

March 1, 1955

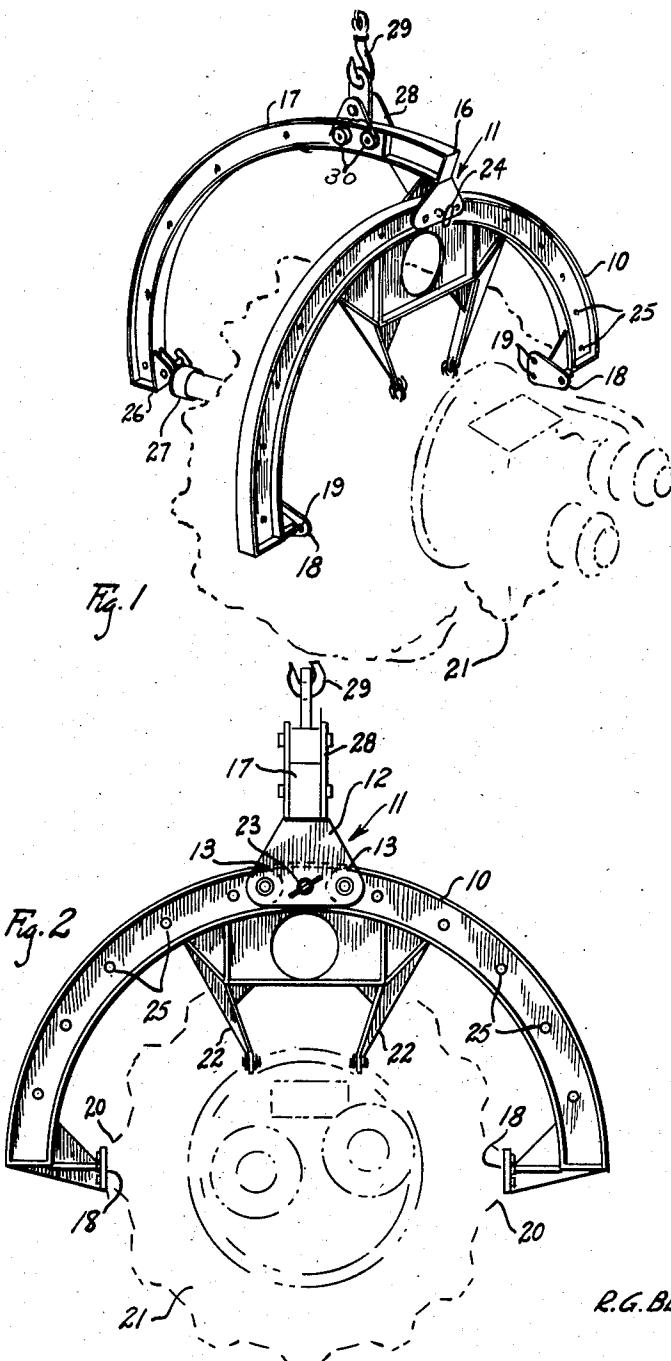
R. G. BLACKWELL

2,703,252

MULTIPLE TILTING ARC SUPPORT

Filed April 2, 1952

2 Sheets-Sheet 1



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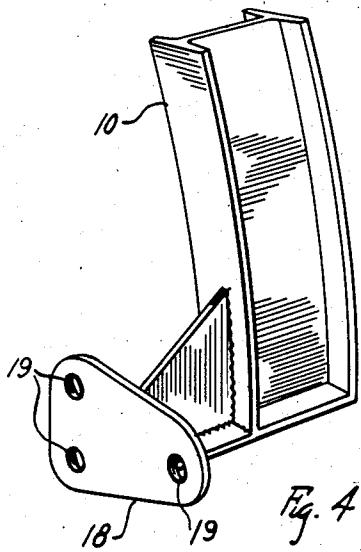
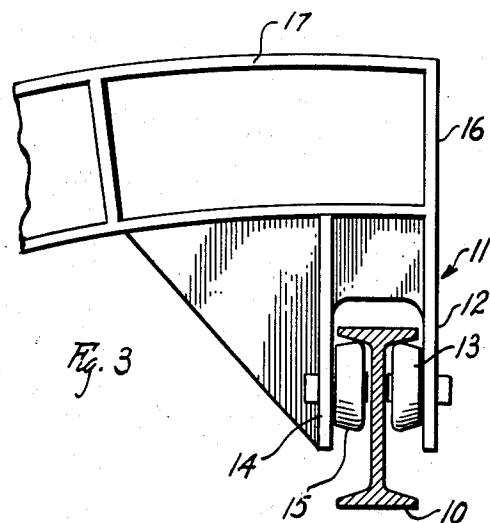
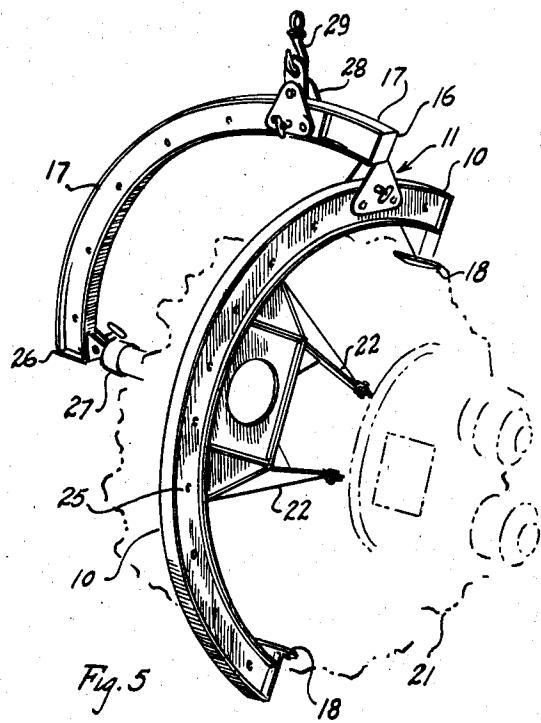
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United States Patent Office

2,703,252

Patented Mar. 1, 1955

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2,703,252

MULTIPLE TILTING ARC SUPPORT

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Application April 2, 1952, Serial No. 280,087

3 Claims. (Cl. 294—78)

This invention relates to an arrangement of tilting arcs adapted to support an airplane engine or other heavy object which requires to be tilted into various positions for repair or inspection. A feature of the invention is the provision of means for supporting a tilting arc for movement in a vertical plane and means on such arc for supporting a second tilting arc in a plane normal to such vertical plane.

The invention also relates to an attachment for use in conjunction with a tilting arc and its objects are to provide a means for attaching an engine or other large heavy object to a tilting arc whereby the engine or object may be easily rotated about its axis while suspended therein; to provide such an attachment which will permit movement of the suspended engine in a vertical as well as rotational plane, and to provide an attachment which may be easily attached to a tilting arc and which may be readily removed therefrom when desired. Other objects will become apparent from the drawings and the description as is hereinafter set forth.

In the tilting arc apparatus presently in use for handling large engines, provision is made for movement of the engine in a vertical plane between vertical and horizontal positions therein, and positioning of the engine for the accomplishment of work thereon is limited to movements in this plane. In many instances the repair or adjustment of an engine may be much more easily and quickly performed by rotation of the engine so that the various portions of it may be brought to the most convenient and accessible positions. Also in preparing an engine for storage by applying a coating of protective material, such as a plastic or oil, the application of the preservative is much more quickly and thoroughly effected by bringing the more inaccessible portions of the engine to the most convenient position by rotating the engine as well as moving it in a vertical plane. When engines covered with the protective coating are removed from storage for use, the removal of the protective material is greatly facilitated by the variety of positions of the engine obtainable through the use of this attachment.

My invention consists primarily of an arcuate shaped I beam or rail supported at one end of a tilting arc by a supporting trolley which is secured to the end of the tilting arc in a transverse position. Securing means which extend from the rail or beam are connected to points opposite each other at or near the horizontal center line of the engine. A supporting means extending from the center of the arc of the rail to the lifting eyes of the engine may be used as additional means for supporting the weight of the engine. The attachment is thus used as a means for securing the engine to one end of the tilting arc, the other end of the tilting arc being secured to the end of the engine propeller shaft by means of a rotational connection.

Reference is hereby made to the drawings illustrating a preferred embodiment of my invention in which similar numerals refer to similar parts throughout the several views and in which:

Figure 1 is a perspective view of the attachment secured to a tilting arc and supporting a large aircraft engine in a horizontal position;

Figure 2 is an end view of Figure 1 illustrating the securing means connecting the arcuate shaped beam or rail to points opposite each other at the horizontal center line of the engine and a pair of arms extending from the center of the arc of the beam to the lifting eyes of the engine, as additional supporting means;

Figure 3 is a cross-sectional view of the arcuate shaped

2

rail also showing the supporting trolley secured to the end of a tilting arc, illustrating the manner in which the wheels of the trolley engage the track on each side of the web of the rail.

Figure 4 is a view showing a portion of the arcuate shaped rail and illustrating a means adapted for rigidly securing the rail to the side of an engine at its horizontal center line.

Figure 5 is a perspective view similar to Figure 1 in which the suspended engine has been rotated about its axis by the use of the attachment.

With reference to the drawings, my tilting arc attachment consists of an arcuate shaped rail 10 the arc of which is the arc of a circle having its center at the center line of the engine to be suspended by it. Rail 10 is preferably formed of an I beam, although rails of different cross-sectional shape may be used, and is sufficiently rigid to support a predetermined weight without appreciable distortion of its shape. A supporting trolley 11 consisting of a first side member 12 to which is attached for rotation a set of wheels 13 and a second side member 14 to which is attached for rotation a second set of wheels 15 in line with wheels 13, is secured transversely to an end 16 of a tilting arc crane 17. The other end of crane 17 is provided with an engine shaft support to be later referred to and the crane itself is movable in and supported by a trolley 28 of substantially the same constructions as those shown in U. S. Patent 2,348,309. The web of rail 10 is disposed between wheels 13 and 15 which engage the under side of circular tracks on each side of the web to movably support rail 10 in trolley 11. On rail 10 at points substantially opposite each other are provided a pair of brackets 18 having holes 19 adapted to receive bolts threaded into the rocker arm housings 20 of an engine 21, thus supporting the engine at opposite points in a plane passing approximately through its center line. Additional means for supporting the weight of the engine is secured to rail 10 at the center of its arc such means comprising a pair of arms 22 adapted to engage the lifting eyes of the engine; however, various other connections may be used instead. To secure rail 10 to trolley 11 in a desired position, the trolley is provided with an opening 23 extending through side members 12 and 14 and adapted to receive a locking pin 24. The web of rail 10 is provided with a series of spaced apart openings 25 which are arranged to coincide with opening 23 in trolley 11, so that by passing pin 24 through opening 23 and one of the openings 25, rail 10 may be secured to trolley 11 in any desired rotational position.

To use the attachment in conjunction with a tilting arc for handling an aircraft engine, the propeller shaft of the engine is rotatably attached to end 26 of tilting arc crane 17 by a rotatably supported cap 27 as shown in the aforesaid patent. Rail 10 is rigidly attached to both sides of the engine at or near its horizontal center line by brackets 18 and additionally secured by supporting arms 22. The lifting carrier trolley 28 which has rollers 30 supporting crane 17 as shown in the aforesaid patent is engaged by a hook 29 of any conventional movable hoist and the entire assembly lifted. When thus suspended the engine may be easily moved to any desired position in a vertical plane by moving crane 17 through the carrier trolley 28 and then, by moving rail 10 through trolley 11, the engine is easily rotated about the axis of its shaft into any desired radial position where the part to be removed or repaired is convenient for the mechanic. The movement of the engine in two perpendicular planes permits the positioning of it so that any portion may be made readily accessible.

This invention may be embodied in other forms or carried out in other ways without departing from the spirit or the essential characteristics thereof. The present embodiment of the invention is therefore to be considered as in all respects illustrative and not restrictive, the scope of the invention being indicated by the appended claims, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. Means for supporting an object to permit easy

movement thereof in a plurality of different planes comprising, in combination: a member supported for vertical movement; a plurality of spaced apart rollers supported by said member and arranged to bear the entire weight of the object, a first arcuate shaped member engaging said rollers and supported thereby for rotary movement in a vertical plane; a member immovably secured to one end of said arcuate shaped member and extending inwardly therefrom; a plurality of spaced apart rollers supported by said last named member; a second arcuate shaped member resting on said last named rollers and supported thereby for rotary movement in a plane substantially normal to said vertical plane; inwardly extending arms attached to the ends of said second arcuate shaped member, the inner ends of said arms being arranged to engage the object at spaced apart regions of the surface thereof; and pivotal supporting means for connecting one end of the object to the second end of the first arcuate shaped member.

2. Means for supporting an object to permit easy movement thereof in a plurality of different planes comprising, in combination: a first arcuate shaped member; at least two roller means for supporting said member for rotational movement in a first plane; a member arranged to elevate said roller means and support the entire weight of the object; at least two spaced apart rollers; pivotal supports secured to a first end of said arcuate shaped member and arranged to support said rollers for rotation in planes substantially normal to said first plane; a second arcuate shaped member resting on said rollers; pivotal means for attaching an end of the object to the second end of the first arcuate shaped member; and inwardly extending spaced apart arms attached to said second arcuate shaped member, the inner ends of said

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arms being constructed for attachment to spaced apart regions of the object.

3. Means for supporting an engine having a shaft defining an axis of rotation comprising, in combination: a depending member; an arcuate shaped crane; pivotally supported members on said member engaging said crane and supporting said crane for rotary movement in its own plane, said crane supporting the entire weight of the engine; an arcuate shaped I beam having a curved track on each side of its web and having a series of spaced apart holes through its web; a rotatably supported cap connecting the engine shaft to one end of said crane; a trolley immovably secured to the opposite end of said crane, said trolley having an opening adapted to receive the top flange of said I beam; spaced apart rollers pivotally mounted on said trolley and engaging the top flange of said beam on opposite sides of the web thereof to permit rotational movement of said beam in a plane transverse to the plane of the crane; spaced apart arms on said beam extending inwardly past the bottom flange thereof; the inner ends of said arms being shaped to engage spaced apart portions of the engine; and a locking pin supported by said trolley and adapted to enter any of said holes selectively to anchor the engine in a desired position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,348,309. Rohr ----- May 9, 1944

2,383,503. Landis et al. ----- Aug. 28, 1945

2,530,016. Landis et al. ----- Nov. 14, 1950

2,586,263. Rose ----- Feb. 19, 1952