate of speed. As the dirigible reaches the landing device the hook 43 of the grapple which faces the landing device as shown in Figure 2 will engage the overlapped free end portions of the arms 36 and assuming that the momentum is not too great the dirigible will be brought to a stop and will remain above the landing device. If, however, the momentum is too great the force instead of breaking the grapple or portions of the landing gear will cause the arms 36 and block 32 to swing forwardly with the pins 34 acting as pivots and as soon as the hook is moved out of engagement with the arms 36, these arms will return to their normal position. The dirigible may then be again brought into position to engage the grapple-engaging arms. As soon as the grapple has engaged the arms 36, and the dirigible brought to a stop the motor 21 may be started to rotate the drum 16 and impart movement to the cable 26 to move the sleeves downwardly. These sleeves move downwardly simultaneously and since the overlapped end portions of the grapple-engaging arms are free these arms and their mountings may have movement toward each other as the sleeves approach the lower ends of the arms 15. Downward movement of the grapple-engaging arms and their mountings will cause pull to be exerted upon the hook 43 of the grapple and the dirigible will be drawn downwardly toward the ground until its gondola is disposed between the arms 15 of the landing gear and the arms may then serve to brace the gondola against transverse movement.

By moving the gondola downwardly into a position in which it rests between the arms 15 it will not only be held against transverse tilting or shifting but also it will be disposed close enough to the ground for the crew and

passengers to alight and others to conveniently enter the gondola. After the dirigible has been engaged with the grapple-engaging arms and moved downwardly between the arms 15, the carriage may be moved forwardly along the track upon which it rests and directly into a hangar or to a mooring mast or when it reaches a turn-table 3, the turn-table may be rotated in order to permit the carriage to move along an intersecting track on its way to the hangar. If only a temporary stop is being made it will be understood that the dirigible may be left anchored to the landing apparatus. When the dirigible is to resume its journey the motor 21 is again started in order to rotate the drum and cause the sleeves to move upwardly and return to the position shown in Figure 1. The latch bars 38 may be swung from the operative position shown in Figures 3 and 4 to a position in which they extend transversely of the block 32 either before or after the sleeves are moved upwardly. When the latches are so moved the grapple-engaging arms will be permitted to swing upwardly and the dirigible may therefore move upwardly and the bill of the hook by engaging the arms 36 will cause them to swing upwardly until the grapple is released. The arms will then again return to a horizontal position and the latches may be moved to an operative position in which they will prevent upward movement of the grapple-engaging arms. The landing gear will then be again ready for use.

I have therefore provided a landing gear by means of which a dirigible may be easily and safely brought to a stop and either temporarily anchored upon a landing field or moved into a hangar.

From the foregoing description of the construction of my improved invention the operation thereof and the method of applying the same to use will be readily understood. It will be seen that I have provided a simple, inexpensive and efficient means for carrying out the objects of the invention.

While I have particularly described the elements best adapted to perform the functions set forth, it is obvious that various changes in form, proportion and in the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the principles of the invention.

Having thus described the invention what is claimed is:

1. Landing gear for dirigibles comprising a carriage movable along a landing field, mountings above said carriage, grapple-engaging arms connected with said mountings and movable horizontally into and out of a grapple-engaging position, and means to yieldably hold the arms against movement towards a releasing position.

2. Landing gear for dirigibles comprising a carriage movable along a track upon a land-

ing field, mountings above said carriage, and grapple-engaging arms connected with said mountings and pivotally mounted for swinging movement horizontally and vertically into and out of a grapple-engaging position.

3. Landing gear for dirigibles comprising a carriage movable along a track upon a landing field, mountings above said carriage, and grapple-engaging arms connected with said mountings and pivotally mounted for swinging movement horizontally and vertically into and out of a grapple-engaging position, means being provided to normally retain the arms in a grapple-engaging position.

4. Landing gear for dirigibles comprising a carriage movable along a track upon a landing field, mountings above said carriage, and grapple-engaging arms connected with said mountings and pivotally mounted for swinging movement horizontally and vertically into and out of a grapple-engaging position, means being provided to yieldably resist movement of the arms in one direction in a horizontal plane, and means to releasably secure upward movement of the arms in a vertical plane.

5. Landing gear for dirigibles comprising a carriage movable along a track upon a landing field, arms extending upwardly from said carriage and diverging transversely thereof, mountings slidable upon said arms, means to move said mountings along the arms and hold the same in vertically adjusted positions thereon, and grapple-engaging arms between the mountings having their inner end portions free and overlapping and their outer end portions pivotally connected with the mountings whereby the arms may swing vertically and horizontally into and out of an overlapped grapple-engaging position.

6. Landing gear for dirigibles comprising a carriage movable along a track upon a landing field, arms extending upwardly from said carriage and diverging transversely thereof, mountings slidable upon said arms, means to move said mountings along the arms and hold the same in vertically adjusted positions thereon, grapple-engaging arms extending towards each other between the mountings with free inner ends overlapped, and blocks pivoted to said mountings for swinging movement in a horizontal plane and pivoted to the grapple-engaging arms to mount the same for swinging movement in a vertical plane.

7. Landing gear for dirigibles comprising a carriage movable along a track upon a landing field, arms extending upwardly from said carriage and diverging transversely thereof, mountings slidable upon said arms, means to move said mountings along the arms and hold the same in vertically adjusted positions thereon, grapple-engaging arms extending towards each other between the

mountings with free inner ends overlapped, brackets carried by said mountings and having horizontal portions projecting inwardly from the same, blocks resting upon the horizontal portions of said brackets, pins extending through said blocks and brackets to pivotally mount the blocks for swinging movement in a horizontal plane, said blocks being pivoted to the grapple-engaging arms to mount the same for swinging movement in a vertical plane, portions of the blocks extending beneath the grapple-engaging arms to limit downward movement thereof, latches carried by said blocks and movable into and out of position to overlap the grapple-engaging arms and releasably prevent upward movement thereof to a grapple-releasing position and springs engaging said pins to resist rotation thereof and yieldably prevent swinging of the blocks and grapple-engaging arms in a horizontal plane to a grapple-releasing position.

8. Landing gear for dirigibles comprising a carriage movable along a track upon a landing field, arms extending upwardly from said carriage and diverging transversely thereof, mountings slidable upon said arms, grapple-engaging means between the mountings having their outer end portions connected with the mountings and movable into and out of a grapple-engaging position, a drum rotatably mounted, and cables engaged about said drum and having their ends secured to said mountings to shift the mountings along the diverging arms when the drum is rotated.

9. Landing gear for dirigibles comprising a carriage movable along a track, mountings above said carriage and grapple-engaging means carried by said mountings, said means being movable horizontally and vertically from a grapple-engaging position to a grapple-releasing position and yieldably held against horizontal movement to a releasing position and releasably held against vertical movement to a releasing position.

10. Landing gear for dirigibles comprising a carriage movable along a track, mountings above said carriage, and grapple-engaging means carried by said mountings, said means being movable horizontally to a grapple-releasing position and yieldably held against such movement whereby a dirigible approaching the landing gear at too great a speed may be released without damaging the landing gear.

11. Landing gear for dirigibles comprising a carriage movable along a track, mountings above said carriage, and grapple-engaging bars pivotally connected with said mountings for swinging movement vertically and horizontally to a grapple-releasing position, said bars having their inner end portions free and overlapping when in a grapple-engaging position, and a grapple adapted to be connected with a dirigible and ex-

tend downwardly therefrom, said grapple having a hook at its lower end to engage overlapping end portions of said bars.

12. Landing gear for dirigibles comprising a carriage movable along a track, mountings above said carriage, and grapple-engaging bars pivotally connected with said mountings for swinging movement vertically and horizontally to a grapple-releasing position, said bars having their inner end portions free and overlapping when in a grapple-engaging position, and a grapple adapted to be connected with a dirigible and consisting of a vertically disposed rack bar to extend through an opening in a gondola, means to vertically adjust said rack bar, and a hook connected with said rack bar in depending relation thereto and disposed to engage overlapping portions of the grapple-engaging bars.

13. Landing gear for dirigibles comprising a carriage movable along a track, mountings above said carriage, and grapple-engaging bars pivotally connected with said mountings for swinging movement vertically and horizontally to a grapple-releasing position, said bars having their inner end portions free and overlapping when in a grapple-engaging position, and a grapple adapted to be connected with a dirigible and consisting of a vertically disposed rack bar to extend through an opening in a gondola, means to vertically adjust said rack bar, a hook to engage the grapple-engaging bars having a shank overlapping the lower end portion of said rack bar, plates connecting the shank and rack bar, and springs between said plates serving as shock absorbers.

14. Landing gear for a dirigible comprising a carriage movable along a landing field, arms extending upwardly from said carriage and diverging upwardly, mountings slidable upon said arms, grapple engaging means between said arms and connected with said mountings for movement into and out of a grapple engaging position, means to control movement of the grapple engaging means to releasing position, and means to shift said mountings along said arms to vertically adjusted positions.

15. Landing gear for dirigibles comprising a carriage, and grapple engaging means above said carriage, said means being movable horizontally to a grapple releasing position and yieldably held against such movement whereby a dirigible approaching said landing gear at too great a speed may be released without damaging the latter.

16. Landing gear for dirigibles including grapple engaging means movable horizontally to a grapple releasing position and yieldably held against such movement whereby a dirigible approaching said landing gear at too great speed may be released without damaging the latter.

17. Landing gear for dirigibles including
grapple engaging means movable horizontal-
ly and vertically to grapple releasing posi-
tions, means yieldably resisting horizontal
5 movement of the grapple engaging means to
a releasing position, and means to releas-
ably hold the grapple engaging means
against vertical movement to a releasing
position.

10 In testimony whereof I affix my signature.

RICHARD THORPE.

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