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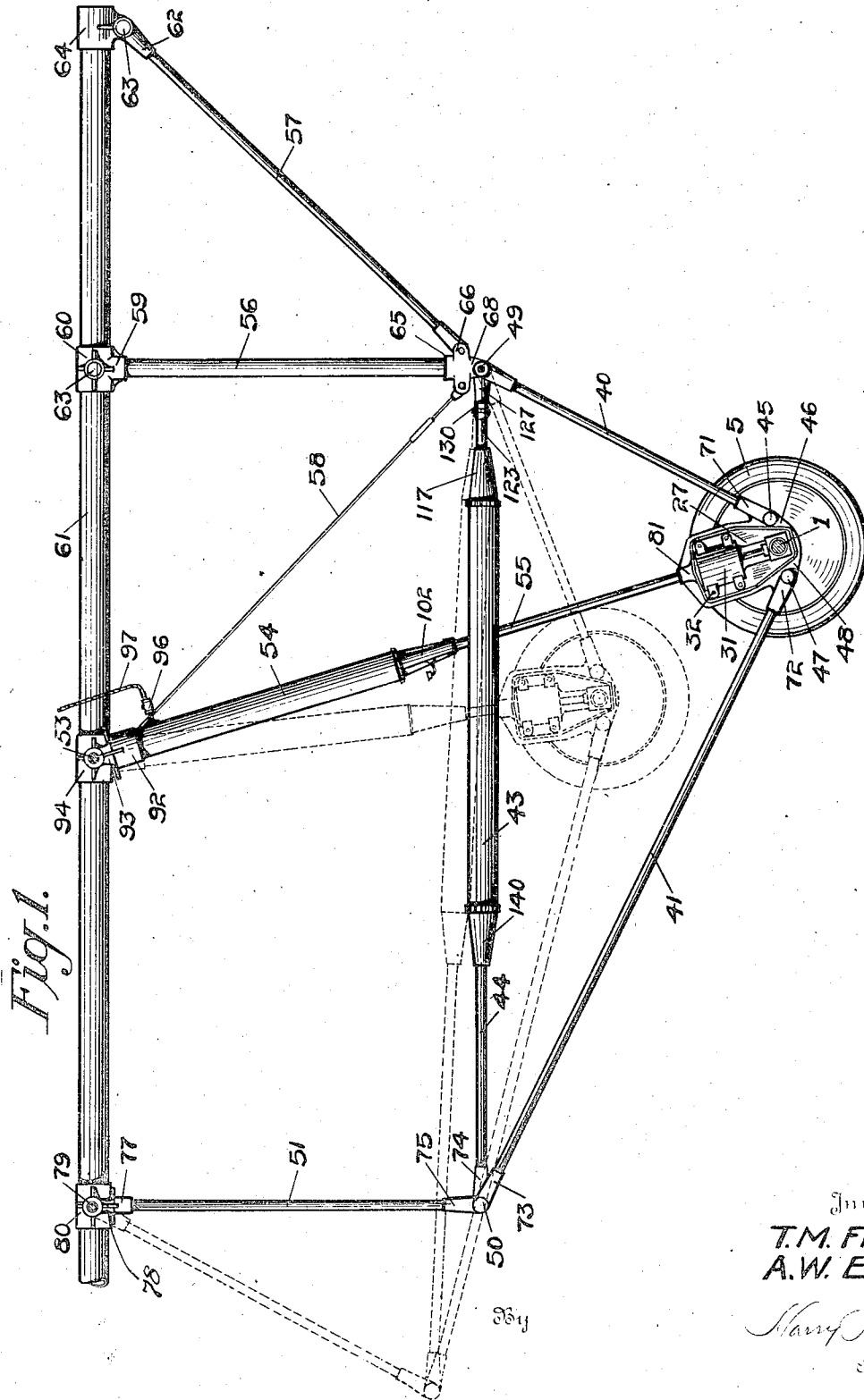
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T. M. FINLEY ET AL

LANDING GEAR FOR FLYING MACHINES

Filed Sept. 9. 1920

9 Sheets-Sheet 1



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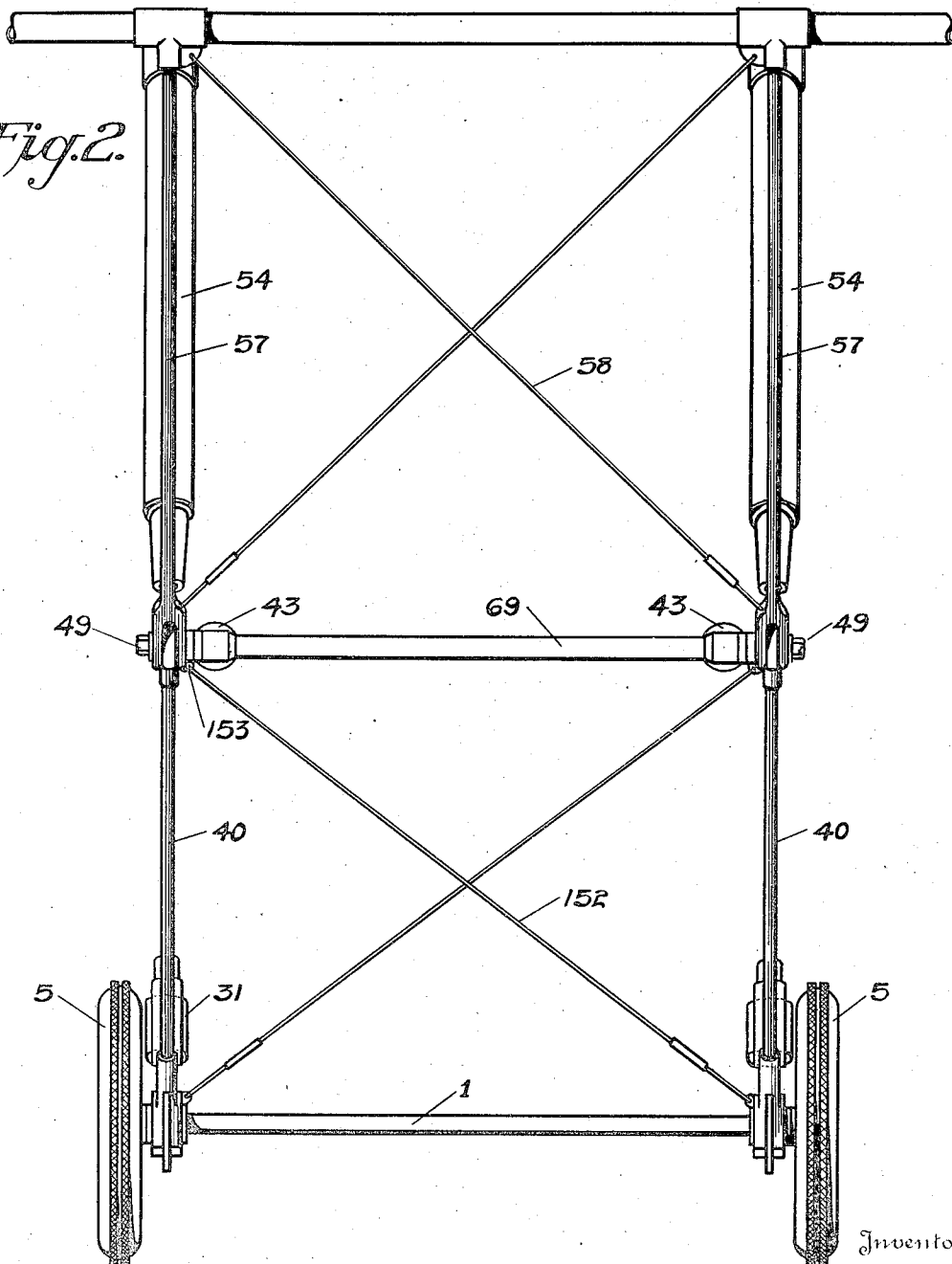
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LANDING GEAR FOR FLYING MACHINES

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Fig. 2.



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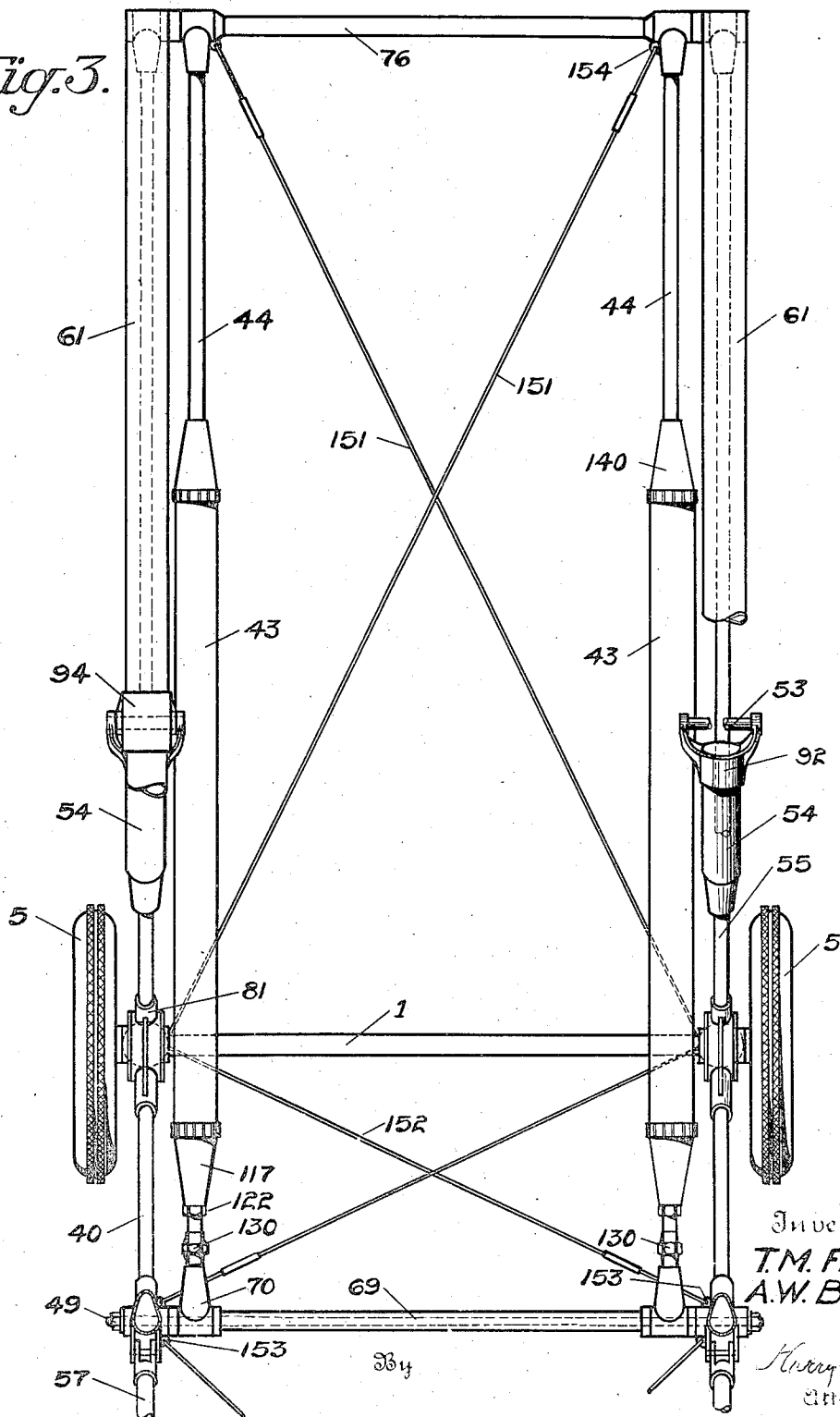
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LANDING GEAR FOR FLYING MACHINES

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Fig. 3.



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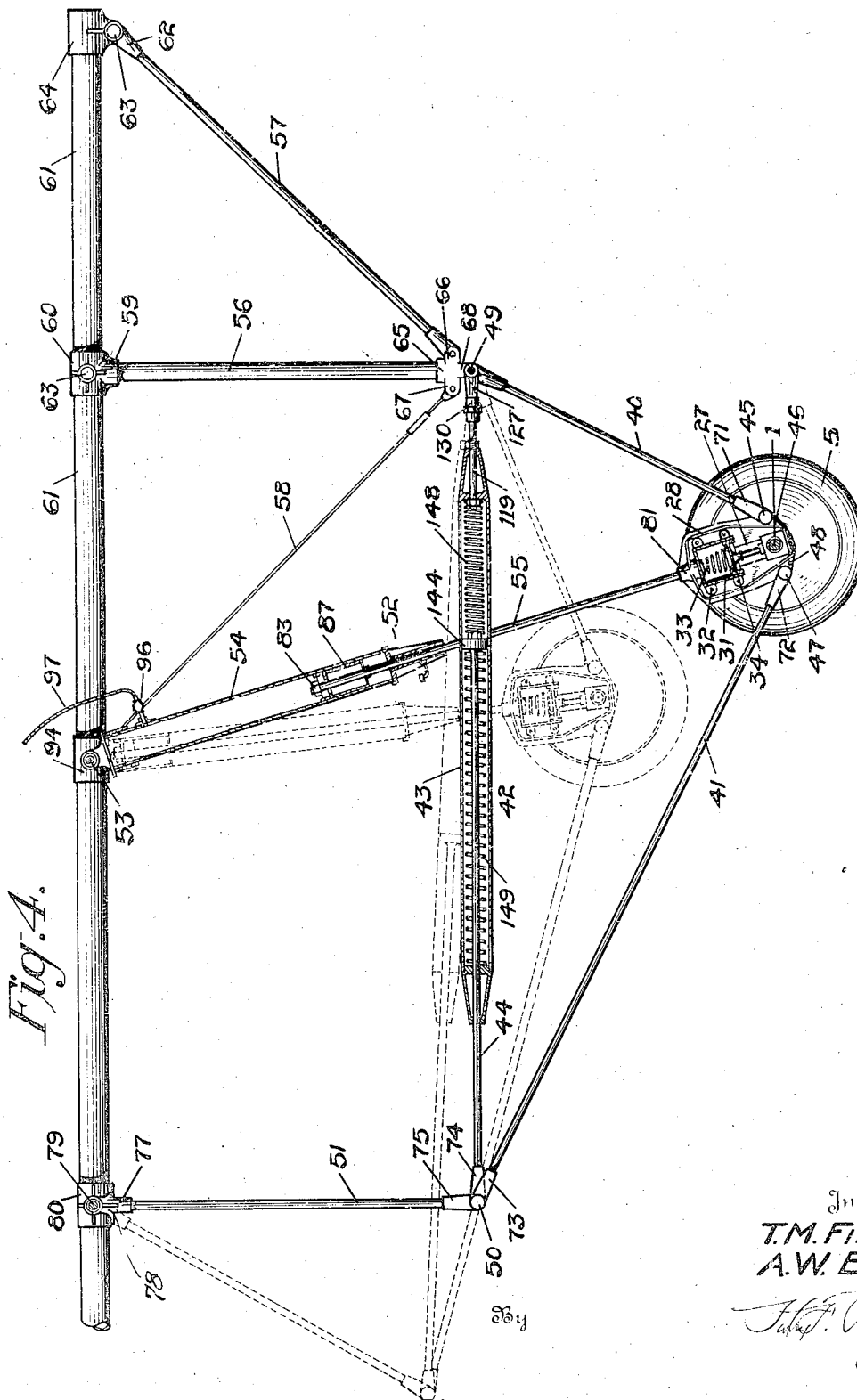
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9 Sheets-Sheet 4



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LANDING GEAR FOR FLYING MACHINES

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Fig. 5.

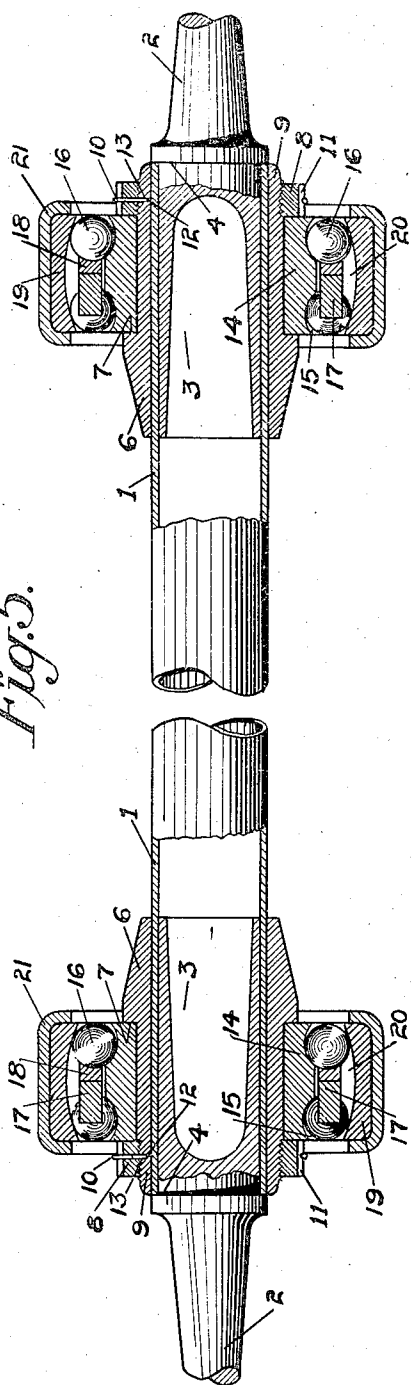
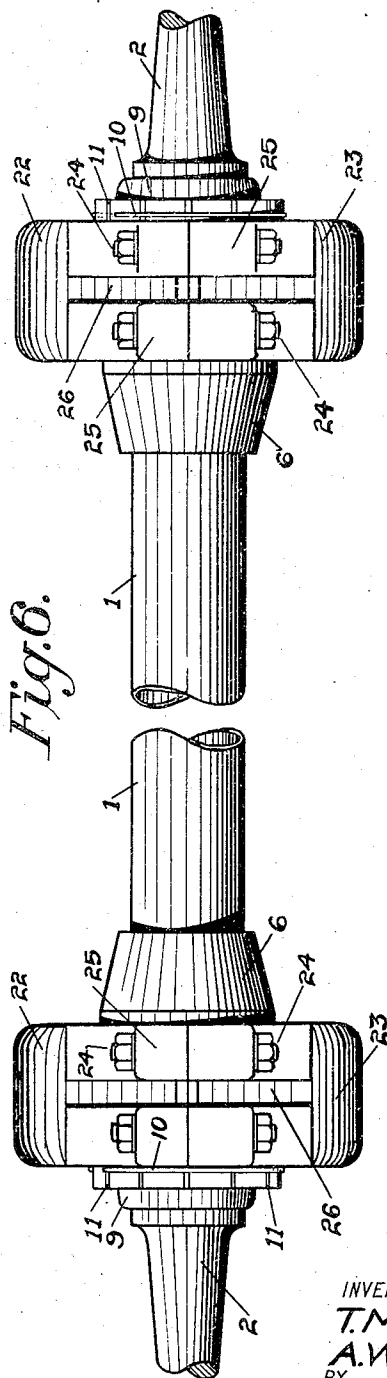


Fig. 6.



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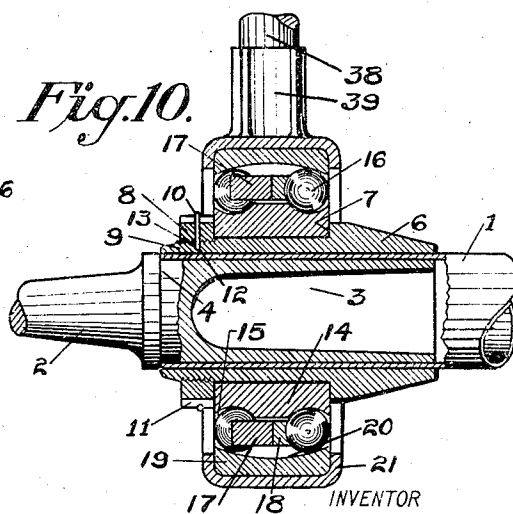
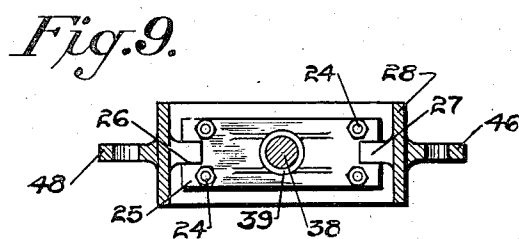
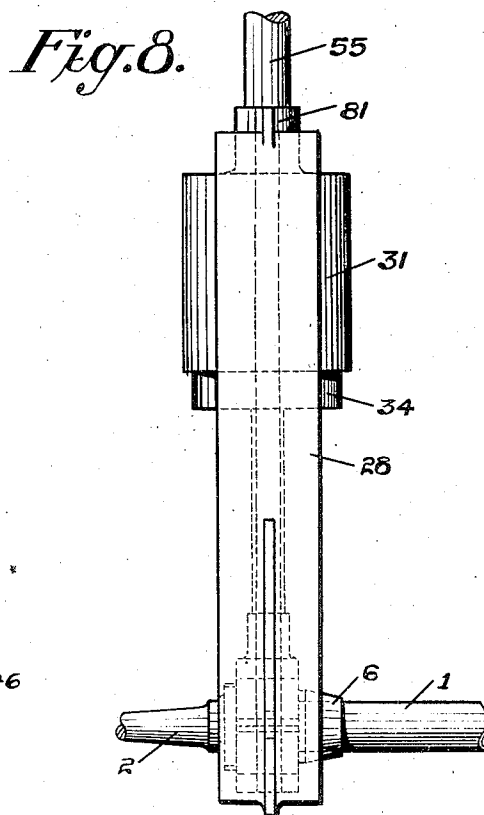
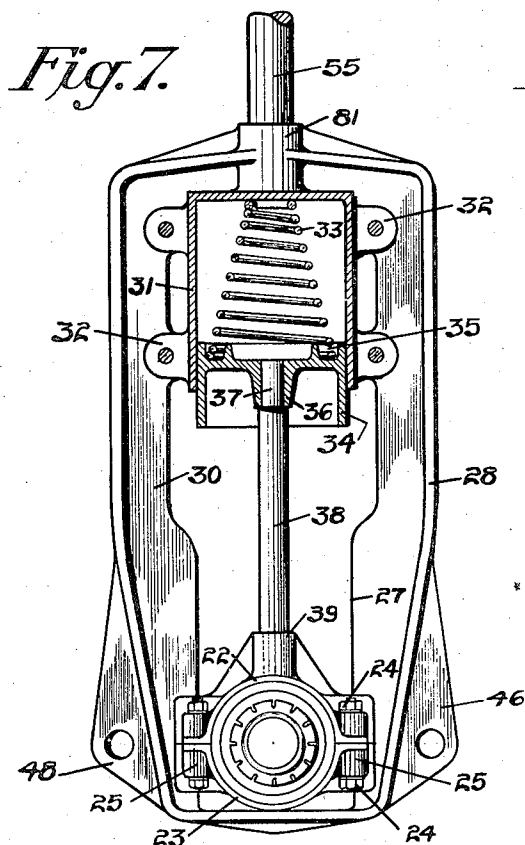
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Fig.11.

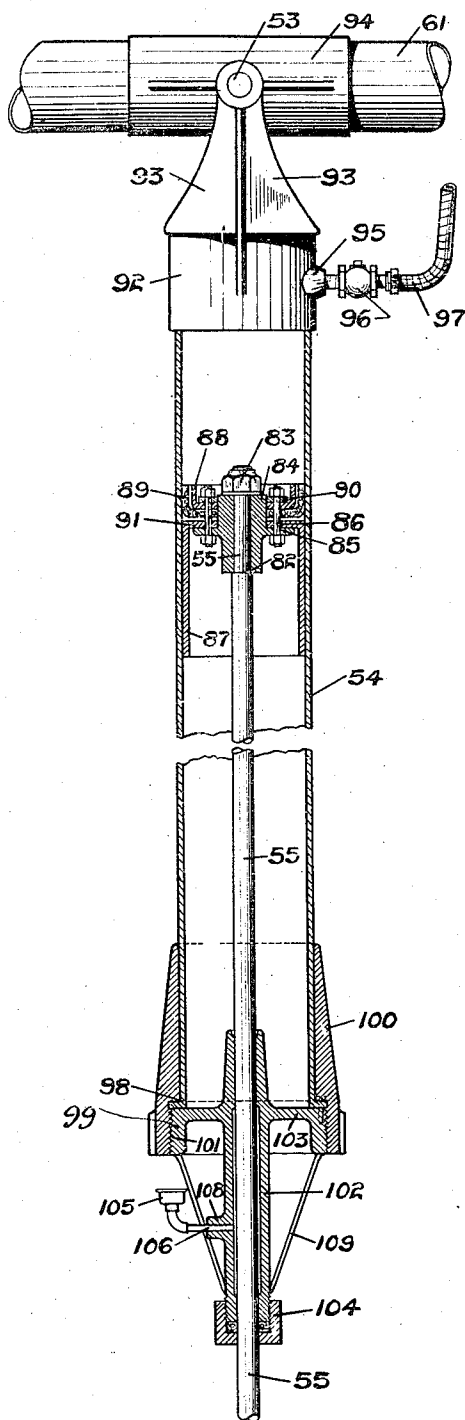


Fig.12.

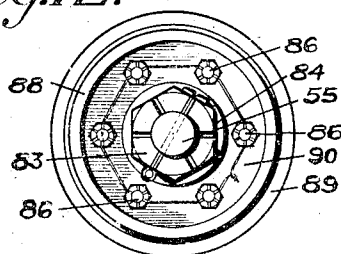


Fig.13.

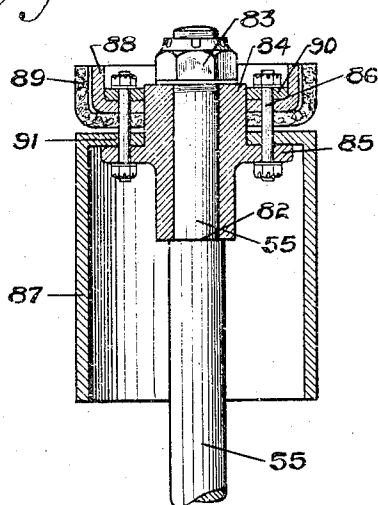
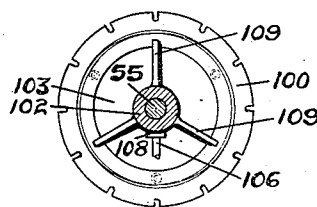


Fig.14.



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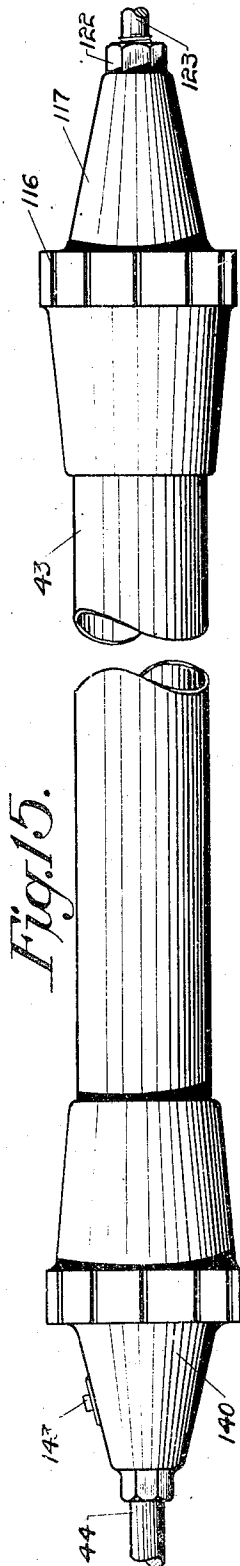


Fig. 15.

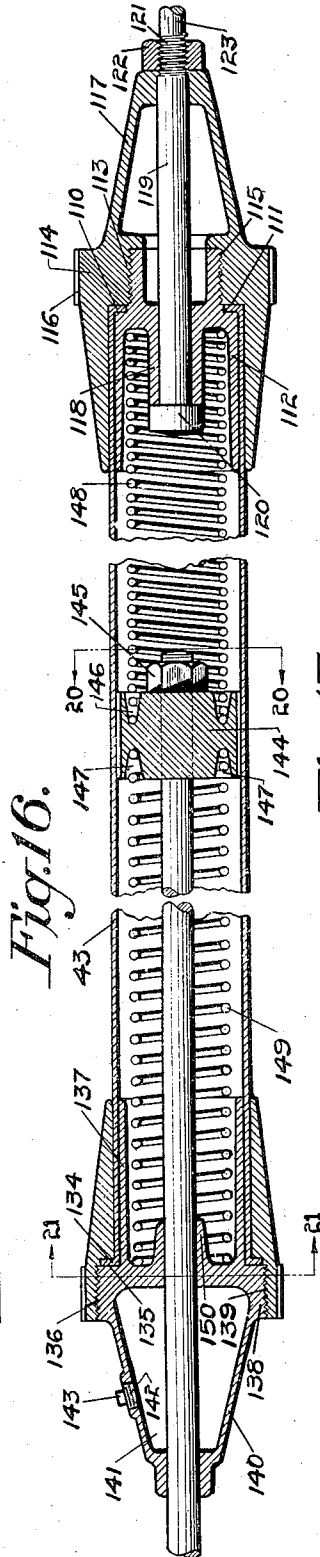


Fig. 16.

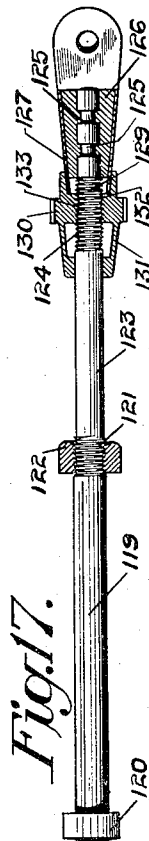


Fig. 17.

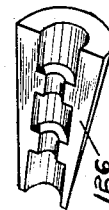
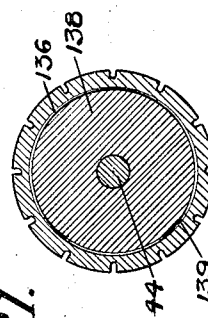


Fig. 18.

Fig. 19.



Fig. 21.



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Fig.22.

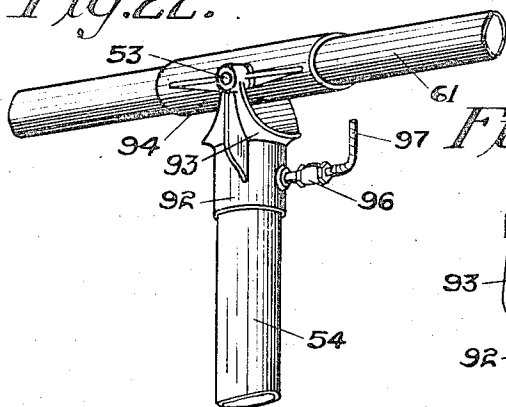


Fig.24.

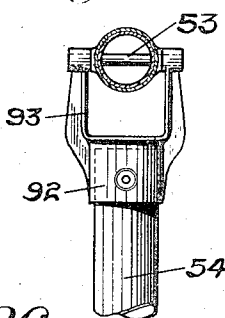


Fig.23.

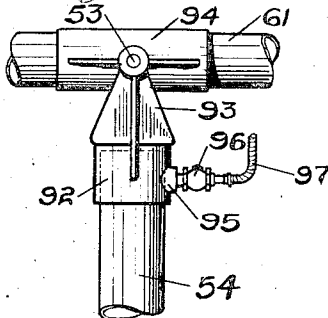


Fig.25.

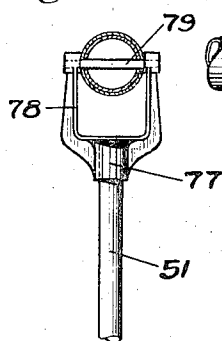


Fig.26.

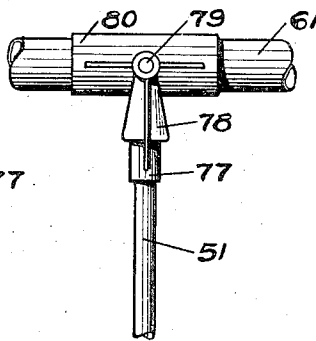


Fig.27.

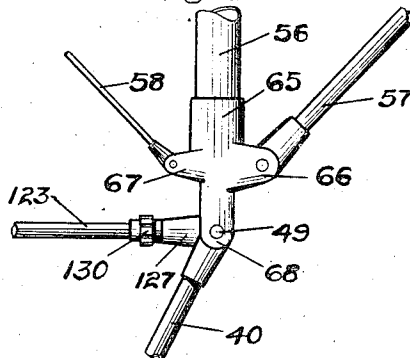
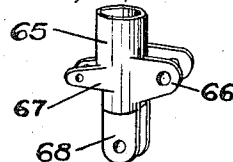


Fig.28.



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UNITED STATES PATENT OFFICE.

THOMAS MILTON FINLEY AND ALLEN W. BROWN, OF ST. LOUIS, MISSOURI.

LANDING GEAR FOR FLYING MACHINES.

Application filed September 9, 1920. Serial No. 409,160.

To all whom it may concern:

Be it known that THOMAS M. FINLEY and ALLEN W. BROWN, citizens of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Landing Gears for Flying Machines, of which the following is a specification.

The invention relates to a landing gear for flying machines.

The object of the present invention is to provide a simple, practical and efficient landing gear of strong, durable and inexpensive construction designed for use on various types of flying machines, either aeroplane or dirigible type, and capable of absorbing and dissipating the shocks incident to the landing of a machine of either type, whereby injury to the plane or machine, or the engine, their machinery and instruments carried by the same, will be prevented.

A further object of the invention is to provide a landing gear of this character equipped with both resilient and pneumatic cushioning means and capable of automatically yielding to the shocks without injury to it.

As the wheels of a landing gear strike the ground in landing, there are two main shocks to be taken care of, the first being what may be called the initial impact or hammer blow caused by contact of the wheels with the surface of the earth. This, in the ordinary plane, is taken care of in various ways. A pneumatic tire takes care of part of it and in such instances, it is taken care of by rubber bands and in others by springs, but if the blow is of such force that there is more than the initial impact or hammer blow, then you have the entire weight of the machine falling on the landing gear, which condition must be taken care of as more injury will result therefrom than from the first impact.

In case a machine is too heavily loaded to rebound in the air through the action of its cushioning means, then the chassis will break through the fuselage causing a dangerous and expensive wreck. In case of an initial impact involving its hammer blow effect, the present invention takes care of it more efficiently than heretofore by virtue of the frame work of the landing gear having a yielding swinging movement in addition to resilient and pneumatic means for taking

care of the force of the initial impact or hammer blow. This yielding or swinging movement of the frame work of the landing gear besides assisting and relieving the machine of the force of the impact also operates to keep the machine from going back into the air out of control.

It is also an object of the invention to provide a landing gear adapted to adjust itself to the surface of the earth and prevent the wings of an aeroplane from striking the ground and capable also of adjusting itself to irregularities of the earth's surface or to sloping ground or the like, and enable the machine to land in a horizontal or upright position without anything but the landing gear attacking with the ground.

With these and other objects in view, the invention consists in the construction and novel combination of parts hereinafter fully described, illustrated in the accompanying drawings and pointed out in the claims here-to appended, it being understood that various changes in the form, proportion, size and minor details of construction, within the scope of the appended claims, may be resorted to without departing from the spirit of the invention or sacrificing any of the advantages thereof.

In the accompanying drawings, in which like numerals of reference designate corresponding parts in the several figures:

Figure 1 is a side elevation of a landing gear constructed in accordance with this invention.

Figure 2 is a front elevation of the same.

Figure 3 is a plan view of the landing gear, parts of the supporting frame work being broken away.

Figure 4 is a longitudinal sectional view of the landing gear.

Figure 5 is a longitudinal sectional view of the axle.

Figure 6 is a side elevation of the same.

Figure 7 is a side elevation partly in section illustrating the construction of the axle guiding frame and the spring cushioning means.

Figure 8 is an edge view of the axle guiding frame and a portion of the axle.

Figure 9 is a detail sectional view through the guiding frame partly in plan view.

Figure 10 is a detail sectional view of one end of the axle, the section being taken in a plane at right angles to Figure 5.

Figure 11 is a sectional view through the cylinder and piston of the pneumatic cushioning means.

Figure 12 is an end view of the piston of the pneumatic cushioning means.

Figure 13 is a longitudinal sectional view of the same.

Figure 14 is a transverse sectional view partly in elevation of one end of the cylinder of the pneumatic cushioning means.

Figure 15 is a side elevation of the longitudinal cushioning connecting member.

Figure 16 is a longitudinal sectional view of the same.

Figures 17 to 19 are detail views illustrating the construction of one of the rods of the longitudinal cushioning connecting member and the coupling means for the outer end of the same.

Figure 20 is a detail sectional view on the line 20—20 of Figure 16.

Figure 21 is a detail sectional view on line 21—21 of Figure 16.

Figure 22 is a detail perspective view illustrating the means for pivotally mounting the upper end of the cylinder to the frame work of a machine.

Figure 23 is a side elevation of the same.

Figure 24 is an end view of the same.

Figures 25 and 26 are detail views illustrating the manner of pivotally mounting the rear hanger member.

Figure 27 is a detail side view illustrating the construction of the couplings of the lower end of the rigid front hanger.

Figure 28 is a detail perspective view of one of the couplings of the rigid front hanger.

In the accompanying drawings, we have illustrated one embodiment of the invention while the claims define the actual scope of the same. The landing gear which is designed primarily for use in connection with the flying machines of our copending applications, is adapted for use on various types of flying machines, either dirigible or of the aeroplane type and it is equipped with an axle comprising a tubular body 1 constructed of cold rolled steel tubing or other suitable material and spindles 2 having hollow shanks 3 suitably secured within the terminal portions of the tubular body which fits against shoulders 4 formed at the inner ends of the wall receiving portions of the spindles.

The wheels 5 are designed to be set rigidly on the spindles and secured to the same by suitable fastening means.

Mounted on the ends of the tubular body portion of the axle are sleeves 6 designed to be sweated on or otherwise secured to the said body portion and provided with enlarged inner portions forming shoulders 7 to receive ball bearings which are secured on the sleeves 6 by nuts 8 mounted on

threaded outer portions 9 of the sleeves 6 and secured in their adjusted positions by locking springs 10. The nuts 8 which may be of any desired construction and which may be locked on the threaded portions of the sleeve by any suitable means, are provided with notches 11 adapted to receive a spanner or other suitable tool for enabling the nuts to be rotated. The locking springs 10 have terminal portions 12 which pierce the nuts and engage suitable perforations or sockets 13 of the sleeves 6. The spring may be readily disengaged from the sleeves when it is desired to adjust the nuts.

Each ball bearing comprises an inner bearing ring 14 fitted on the sleeve 6 and held between the shoulders 7 and the nut 8 and provided in its periphery with annular grooves 15 spaced apart and receiving anti-friction balls 16 arranged in staggered relation and maintained in proper spaced position with relation to one another by means of a recessed spacing or cage ring 17. The space ring or member 17 is provided in its side edges with recesses 18 to receive the balls and the said recesses 18 present to the balls curved faces which are arranged in the arc of the curvature of the grooves or faces 15 of the inner bearing ring 14. The anti-friction balls are engaged at their outer portions by an outer bearing ring 19 having an inner concave face 20 extending entirely across the inner periphery of the bearing ring or member 19. The outer bearing ring or member 19 is arranged within a sectional housing or casing 21 composed of upper and lower sections 22 and 23 secured together by bolts 24 arranged in pairs as shown. The upper and lower sections of the casing or housing are provided with lateral projections 25 which are pierced by the said bolts 24 and which are spaced apart to provide intervening recesses 26 to receive guide flanges 27 of an axle guiding frame or pedestal 28. The section or housing enables the parts or members of the ball bearings to be readily assembled and slidably connect the axle with the guiding frames or pedestals 28.

The axle guiding frame or pedestal is preferably constructed of a single piece of metal but while it may consist of a casting as shown, it may be constructed in any other desired manner as will be readily understood and it is composed of sides and upper and lower connecting end portions and is of substantially oblong form as clearly shown in Figure 7. The sides are provided at their lower portions with the guiding flanges 27 which form the lower portions of reinforcing webs 30 to the upper portions of which is secured a cylinder 31 of a dash pot cushion. The cylinder 31 is provided at opposite sides with spaced lugs or ears 32 which are bolted or otherwise se-

cured to the webs or flanges 30 and the said cylinder which is inverted houses a conical coiled spring 33 interposed between the upper wall of the cylinder and the piston 34. The piston 34 which is provided at its upper end with a groove 35 to receive the lower base portion of the tapered coil spring 33 is also provided at its center with a depending socket 36 receiving the reduced upper end 37 of a piston rod or stem 38, which has its lower end bolted or otherwise secured in a socket 39 formed integral with the upper section of the housing or casing of the ball bearing of the axle. While the conical spring is shown in the dash pot cylinder, any other yieldable cushioning means may of course be employed and the cushioning means is a compound cushioning means in that the spring is not only compressed but air is also compressed on the inward or upward movement of the piston 34.

The wheels 5 which may be of any desired construction are equipped with pneumatic tires as shown and the axle is mounted at the lower angles of yieldable triangular side frames adapted to yield longitudinally of the landing gear in the cushioning action and the adjustment of the same. Each yieldable side frame comprises in its construction a front inclined link member 40, a rear inclined link member 41 and a top longitudinally disposed cushioning connecting member composed of relatively slidable telescoping sections 43 and 44 consisting respectively of a tube or cylinder and a rod or piston as herein fully explained. The lower end of the inclined link 40 is connected by a suitable pivot 45 with a front exterior web or flange 46 of the axle guiding frame and the rear inclined link member 41 is connected by a suitable pivot 47 with a rear web or flange 48 of the axle guiding frame. The axle guiding frame is also flanged at the top and bottom and the exterior webs or flanges increase the strength of the structure as will be readily understood. The upper end of the front inclined link member is connected by a suitable pivot 49 with a front depending fixed hanger to which the front end of the top longitudinal connecting cushion member 42 is also connected by the said pivot 49. The upper end of the rear inclined link member 41 and the rear end of the top longitudinal cushioning member are connected by a suitable pivot 50 with a depending oscillatory hanger link or member 51 and it will be clear that as the upper ends of the front link member 40 and the longitudinal cushioning member 42 are pivoted to the fixed hanger, the side frame in yielding permits a relative upward and rearward movement of the axle as clearly illustrated in dotted lines in Figure 4 of the drawings. For the convenience of illustration, the dotted posi-

tion is shown above the full line position whereas in practice the wheels on touching the ground will remain in contact with the same and yield to any unequality in the surface thereof without rebounding therefrom as the shocks and jars will be absorbed by the landing device, the relative upward movement of the axle and the depending movement of the supporting framework or machine being cushioned by an inclined oscillatory cushioning member extending upwardly and rearwardly from the axle guiding frame when the landing gear is in its normal position and pivoted at its upper end by a suitable pivot 53. The inclined upwardly extending cushioning member 52 is composed of two relatively slidable telescoping sections consisting of an upper cylinder 54 and a lower piston rod 55 equipped at its upper end with a piston rod constructed as hereinafter fully explained and adapted to compress air within the cylinder 54. The cylinder 54 is designed in practice to contain compressed air at the desired pressure to form an effective cushion and the inward movement of the piston will increase the pressure and produce a yieldable resistance proportionate to the resistance encountered by the landing gear. It will thus be seen that the yieldable triangular side frame with which the axle is connected, is resisted both by the longitudinal cushioning member and the upwardly extending cushion member, the upwardly extending pneumatic cushioning member being in direct line of the relative movement of the axle and by its pivotal mounting being adapted to maintain this position in the adjustment of the triangular side frame so that the angular cushion will be always in position properly opposed to the impact force resulting from the contact of the landing gear with the ground.

The front fixed hanger is composed of two sides which consist of a vertical tubular standard or member 56, the front inclined brace 57 and rear crossed or diagonally arranged tensioning members or braces 58. Each tubular member or standard 56 is secured at its upper end in a coupling socket 59 of a sleeve 60 arranged on the longitudinal frame member 61 consisting of one longitudinal tube of the framework of the flying machine of the said applications. The sleeve 60 is secured in position by suitable fastening device 63. The upper end of the inclined bracing member 57 is secured in a socket 62 which is secured by a suitable fastening device 63 to a sleeve 64 also mounted on the longitudinal top or frame member 61. The lower end of the vertical tubular member or standard 56 is mounted on a socket 65 having forwardly and rearwardly extending lugs or ears 66 and 67 to which the lower ends of the bracing members 57

and the bracing and tensioning members 58 are secured. The socket 62 is also provided with depending lugs or ears 68 through which pass the pivot 49. The pivot 49 consists of a rod threaded at its ends to receive suitable nuts and extending through a tube 69, which spaces a hanger socket 65 and also the socket member 70 by which the front ends of the longitudinal cushioning and connecting members are connected to the pivot 49. The sleeve 69 and the pivot rod provide a firm, strong and compact construction for fixedly pivoting the front angles of the yieldable tubular side frames.

The lower ends of the inclined link members 40 and 41 are equipped with sockets 71 and 72 and the upper end of the rear inclined link members 41 and the rear end of the top longitudinal cushioning and connecting member 42 are provided with sockets 73 and 74 which are connected by the pivot 50 to sockets 75 carried by the lower ends of the rear oscillatory hanger links or members 51. The rear pivot 50 consists of a rod constructed similar to the rod 49 and having mounted on it a sleeve or tube 76 which is interposed between the spaces or sockets at the opposite ends of the said pivot 50. The upper end of the oscillatory rear hanger member 51 is secured in a socket 77 having forked arms 78 which are secured by a suitable pivot 79 to a sleeve 80 mounted on the frame member 61 and pierced by the pivot 79 which secures the sleeve in position on the said member 61. This permits the rear hanger member 51 to oscillate longitudinally of the landing gear.

Each axle guiding frame is provided at the top with a socket 81 in which the lower end of the rod 55 is secured and the upper end of the rod 55 is reduced to form a shoulder 82 and is threaded for the reception of a nut 83 which secures a flange head or sleeve 84 on the reduced upper portion of the rod 55. The head is provided with an annular flange 85 which is pierced by bolts 86 extending through a lower inverted cylinder member 87 and an upper metallic cup 88 which fits within a cup washer 89 of leather or other suitable material. A metallic washer 90 is arranged within the metallic cup or member 88 and is engaged by nuts at the upper ends of the bolts 86, the said bolts 86 being also preferably provided at their lower ends with nuts for engaging the flange 85 of the head 84. The flexible cup washer 89 may be constructed of any suitable material and the cylindrical sliding member 87 is provided at its upper end with a flange or end wall 91 having an opening to receive the head 84 and arranged upon the flange 85 as clearly shown in Figure 11 of the drawings. This structure forms a piston head which operates within the cylinder 54 which has its upper

end secured within a socket 92 provided with spaced arms 93 secured by the said pivot 53 to a sleeve 94 arranged on the frame member 61 which is pierced by the said pivot 53. The socket 92 is provided with a boss or enlargement 95 having a threaded aperture receiving a coupling valve or union 96 with which is connected a flexible tube 97 extending to any suitable source of fluid pressure for supplying fluid under pressure to the upper portion of the cylinder 54 above the piston head. The flexible washer 89 is expanded against the interior of the cylinder 54 and is supported by the metallic cup member 88, sufficient space being provided between the flanges of the metallic cup member and the washer to permit the fluid pressure to act on the flexible washer. The cylindrical member constitutes a guiding portion for the piston head and the tubular section or cylinder 54 is provided at its lower end with an outwardly extending annular flange 98 arranged within a counter bore 99 of a sleeve 100 arranged on the flanged lower end of the cylinder 54. The counter bore is threaded to receive a threaded flange 101 of a tubular guide 102. The guide 102 is provided with an integral disk or plate 103 constituting the lower head or end of the cylinder 54 and having the threaded flange 101. This tubular guide which extends above and below the disk or plate 103 receives and guides the piston rod and stiffens and supports the same and is provided at the lower end with a stuffing box 104 and is equipped with an oil cup 105, or any other lubricating means may of course be provided. The oil cup has a stem 106 extending into an opening of a boss or enlargement 108 of the tubular guide 102. It will thus be seen that the piston rod is guided and supported both at the piston head and at the lower end of the cylinder 54 and an easy operation and an effective pneumatic cushion results. Instead of employing compressed air, any other fluid pressure may of course be used. The guide 102 is preferably reinforced and braced by integral tapering longitudinal belts or flanges 109.

The cylinder or tubular section 43 of the longitudinal cushioning and connecting member 42 is provided at its front end with an inwardly extending annular flange 110 against which is fitted a shoulder 111 of an inner tubular member or sleeve 112 reduced at its outer portion to form the said shoulder 111, the outer reduced portion 113 being threaded to receive a nut member 114. The nut member 114 which is in the form of a sleeve and which embraces the front end of the tubular section or cylinder 43 is interiorly threaded at its central portion at 115 to engage the threaded outer portion 113 and the said nut member which is provided

at the intermediate portion with grooves or notches 116 for engagement by a suitable tool, is provided with an outer hollow conical portion 117 and the sleeve 112 has an inner reduced tubular portion 118. A front longitudinal rod 119 which is provided at its inner end with a head 120 extends through the inner tubular portion 118 and through the conical extension 117 and is threaded at its outer end thereof 121 to receive a nut 122 for drawing the rod 119 in tight clamping engagement with the inner portion of the sleeve and the conical portion of the member. This construction not only securely connects the front longitudinal rod 119 to the tubular member or cylinder 43 but constitutes a lock for securing the nut member in its threaded engagement with the reduced threaded portion of the sleeve member.

The front portion 123 of the rod 119 which is of slightly less diameter than the rear portion, is threaded adjacent its front end at 124 and is provided in advance of the pivot portion with a plurality of grooves 125 and is interlocked with separable sections 126 of a coupling or socket 127 which is secured to the hanger socket 125 by the pivot 49. The pivot 49 also secures to the hanger socket 65 a socket member 128 which is fitted on a section to the upper end of the inclined link member 40. The sections 126 constitute a tapered wedge which is fitted around the front end of the rod 119 and which are arranged within the socket 127 which is also tapered and which forms a sleeve for holding the sections of the wedge together and in interlocked relation with the rod 119. The smaller or inner end of the socket 127 is threaded at 129 and is engaged by a nut member 130 having a smooth inner tapered conical portion 131 and threaded portions 132 and 133 for engaging the threaded outer portions 124 of the rod 119 and the inner threaded end of the socket 127. The nut member 130 is provided with grooves or recesses for enabling it to be readily engaged by a tool for rotating it to turn it on or off the socket. The tapering socket may, however, be either smooth or threaded at this point of engagement with the nut member 130 and when threads are employed at the tapered portions, the nut member grips and locks the socket 127.

The rear end of the tubular section 43 is provided with an outwardly extending flange 134 which engages a shoulder 135 formed by a terminal interiorly threaded counter bore 136 and a sleeve 137 which fits within the rear end of the tubular section 43 is provided with an intermediate enlarged portion 138 threaded for engagement with the nut and forming a shoulder 139 for abutting against the outwardly extending flange 134 of the tubular section 43. The sleeve 137 is provided with an integral

outer hollow tapered guiding portion 140 forming a lubricant chamber 141 and having an aperture 142 and a closure plug 143 for permitting lubricant to be readily supplied to the chamber 141 and for closing the aperture 142. The lubricant lubricates the rod or section 44 which is provided at its front end with a head 144 secured on the rod by a nut 145 and provided with front and rear grooves 146 and 147 receiving the adjacent ends of front and rear coiled cushioning springs 148 and 149. The front end of the first spring 148 fits within the space between the front sleeve and the reduced tubular portion 118 thereof and the rear end of the rear spring 149 fits between the sleeve 137 and a tubular extension 150 which is aligned with the outer end of the tapered conical guiding portion 140. This forms spaced guides for the slidable rod 44. The sliding of the rod in the cylinder or tubular section 43 cushions the triangular side frame and the axle and wheels carried thereby and the springs yieldably maintain the frame in a predetermined position.

The landing gear is braced by crossed diagonally arranged tensioning or bracing members 151 and 152 in addition to the cross diagonal guiding members of the fixed hanger. The cross diagonally arranged bracing and tensioning members may consist of rods or cables and they extend forwardly and rearwardly from the axle guiding frames to the hanger sockets which are provided with lugs or ears 153 and 154 for the adjustment of the terminals of the bracing and tensioning members. Any desired number of tensioning and bracing members may be employed and they may be constructed of any suitable material and of any desired strength to suit the requirements.

When the landing gear is applied to the flying machine of the said applications, the inner wheels will, in practice, be arranged in stream line recesses of the cabin at opposite sides thereof and the landing gear will offer comparatively little resistance at this point as it has been found by model tests that the propellers draw the air away from the cabins so that there will be comparatively little resistance encountered by the flying machine from the landing gear equipment.

The landing gear when applied to a flying machine of the dirigible type, will yield to the swaying of the machine when landing without straining connections so that the machine will rest firmly upon the ground irrespective of the character of the same and in a heavier air condition and securely anchored.

Also in practice a suitable tank or tanks will be provided for compressed air which will increase in pressure with the inward movement of the piston of the inclined

cushioning members and the presence of the compressed air in the tubing will strengthen the same.

The separate sets of landing gear of a machine of the dirigible type will adjust themselves longitudinally to the ground and transversely without undue strain of the framework of the body of the machine and the landing gear will take out and dissipate undue shocks from the machine even when landing heavily. The slidable mounting of the ends of the axles will permit independent upward and downward movement of the wheels of the landing gears, and the landing gear at their side of the machine is adapted to yield until the entire landing gear of the machine comes in contact with the ground so that the landing gear cannot be injured by being forced to sustain the entire weight of the machine and is also prevented from being injured by a side thrust as the contacting wheels will jump up and escape injury. The landing gear is adapted for any type of flying machine, either of the aeroplane or aerocruiser type. An air exhaust means may be employed for lifting the landing gear when the same is designed for use on hydroplanes.

What is claimed is:—

1. A landing gear of the class described including an axle, oppositely inclined link members connected with and diverging upwardly from the axle, means for mounting the link members to permit the same to swing longitudinally of the landing gear and to change their angular relation, and separate pivotally mounted yieldable means arranged to swing both longitudinally and vertically for resisting such movements to cushion the landing gear, said yieldable means extending upwardly from the axle and located between the inclined link members and composed of telescoping sections.

2. A landing gear of the class described including an axle, oppositely inclined link members connected with and diverging upwardly from the axle, means for mounting the link members to permit the same to swing longitudinally of the landing gear and to change their angular relation, yieldable means disposed longitudinally of the landing gear and composed of telescoping sections and connected with the link members to resist the said movements to cushion the landing gear, and pivotally mounted cushioning means arranged to swing longitudinally of the landing gear.

3. A landing gear of the class described including an axle, oppositely inclined link members connected with and diverging upwardly from the axle, means for mounting the link members to permit the same to swing longitudinally of the landing gear and to change their angular relation, yieldable longitudinally disposed means com-

posed of telescoping sections connected with the upper ends of the link members and forming with the same a yieldable triangular side frame for cushioning the landing gear, and pivotally mounted cushioning means arranged to swing longitudinally of the landing gear.

4. A landing gear of the class described including an axle, oppositely inclined front and rear link members pivotally connected at their lower ends with the axle, means for pivotally mounting the front link members, oscillatory means connected with the rear link members to permit the axle and link members to swing longitudinally of the landing gear and to change their angular relation, longitudinally disposed yieldable means composed of telescoping sections for resisting such movement to cushion the landing gear, and pivotally mounted cushioning means arranged to swing longitudinally of the running gear.

5. A landing gear of the class described including a relatively fixed depending hanger, an axle, a front link member pivotally connected to the hanger and axle, a rear depending oscillatory hanger member, having its lower end in approximately the same horizontal plane as the lower end of the front hanger, a rear link member connected with the axle and oscillatory members, said members being arranged to swing longitudinally of the landing gear and yieldable means for cushioning such movement.

6. A landing gear of the class described including a relatively fixed depending hanger, an axle, oppositely inclined link members pivotally connected with the axle at their lower ends and extending upwardly therefrom, one of the link members being pivoted at its upper end to the fixed hanger, an oscillatory depending hanger pivoted to the upper end of the other link member and having its lower end in approximately the same horizontal plane as the lower end of the fixed hanger, and yieldable means connecting the upper ends of the link members to resist the pivotal movements thereof for cushioning the landing gear.

7. A landing gear of the class described including an axle, front and rear link members pivotally connected with the axle and arranged to swing longitudinally of the running gear and permit a relatively upward and downward movement of the axle, and cushioning means located above and connected to and extending upwardly from the axle and composed of telescoping sections.

8. A landing gear of the class described including an axle, front and rear link members pivotally connected with the axle and arranged to swing longitudinally of the running gear and permit a relatively upward and downward movement of the axle, and pivotally mounted cushioning means con-

nected to and extending upwardly from the axle and arranged to swing with the same and composed of telescoping sections.

9. A landing gear of the class described including an axle, front and rear link members pivotally connected with the axle and arranged to swing longitudinally of the running gear and permit a relatively upward and downward movement of the axle, and an inclined cushioning member located above and connected to and extending upwardly from the axle and composed of telescoping sections.

10. In a landing gear of the class described including an axle, oppositely inclined front and rear links pivotally connected with the axle, means for mounting the links to permit the same to swing longitudinally and change angular relation, and yieldable means located above and connected to and extending upwardly from the axle and arranged to resist such movement, said yieldable means being composed of telescoping sections.

11. In a landing gear of the class described including an axle, oppositely inclined front and rear links pivotally connected with the axle, means for mounting the links to permit the same to swing longitudinally and change angular relation, and yieldable oscillatory means located above and connected to and extending upwardly from the axle and arranged to swing longitudinally of the landing gear, said yieldable means being composed of telescoping sections and adapted to resist the said movement of the links.

12. In a landing gear of the class described including an axle, oppositely inclined front and rear links pivotally connected with the axle, means for mounting the links to permit the same to swing longitudinally and change angular relation, and yieldable means located above the axle and connected with the links and a cushioning member composed of telescoping sections and extending upwardly from the axle and located between the links at an angle to the same and adapted to resist the said movement of the axle.

13. In a landing gear of the class described including an axle, oppositely inclined front and rear links pivotally connected with the axle, means for mounting the links to permit the same to swing longitudinally and change angular relation, yieldable means located above the axle and connecting the links, and an inclined cushioning member extending upwardly and rearwardly from the said axle and composed of telescoping sections and arranged to resist the movement of the same for cushioning the landing gear.

14. In a landing gear of the class described including an axle, oppositely in-

clined front and rear links pivotally connected with the axle, means for mounting the links to permit the same to swing longitudinally and change angular relation, yieldable means located above the axle and connecting links, and an inclined pivotally mounted cushioning member arranged to swing longitudinally of the cushioning member and connected with the axle and adapted to resist the said movement of the links, said inclined member being composed of telescoping sections.

15. A landing gear of the class described including an axle, link members connected with the axle and arranged to swing longitudinally of the landing gear, a longitudinal cushioning member connected with the links and an upwardly extending cushioning member connected with the axle, said cushioning members being composed of telescoping sections.

16. A landing gear of the class described including an axle, inclined link members connected with the axle and arranged to swing longitudinally of the landing gear, a longitudinal cushion member connected with the links, and an inclined oscillatory cushioning member connected with the axle and arranged to swing longitudinally of the landing gear, said cushioning members being composed of telescoping sections.

17. A landing gear including a fixed hanger, an oscillatory hanger, an axle, inclined link members connecting the axle with the said hangers, a longitudinal cushioning member connecting the link members, and an upwardly extending cushioning member connected with the axle, said cushioning members being arranged to resist the movement of the axle for cushioning the landing gear.

18. A landing gear of the class described including a relatively fixed frame, side hangers rigidly connected with the fixed frame, oscillatory hanger links, an axle, oppositely inclined link members connecting the axle with the said hangers and hanger links, longitudinal cushioning members connecting the inclined link members, and inclined oscillatory cushioning members connected with the axle, said cushioning members being composed of telescoping sections.

19. A landing gear of the class described including an axle, oppositely inclined link members connected with the axle and arranged to swing longitudinally of the landing gear, a longitudinal cushioning and connecting member pivotally connected with the said link members and comprising a tubular section, a rod extending into the tubular section and provided with a head, a detachable sleeve guiding the rod, and cushioning springs arranged within the tubular section at opposite sides of the head.

20. A landing gear of the class described

including an axle, oppositely inclined link members connected with the axle and arranged to swing longitudinally of the landing gear, and a longitudinal cushioning member connected with the upper ends of the links and comprising a tubular section, a fixed front rod projecting into the tubular section and a relatively slidable rear rod extending into the tubular section and having a head, sleeves carried by said tubular section and receiving the said rods, and cushioning springs arranged within the tubular section and interposed between the head and the terminal portions of the tubular section.

21. A landing gear of the class described including an axle, oppositely inclined link members connected with the axle and arranged to swing longitudinally of the landing gear, and a longitudinal cushioning member comprising a tubular section provided at its ends with sleeves having nuts for securing the sleeves to the tubular section, and hollow tapered extensions projecting from the tubular section, a relatively fixed rod rigidly connected with one of the sleeves a slidable rod extending through the other sleeve, a head carried by the slidable rod and arranged within the tubular section, and cushioning springs located at opposite sides of the head.

22. A landing gear of the class described including an axle, oppositely inclined link members connected with the axle and a cushioning member extending upwardly from the axle between and at an angle to the link members and comprising a cylinder, a piston operating within the cylinder and having a rod extending therefrom, means for introducing fluid pressure into the cylinder, and cushioning means connecting the upper ends of the link members and resisting the upward movement of the axle.

23. A landing gear of the class described including an axle, oppositely inclined link members connected with the axle, and a cushioning member located between and at an angle to the link members comprising a cylinder provided at the upper end with a socket having a guide at the other end, a piston operating in the cylinder and having a rod extending through the said guide, means for introducing fluid pressure into the cylinder for cushioning the piston, and cushioning means connecting the upper ends of the link members and resisting upward movement of the axle.

24. A landing gear of the class described including an axle, a guiding frame having a lower guiding portion, bearings for the axle slidable in the said guiding portion, an inverted cylinder held in the upper portion of the frame, a piston operating in the cylinder and having a piston rod extending to the axle, and yieldable means in the cylinder for cushioning the downward movement of the cylinder and the frame relative to the axle.

25. A landing gear including an axle, means extending forwardly and rearwardly from the axle at the ends thereof and movable upwardly and downwardly and forwardly and rearwardly with respect to a flying machine, an axle carried by the said means, an annularly related means for cushioning the said movements, one of said cushioning means being arranged to swing upwardly and downwardly and the other of the said cushioning means being arranged to swing backwardly and forwardly, and the said cushioning means including telescoping sections.

In testimony whereof we affix our signatures.

THOMAS MILTON FINLEY
ALLEN W. BROWN.