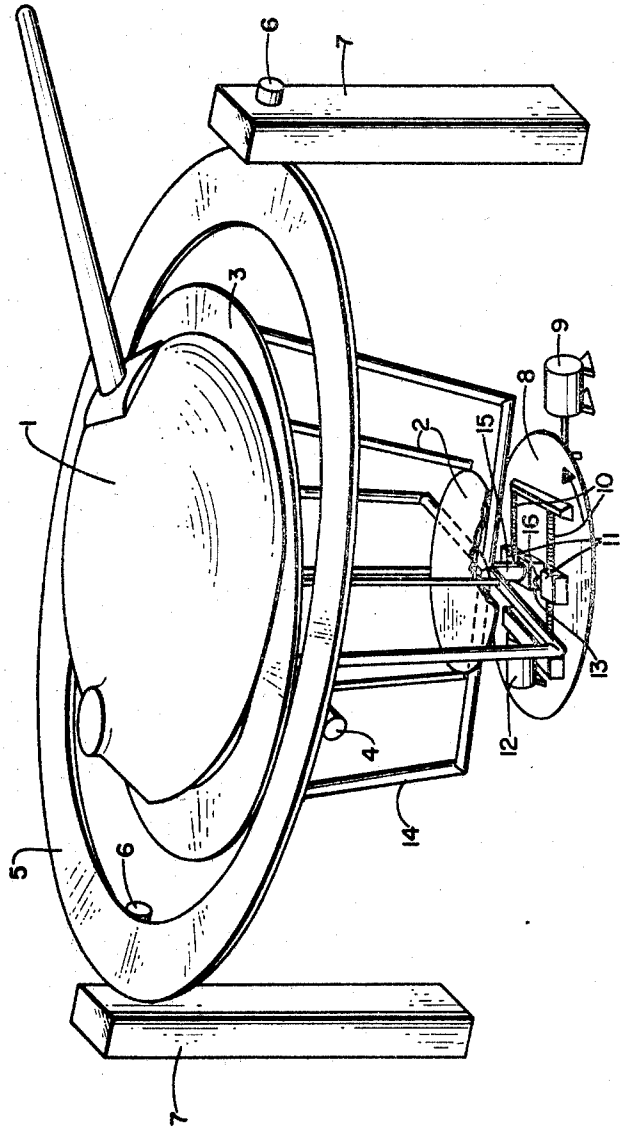
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CONTROL APPARATUS

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CONTROL APPARATUS

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ABSTRACT OF THE DISCLOSURE

Apparatus for simulating the movements about pitch and roll axes of a tank traveling through a terrain.

BRIEF SUMMARY OF THE INVENTION

For training a tank crew it is necessary to submit the crew during aiming exercises to the various movements of a tank traveling through a terrain, in order to exercise the correct reaction of the crew with respect to the various types of movements. Such training by means of a tank traveling through a terrain involves some disadvantages. In many cases no training area of sufficient size can be used. It is furthermore disadvantageous that such practice runs require a great quantity of fuel and that such training tanks often show essential wear. It, therefore, is desirable to train a tank crew by means of a simulator in a manner already done in pilot training. It is an object of this invention to disclose a suitable apparatus for simulating the movement of a tank about its pitch and roll axis by means of a training turret which is mounted stationary.

According to the invention a basket which supports the tank crew and the devices which have to be submitted to the various movements, is cardanically supported within two concentric rings with a mechanism engaging the inner ring below the bottom of the basket and tilting this ring about its gimbal axis. The inner dimensions and the equipment of the basket correspond to that of an actual tank. At the top of the basket here is mounted a light training turret for motion together with the basket.

According to a preferred embodiment of the invention, the driving mechanism includes a pin which is fixed to the inner ring and extends in the direction of the axis of that inner gimbal ring. This pin is guided by means of a supporting disc which is rotatable about the same axis. The pin supporting means can be displaced by controlled amounts away from the center of the disc. If the link between the pin and the disc is displaced from the disc center and the disc rotates about its center, the inner gimbal ring, including the basket and the training turret, carries out wobbled movements which are a combination of movements about the pitch and roll axis. In predetermined angular positions of the turret these wobble movements can be restricted to either pitch or roll movements. The amount of the displacement of the pin guiding means away from the center determines the amplitude of the motion.

The training turret with its circular track is supported rotatably by the inner gimbal ring. In order to submit the turret additionally to rotation about its vertical or yaw axis according to further improvement of the invention an intermediate ring is mounted rotatably within and with respect to the inner gimbal ring and bears the circular track of the turret so that the turret can be rotated with respect to this intermediate ring. If the intermediate ring is rotated, it has the same influence on the turret and its crew as a rotation of tank about its vertical axis. By means of the azimuth aiming mechanism the crew can pivot the turret within the intermediate ring in such a manner that

the orientation of the turret with respect to the terrain remains constant. Instead of an intermediate ring one could use a rotatable supporting plate which carries the supporting pillars for the outer gimbal ring. Turning the turret about its yaw axis, then however, would require more energy. Such rotation of the turret about its yaw axis, of course, could also be simulated by feeding suitable disturbance signals into the azimuth aiming mechanism.

For displacing the pin support out of its center position according to a preferred embodiment of the invention, two spindles, preferably threaded spindles, extending parallel to the supporting disc are used. Guided by these two spindles are two spindle nuts which bear a supporting piece for the pin which can be displaced out of its center position. The supporting piece is rotatable about an axis which lies in the plane of the two spindles and cuts the spindles under 90° angle. The pin is guided within a hole of the plug support so that it can be moved axially and also can be rotated with respect to the guiding piece. The rotation of the supporting disc about its center axis and the displacement of the guiding piece on the supporting disc, or preferably accomplished by separate motors so that during the rotation of the supporting disc the amplitude of the wobble motion may be changed by means of displacing the supporting piece.

Further features of the invention are disclosed in the claims and will become apparent from the following description of the embodiment as shown in the drawing.

DETAILED DESCRIPTION

The training turret **1** with its basket **2** is with its circular track rotatably supported in the inner gimbal ring **3** of the training apparatus. In the drawing basket **2** is only schematically shown by four poles and a platform at the bottom. In practice the basket will be closed and support all equipment of a normal tank turret. The inner gimbal ring **3** is supported pivotally at the outer ring **5** by means of two pins **4**. The two supporting pins **6** of the outer ring **5** are displaced with respect to that of the inner ring about 90 degrees and are born in two supporting pillars **7**. By means of this cardanic support turret **1** can be tilted about any axis lying in the horizontal plane through pins **6**. The tilting motion of the turret **1** is effected by means of a driving mechanism which engages the basket **2** below its bottom.

For this purpose four support members **14**, extending downwardly, are fixed to the inner gimbal ring **3** and are joined together below the bottom of basket **2**. Fixed to these support members is a pin **15** which extends in direction of the center axis of the inner gimbal ring **3**. The free end of pin **15** is guided within a guiding piece **13** which can be rotated about axle **16** and can be moved in a direction parallel to supporting disc **8** by means of two threaded spindles **10**. Guided by these spindles **10** are two spindle nuts **11** which bear axle **16**. By these means guiding piece **13** can be displaced away from its central position and the pin can move along its axis within the guiding hole of guiding piece **13**. If now disc **8** is rotated by means of motor **9**, the inner gimbal ring **3** and with it turret **1** and basket **2** carry out wobble motions about the two cardan axes **4—4** and **6—6**. The more guiding piece **13** for pin **15** is displaced out of the central position the greater will be the amplitude of such wobble motion. Additionally, turret **1** and basket **2** can be rotated by means of the azimuth aiming mechanism and the circular track with respect to cardan ring **3**.

For guiding pin **15** in the guiding piece **13** this may be provided with a hole in which the pin **15** can be displaced axially as well as rotated.

I claim:

1. Apparatus for simulating the motion of a tank about

its pitch and roll axes as such tank is moving through the terrain, said apparatus comprising:

a basket for carrying the equipment and the crew;

an inner and an outer concentric ring, the inner ring being attached to said basket, the outer ring being attached to support means, and the two rings being connected to each other for relative angular motion with respect to each other; and

driving means for tilting said inner ring, said driving means including,

a pin rigidly connected to the inner ring and extending along the direction normal to the plane of the ring,

a pin guiding means attached to a rotatable supporting disc for engaging said pin in a manner which will determine its position relative to said disc but which will leave it free to turn relative to said pin guiding means as the disc rotates, said pin guiding means being adjustable for various positions relative to said disc, and

means for rotating said disc.

2. Apparatus according to claim 1 wherein said pin is carried by a frame which surrounds the basket and is fixed to the inner ring.

3. Apparatus according to claim 1 wherein the pin guiding means is supported by means of two parallel threaded spindles carried by said supporting disc.

4. Apparatus according to claim 3 wherein said pin guiding means is supported on an axle extending between the two spindles and carried by two spindle nuts, said guiding means further having a central hole for engaging said pin.

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