This invention has to do with the landing gear of airplanes, and it is concerned principally with a construction for the securing of skis to a plane, in place of the usual landing wheels, for use on ice or snow or the like.

There are a number of objects in the invention; one is the provision of a construction which affords for the cushioning and/or absorbing of shocks, which in the case of a landing wheel, are more or less taken by a pneumatic tire; the provision of a construction which may be readily substituted for landing wheels; the provision of a construction which keeps the skis lined up and resists twisting action, and side load. Still other features of the invention are the provision of a ski mounting which affords material flexing or resilience in the nose of the skis, and the provision of means for stabilizing the position of the skis in flight. Other objects of the invention will become apparent as the description progresses.

In the accompanying drawings, Fig. 1 is an assembly view illustrating a plane equipped with a ski and a ski mounting constructed in accordance with the invention.

Fig. 2 is a plan view of the ski mounting with the shock absorbing unit omitted for the sake of illustrating other structural features.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a rear end elevational view of the ski mounting, showing the ski per se in section.

The fuselage of an airplane is illustrated at 1, and same is equipped with suitable landing gear struts 2, braced as at 3. The landing skis and their associated structure are attached to the struts. The particular construction of the struts may vary, and in this regard the struts 2 may be of a shock absorbing nature, or they may be of a fairly rigid nonshock absorbing type.

As illustrated in Fig. 4, a stub shaft or axle 5 is carried by the strut and the ski is to be mounted upon this stub axle. With the construction as shown, a landing wheel may be used on this stub shaft, and in order to place skis on the plane it is but necessary to remove the wheel and mount the ski on the stub shaft. It is, of course, appreciated by those skilled in the art, that the landing gear struts are usually duplicated on each side of the airplane and that there are, correspondingly, usually two skis provided; obviously it is necessary to describe only one ski in this application. The ski proper is illustrated at 6. The construction which it may take is illustrated in section in Fig. 4. This construction of course may vary.

It is also appreciated that it is customary to mount a third and smaller ski near the tail of the airplane, preferably attached to the usual tail skid. This ski may be rigidly attached to said tail skid or may be pivotally and flexibly attached in the manner described herein for the main skis.

The mounting of the ski comprises elements attached to the ski proper and journaled upon the stub shaft 5. Attached to the ski, as by means of suitable bolts 7, are a pair of brackets 8. Each bracket is fixedly secured to the ski and the brackets are preferably reinforced one to the other by means of reinforcing cross rods 9 and 10. For receiving these cross rods each bracket may be provided with apertures through which the rods extend and nuts 11 may be screwed on to the ends of the rods. These two brackets form the rear attachment. The forward attachment comprises a bracket 15, secured to the ski by suitable bolts, as shown, and this bracket is provided with spaced ears 16. Preferably this forward bracket and the two rearward brackets are braced one to the other by rods 18 and 19, these rods having their ends extending through apertures in the respective brackets with nuts 20 and 22 screw-threaded on to their ends. It is, of course, within the invention to provide the brackets 8, or the brackets 8 and 15, in one integral part, such as a single casting, but it is advantageous to make them separate and reinforce them one to the other by the cross rods for the sake of lightness of construction.

The brackets 8 have suitable bearings for the reception of a pivot pin 22, and as shown, the rods 18 and 19 extend through these bearings and through the pivot pin. This con-
struction thus serves to hold the brackets securely, one with respect to the other, and at the same time bracing them to the forward bracket 15, and holding the pivot pin in place.

A rocker arm is journaled on this pivot pin. This rocker arm is illustrated at 23, and it comprises a rigid frame-like construction, as illustrated in Figs. 2 and 4. This rocker arm has a relatively wide bearing 24 designed to receive the stub shaft 5 and be held thereon in any suitable manner as by means of nut 26.

It should be noted that it is within the invention for the mounting elements to be turned around 180° with the rocker arm to the front and shock absorbing unit to the rear. Other possible variations consist of using multiple shock absorbing units in lieu of the single unit shown. Furthermore, the device, while preferably made as shown symmetrical about the center of the ski, permits of its being made offset, in whole or in part, to one side of the ski or with other variations.

A shock absorbing unit is connected to this rocker arm, and to the forward bracket 15.

This shock absorbing unit may advantageously be of the so-called spring-hydraulic type in which a cushioning action is effected by a spring-damped and assisted by the displacement of a suitable liquid, such as oil.

The shock absorbing unit comprises a cylinder 30, pivotally mounted as at 31, between the ears 16 of the bracket 15. Telescoping within the cylinder 30 is a hollow piston 32, which in turn has a pivotal connection as at 33 with the rocker arm. Details of this shock absorbing unit need not be gone into as units of this kind are well understood by those versed in the art. Sufficient to say that the normal position of the parts during the flying is substantially as illustrated by the full lines of Fig. 3, and when under shock, as when the plane lands, the piston 32 telescopes into the cylinder 30 thus permitting the rocker arm to move pivotally on its mounting 22.

The dotted line position of Fig. 3 illustrates one position to which the rocker arm may be removed.

As illustrated in Fig. 1 each ski is connected on its ends with some portion of the body of the plane in order that the skis are stabilized while flying. The rear end may be connected by a suitable cord or wire 35, and the forward end may be connected by a suitable cord or wire 36, in conjunction with a resilient element such as rubber shock cord 37. The figure shows the position of the parts substantially when the plane is on the ground. When the plane is in the air, the rubber cord 37, which is stretched in the figure shown, raises the forward end or nose of the ski until the action is limited by the tightening of the cord 35, the parts being proportioned so that the ski is stabilized with its length substantially in the line of flight. This, however, is the practice now employed.

The rear wire 35 may include a resilient element similar to 37 to prevent its being damaged by shock.

The stabilization of the position of the ski in flight may also be attained by attaching the wires 35 and 36 to parts of the airplane other than the body, such as the wing or the landing gear struts, or by attachment to arms fixed to these parts, as for example a removable arm attached to the axle 5 in place of the nut 26; this arm being of such a length and so positioned that the cables 35 and 36 when attached to its end pull efficiently for the purpose of limiting the rotation of the ski about the axle.

While the ski construction and mounting has been described as embodying a spring-hydraulic shock absorbing unit, it is to be appreciated that other types of shock absorbers may be used, and that it is within the invention to utilize these other types, which may employ in place of the liquids, air cushions, telescoping cylinder and pistons, shock absorbers using springs, rubber blocks, or shock cord or the like, or any combination of these types.

It will be appreciated that the ski is subjected to twisting strains; that is to say, a twisting force which tends to turn the ski substantially in a horizontal plane. The shock absorbing unit in itself offers little or no resistance to these strains, but this strain is overcome by the rocker arm, and its associated parts. In this regard, the rocker arm, which is in the form of a rigid frame, is advantageous. Its relatively wide bearing between the spaced brackets 8, its rigid frame construction and the mounting at 25 are effective for adequately resisting these twisting strains. Moreover, these same parts resist and overcome side load. In other words, viewing Fig. 4, the ski is held strongly in a horizontal position even though an appreciable force is applied to the side of the ski. Accordingly, while relative movement between the ski and the plane struts are afforded by the shock absorbing element, yet the associated parts are such as to resist strains communicated to the ski and the construction is adequate for keeping the ski lined up properly in the direction of the plane movement.

The three point suspension with the single point located forwardly and centrally of the ski makes for considerable flexibility, in that if the ski contacts with a high point, which is near one side of the ski, the nose of the ski is permitted to twist all the way back to the location of the brackets 8. At this point, however, the brackets in conjunction with the rocker arm and its mounting, resist this twisting action. This flexibility of the ski forward of the brackets 8 is, however, not essential to the attainment of the other objects of the invention and, if desired, the ski proper.
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may be braced more rigidly to the brackets by means of additional braces run to any desired points of the top surface of the ski.

While the ski mounting, as shown herein, is constructed with the thought that it is capable of replacing the usual landing wheel, yet it is within the invention to make the construction of a permanent nature in the event the plane is to be permanently employed where skis may be used.

I claim:

1. In a ski mounting for airplanes, a structure having a three point connection with the ski, said structure including a shock absorbing element connected to one of said points, and an associated element connecting with the other points, said structure being adapted for connection with an airplane axle or the like.

2. A ski mounting for airplanes, comprising a ski, a rocker arm pivotally mounted on the ski, one or more shock absorbing elements connected to the ski and to the rocker arm, and means connecting the aforesaid structure to an airplane axle or the like.

3. A ski mounting for airplanes, comprising a rocker arm pivotally mounted on a ski, a shock absorber element pivotally mounted on the ski at a point spaced from the pivot of the rocker arm, means pivotally connecting the rocker arm and shock absorbing element whereby functioning of the shock absorbing element effects rocking of the said rocker arm, and means connecting the rocker arm to an airplane axle or the like.

4. A ski mounting for airplanes, comprising a rocker arm of frame-like construction, means pivotally mounting the rocker arm at relatively widely spaced points extending transverse to the length of the ski, means pivotally mounting the rocker arm to an airplane axle or the like on a relatively wide axis extending substantially parallel to the pivot point of the rocker arm, the frame-like structure of the rocker arm and its relatively wide pivotal connection serving to resist twisting strains and side load on the ski, and a shock absorber element connected to the ski and rocker arm.

5. A ski mounting for airplanes, comprising a pair of brackets secured adjacent the side portions of a ski, a frame-like rocker arm pivotally carried by the brackets, means connecting the rocker arm to an airplane strut or the like, a shock absorber element, means pivotally connecting the shock absorber element to said rocker arm near its end, and means pivotally connecting the shock absorber element to the ski forwardly of the said brackets.

6. A ski mounting for airplanes, comprising a pair of brackets secured in spaced manner to a ski, a rocker arm of frame construction journaled between the brackets, means pivotally connecting the rocker arm to an airplane axle, or the like, and a shock absorber element connected respectively to the rocker arm near its end and to a single point on the ski, said point being positioned substantially centrally of the ski, and forwardly of the said brackets.

7. A ski mounting for airplanes, comprising in combination a ski, a pair of brackets mounted on the ski, a rocker arm of frame-like construction journaled between the brackets, means pivotally mounting the rocker arm to an airplane axle, or the like, a hydraulic shock absorber element, means pivotally connecting the shock absorber element to the rocker arm, and means pivotally mounting the shock absorber element to the ski.

8. A ski mounting for airplanes, comprising in combination a ski, a pair of brackets mounted on the ski, a rocker arm of frame-like construction journaled between the brackets, means pivotally mounting the rocker arm to an airplane axle or the like, a hydraulic shock absorber element, means pivotally connecting the shock absorber element to the rocker arm, and means pivotally mounting the shock absorber element at a single point to the ski located forwardly of the said brackets.

9. In a ski mounting for airplanes, the combination of a ski, a pair of brackets secured respectively adjacent the sides of the ski, supporting cross rods connected to the brackets, a fixture located forwardly of the brackets and substantially centrally of the ski, bracing rods connecting the fixture with the brackets, a rocker arm journaled between the brackets, one or more shock absorbing elements secured to the fixture, means securing the rocker arm and shock absorbing element together, and means connecting the rocker arm to an airplane axle or the like.

In testimony whereof I affix my signature.

ARTHUR RALSTON STALB, Jr.