

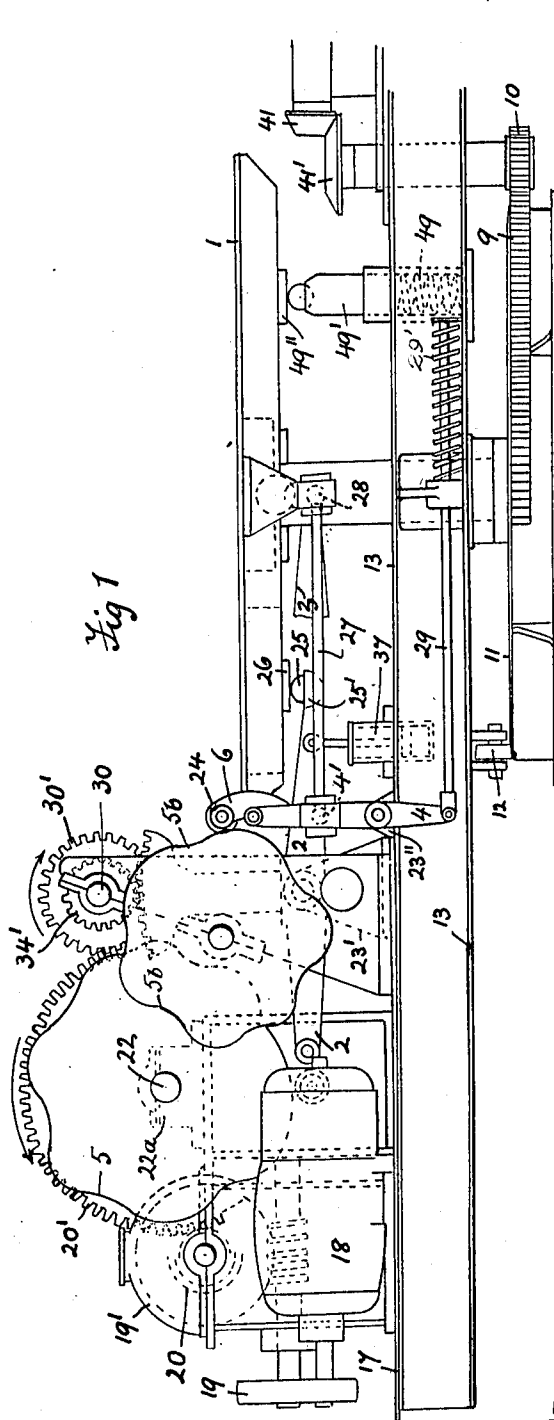
W. R. GILBERT.

APPARATUS FOR REPRODUCING THE MOTIONS OF THE UPPER PART OF VESSELS IN MOTION.
APPLICATION FILED FEB. 14, 1919.

1,313,685.

Patented Aug. 19, 1919.

4 SHEETS—SHEET 1.



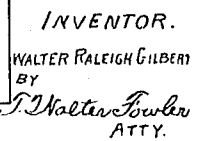
INVENTOR.

WALTER RALEIGH GILBERT.
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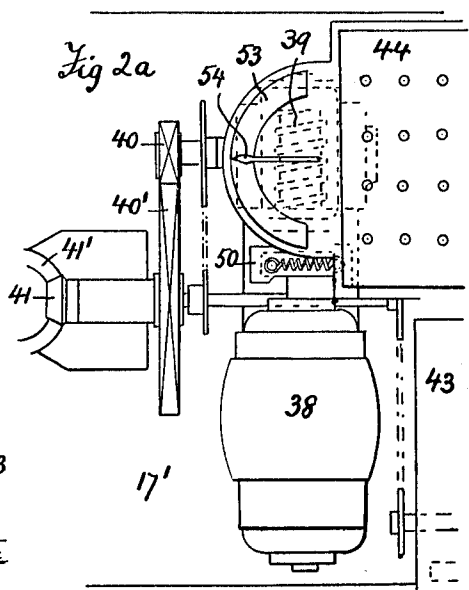
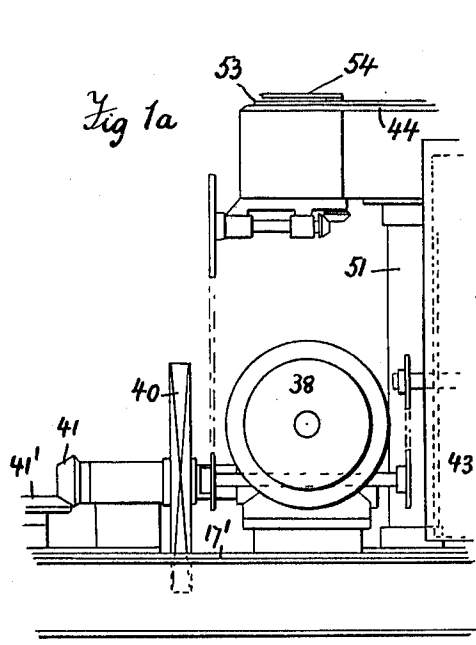
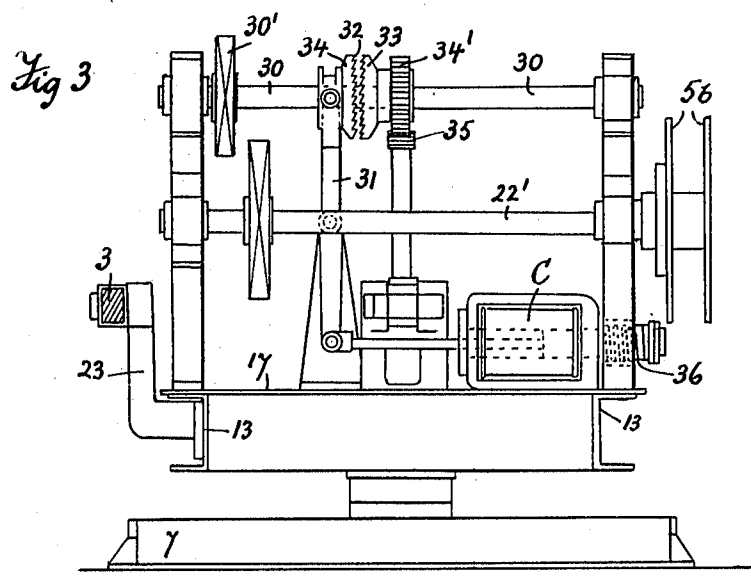
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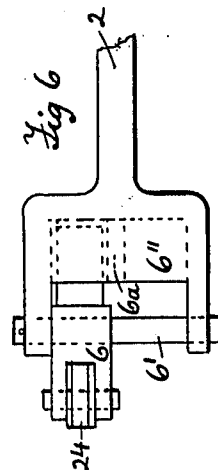
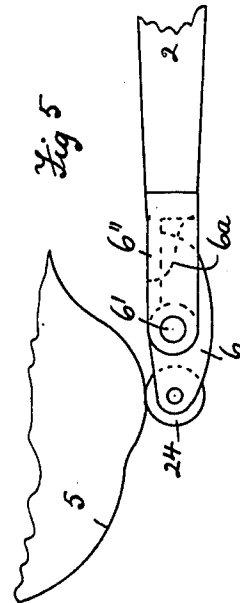
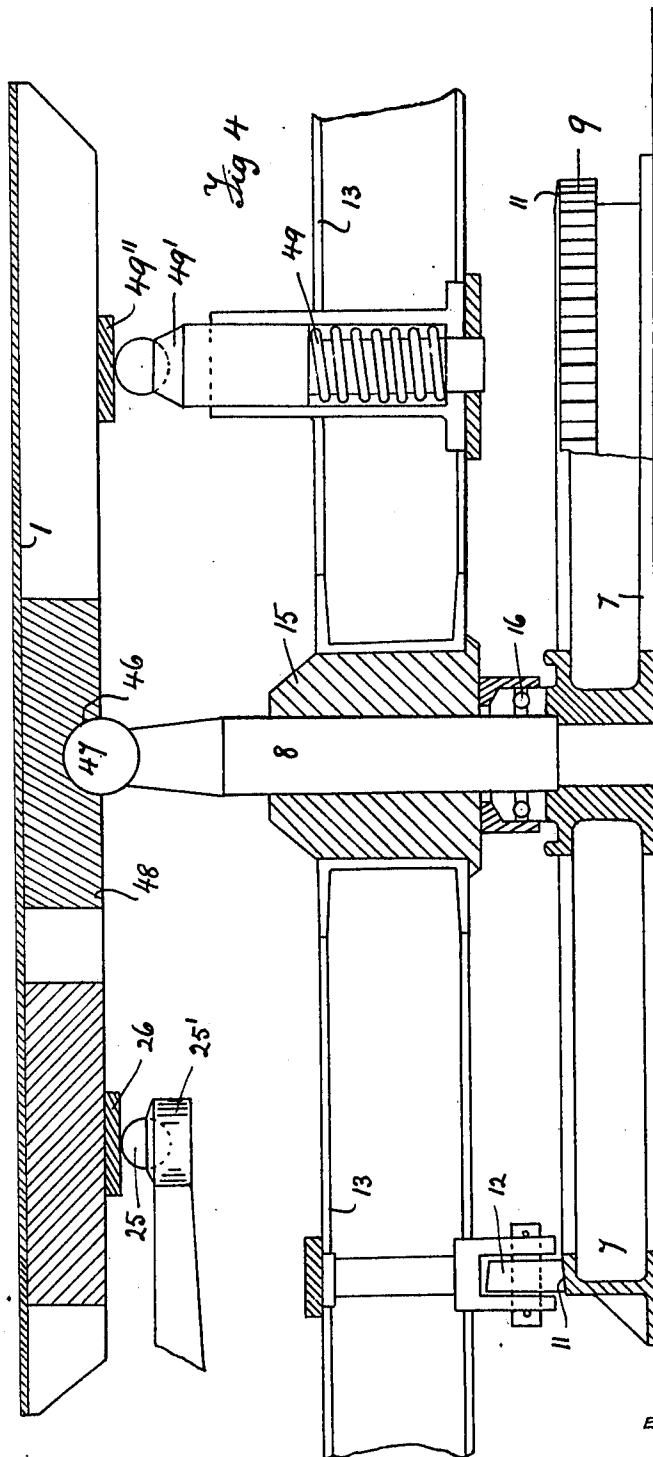


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UNITED STATES PATENT OFFICE.

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APPARATUS FOR REPRODUCING THE MOTIONS OF THE UPPER PART OF VESSELS IN MOTION.

1,313,685.

Specification of Letters Patent.

Patented Aug. 19, 1919.

Application filed February 14, 1919. Serial No. 277,122.

To all whom it may concern:

Be it known that I, WALTER RALEIGH GILBERT, a subject of the King of England, residing at London, England, have invented certain new and useful Improvements in Apparatus for Reproducing the Motions of the Upper Part of Vessels in Motion, of which the following is a specification.

This invention relates to an improved apparatus for reproducing the motions of the upper part of a moving ship and is especially applicable for use with firing teachers and the like. It consists of a platform or carrier designed to reproduce the various movements which take place on the deck or upper part of a moving ship for the purpose of realistic instruction in the operation and handling of "director firing", range-finding, searchlight or the like apparatus which is secured preferably centrally on the platform. The motions which can be reproduced by this invention are those of "rolling", "pitching", "yawing" and "training", and in addition a "kicking" movement to reproduce the recoil due to firing a (broadside of) ship's guns. The platform is arranged to oscillate upon its fixed support and make other movements to obtain the foregoing effects and also to be revolved for a portion of its revolution. The rolling, pitching, yawing and kicking effects are obtained by subjecting the platform to vertical and lateral forces: these may be obtained by means of cam-actuated rocking levers engaging the platform, and the training effect is preferably obtained by toothed gearing to effect the turning of the platform. The "kicking" action is caused in a suitable manner by a supplementary actuation of the roll-producing lever. Other features of the invention will hereinafter be pointed out.

Upon the accompanying sheet of drawings, an apparatus is shown constructed in accordance with this invention. Figure 1 is an elevation and Fig. 2 is a plan. Figs. 1^a and 2^a are respectively continuations of Figs. 1 and 2. Fig. 3 is an elevation of the kicker gear. Fig. 4 is a sectional elevation on a larger scale showing the supports for the platform. Figs. 5 and 6 are enlarged views in elevation and plan respectively of the cam and the engaging roller mounted on the rocking lever for the "rolling effect".

A normally horizontal platform or carrier 1 is mounted on a ball-joint 47 by means

of a central inverted cup 46, the ball being carried by a fixed pillar 8 upstanding from a base 7. The platform is engaged by pivoted rocking levers 2, 3 and 4 which respectively impart the "rolling", "pitching" and "yawing" movements to the platform 1. These levers 2, 3 and 4 at one end each engage or are connected with the underside of the platform 1 and they are pivoted immediately of their length, while at their other ends they are fitted with a ball or roller 24 which may be mounted on ball or roller bearings, which roller 24 is caused to follow the periphery of a revolving cam plate. These cam plates 5, 5^a, 5^b are shaped to reproduce (as from actual chart records) the movements of any particular vessel and they are made detachable. As will be seen from Figs. 5 and 6, the mounting preferably allows of two cam plates 5 of different curvatures being fitted at the same time so that by a throw-over device either cam 5 can be engaged by the roller 24. The two pairs of cam-plates 5 and 5^a respectively for levers 2 and 3 are mounted to rotate with shaft 22 supported in brackets 22^a.

It will be understood from Figs. 2 and 6 that each two cam plates 5 are parallel and spaced apart and that the lever 2 is forked at its roller-carrying end to afford a carrier wider than the two cams. The roller 24 is mounted in a trip 6 slidable on cross shaft 6', the tail of the trip being held against lifting by a plate 6'' having a central web 6^a. By depressing lever 2 below the one cam 5, the projecting end of trip 6 can be raised so that its tail clears the web 6^a and the whole trip then be caused to slide along the shaft 6' to be beneath the other cam 5, and the lever 2 finally released and allowed to rise.

The arrow in Fig. 2 indicates the front or forward direction. The rocking levers 2 and 3 for the "rolling" and "pitching" motions impart vertical movements to the outer portions or edges of the platform at points which lie on radial lines at right angles to one another; these levers are pivoted on brackets 23' and 23 respectively and are each fitted at their ends opposite to the rollers 24 with preferably a hardened steel ball 25 in a cup-socket 25', this ball working against a hardened steel or other wearing plate 26 underneath platform 1. The rocking lever 3 can be fitted to the front of the platform

(as shown) or to the rear of the platform, as will be obvious.

The "yawing" lever 4 has a connecting rod 27 with universal ball joint 28 and is kept up to its cam 5^b by a compression spring 29' on rod 29. This yawing lever 4 is pivoted in a bracket 23'' and the rod 27 which connects with the platform is pivoted to lever 4 at ball-joint 4' in the length between its roller 24 and the pivot 23''. Rod 27 may be connected to the platform 1 at any point which is suitable for providing the lateral movement; and as shown, it forms a coupling connection for the "training" movement between main frame 13 and the platform 1. The lines from the points where the balls 25 of levers 2 and 3 make contact with the platform to the oscillation center 47, are at right angles to one another.

The "roll", "pitch" and "yaw" motions are shown obtained from an electric motor 18. A first speed reduction gear consists preferably of chain drive 19 from the motor 18, which revolves a worm meshing with a worm wheel in gear box 19'. The speed is then further reduced by spur gears 20, 20' which revolve the shafts 22, 22' geared together by spur wheels 21 and carrying the cam plates 5, 5^a for the rolling and pitching motions.

The "kicker" gear may consist, as shown, of a clutch member 34 revoluble with shaft 30, slidably mounted on said shaft 30. This shaft 30 rotates, in the direction shown by the arrow in Fig. 1. The member 34 is so arranged that when an electromagnet C is energized, a rocking lever 31 (which controls the position of clutch member 34 on shaft 30) brings the teeth 32 of the slidable member of the clutch 34 into engagement with the member 33 of the clutch which is fast at one end with a spur pinion 34'; clutch member 33 is loosely mounted on shaft 30 and the gear 34' is in constant mesh with a quadrant 35, the latter being preferably bolted to, but in any case movable with, the rocking lever 2 for the "roll" motion. This quadrant 35 normally follows the "roll" motion and then idly oscillates the clutch member 33. When the clutch member 34 is engaged with member 33, the motion of shaft 30 is transmitted to the "roll" lever 2, producing in the correct direction (to correspond with the effect of gun recoil) either an additional or an opposing "roll" to the platform 1, as the case may be, beyond that imparted by the cam 5 at that particular moment. This "kicking" movement may thus be an increase of the normal rocking movement of lever 2 or it may act on the lever 2 oppositely to its normal movement at the particular moment, according to the time at which the kicker gear comes into action.

In either case, lever 2 is caused to leave

cam 5 to a greater or less degree and the resultant of the two forces (rolling and kicking) is reproduced on the platform. Shaft 30 is driven from shaft 22 by the meshing gears 20' and 30'. When the energizing circuit of the electro-magnet C is opened and the clutch is finally disengaged by a spring 36, an adjustable dashpot device 37 secured to the lever 2 controls the return of the said lever and quadrant so that the return motion is performed in such a way that the roller 24 on lever 2 again engages with the cam 5 without undue jar. Instead of the quadrant 35 and spur gear 34', other forms of mechanism for imparting the supplemental movement to rocking lever 2 may be employed, such as a rack and pinion mechanism.

Around the base 7 is a semi-circular rack 9 with which engages a pinion 10 to effect the "training" movement. The lower surface of base 7 may be bolted or otherwise affixed to any suitable foundation. The upper surface of base 7 is arranged to form a track ring 11 for guide rollers 12 to revolve upon, as a support for part of the weight of the revoluble superstructure or main frame 13 on which all the driving mechanism is mounted. As shown, this main frame 13 consists of two horizontal steel members strongly framed and gusseted, and secured to a central boss 15 which is revoluble around the fixed pillar 8, the central portion of the weight of the frame 13 being carried on a ball thrust bearing 16. At each end of this frame 13 are secured foundation plates or decks 17, 17' on which are mounted the motors and other gears whereby the various motions of platform 1 are produced and controlled.

The motor 18, cam-plates 5, 5^a and 5^b and the gears for operating the cam-plates and the "kicker" mechanism are mounted on deck 17 which, as stated, is secured to one end of the main frame. At the other end is secured the deck 17' on which is arranged the electric motor 38 directly coupled to worm gear 39 which drives, preferably through spur gears 40, 40' and bevel gears 41, 41', the pinion 10 which engages the curved rack 9 on the fixed frame 7. The shaft connecting the gears 41' and 10 is journaled in the main frame 13. In this way a horizontal "training" movement can be imparted to the main frame 13 by reason of the pinion 10 traveling around the fixed rack 9.

Preferably on this deck or bed-plate 17' are also mounted the electric controlling gear 43 and the horizontal keyboard 44 before which the instructor can sit on a suitable seat (not shown).

The platform 1 is shown mounted on the central ball and socket joint 47—46 so as to oscillate freely in any direction about

the ball 47, and the platform is so counter-weighted as shown at 48, that it will always keep in contact with the "roll" and "pitch" levers. Other means for keeping the rocking levers in constant engagement with their cams may be provided, such as springs acting on the levers.

The tilting action due to variation of the center of gravity of the "director firing" or other apparatus in use and the live load, is taken up by compression springs 49 or the like, on which ball-fitted shafts 49' are mounted to engage wearing pieces 49'' fitted underneath the platform. Instead of the springs 49, other cushioning and automatic-return devices, such as plungers working in air cylinders, may be employed.

By way of example, one can state that the constantly-rotating cam plates 5, 5^a, 5^b may perform a complete revolution in about 60 seconds. Different intensities of "roll" may be provided by the cams 5 for the "roll" lever 2, such as 2½ degrees, 5 degrees, or 7½ degrees. Different intensities of "yaw" may be provided such as representing 2 degrees and 3 degrees and different intensities of "pitch" such as 1½ degrees, 3 degrees or 5 degrees. With regard to the "training" motion, a total movement of 90 degrees on either side of the beam may be provided for, and, if desired, with variable speeds say from 1 minute to 2 minutes to train through an angle of 90°. The amount of movement and the speed of the "kicker" gear may be an extra movement of 3 degrees in about 2 seconds, and the "kicker" action is preferably rendered operative while the platform 1 is within 45° of either side of zero (*i. e.* broadside) "training" position.

The controllers and electrical connections may be of any suitable type and mounted on the keyboard 44. The switches and the electrical gear 43 may also be of any suitable pattern. If it be desired to provide several "training" speeds, a tramway-type controller with a series of notches for cutting out the motor resistances may be employed for the motor 38. An indicator dial 53 and pointer 54 are represented on the keyboard 44 to show the number of degrees of "train" on either side of central or zero position. An electric brake 50 is shown on worm shaft 39 to bring motor 38 to rest immediately the current is cut off. On the spindle of indicator 54 a contact switch operates to open the "kicker" circuit after a movement of 45° has taken place on either side of zero.

While it is intended that the "rolling," "pitching" and "yawing" motions should be obtained simultaneously, the "training" movement is introduced only when required, and the "kicker" action is employed only when the "rolling" motion is to be suddenly accentuated or modified as above described.

It will thus be seen that this invention

provides an apparatus for the practical instruction of the crews of guns, gun-directors, range-finders, searchlights or other appliances dependent upon or subject to the ship's movements, with a view to training such crews to carry out their duties under conditions similar to those arising from the motion of a ship at sea, such apparatus being applicable for instruction on shore or elsewhere. Further, instead of the gun or other device being mounted on a fixed foundation and the target being caused to move, as in instructional devices hitherto employed, this invention enables the gun or other load on the carrier or platform to participate in movements which are similar to those experienced when at sea.

Having thus described my invention, what I claim as such and desire to secure by Letters Patent of the United States is:—

1. An apparatus for reproducing the movements of the upper portion of a vessel in motion, comprising a fixed support, a platform mounted to oscillate on said support, means for imparting rising and falling movements to the edges of said platform, a main frame, said main frame being revoluble about said support, connections between said main frame and said platform so that the platform revolves with said main frame, means for imparting sidewise movement to the platform to reproduce a "yawing" movement, and gearing between said main frame and said support so that the platform may be turned to reproduce a "training" movement.

2. An apparatus for reproducing the movements of the upper portion of a vessel in motion, comprising a fixed support, said support including a pillar mounted on a base, a platform mounted on said pillar in an oscillating manner, power-actuated means for imparting lifting movements to the edges of said platform, spring members acting on the platform to return said platform, a main frame, said main frame being revoluble around said pillar with said platform, a track-ring upon said base, rollers secured to said main frame and traveling on said track-ring, a gear rack on said base, and a power-actuated pinion carried by said main frame and engaging said gear rack.

3. An apparatus for reproducing the movements of the upper portion of a vessel in motion, comprising a platform, a fixed support upon which said platform is rockably mounted, means for imparting vertical movements to the edges of the platform to reproduce both "rolling" and "pitching" movements, and power-actuated means for imparting a supplementary "rolling" movement to reproduce the corresponding "kicking" effect due to the discharge of a ship's guns broadside.

4. An apparatus for reproducing the

movements of the upper portion of a vessel in motion, comprising a carrier-platform, a fixed support for said platform, said platform being mounted on said support in a rockable manner, means for imparting rising movements to the edges of the platform so as to rock the platform and its load, said means including levers pivoted intermediately of their length to supports, each of said levers being operatively connected at one end with said platform and at the other end bearing against a revolving cam plate with appropriately shaped periphery, said connections with the platform being on radial lines at right angles to one another, and spring-pressed members bearing upon said platform to act as automatic return members and keep the platform bearing upon its lifting levers.

5. An apparatus for reproducing the movements of the upper portion of a vessel in motion, comprising a carrier-platform, a fixed support upon which said carrier-platform is rockably mounted, means for imparting rising and falling movements to the outer edges of said platform to reproduce "rolling" and "pitching movements" and a rocking lever pivoted upon a support, said lever having its ends respectively bearing against a revoluble cam disk and acted upon by a spring, and a connecting rod between said rocking lever and the underside of the platform, to reproduce the "yawing" motion.

6. An apparatus for reproducing the movements of the upper portion of a vessel in motion, comprising a carrier-platform, a fixed support upon which said platform is rockably mounted, means for imparting a rising and falling movement to the edges of the platform, to reproduce a "rolling" movement on the platform, said means including a rocking lever connected with the platform at one end and at the other outer end bearing against a revoluble cam-device, said cam device including alternative cam plates mounted parallel and spaced apart, a forked outer end to said rocking lever with a shaft between fork ends, a roller-fitted trip slidable along the said fork shaft, and means for holding said trip in either of two positions upon the shaft so that its roller can engage with either of the cam plates.

7. In an apparatus of the character described, a carrier-platform, a fixed support upon which said platform is rockably mounted, means for imparting a rising and

falling movement to the edges of the platform to reproduce a "rolling" movement, said means including a rocking lever connected at one end with the platform and at its opposite end bearing against a revoluble cam-device, a toothed quadrant secured to said rocking lever, a spur wheel loose on a revoluble shaft and engaged with said quadrant, a clutch member secured to said spur wheel, a complementary clutch member being slidably mounted on and rotating with said revoluble shaft, and means for engaging said slidable clutch member with the loosely mounted clutch member to transmit the movement of the revolving shaft to the aforesaid rocking lever so as to produce a supplementary rolling or "kicking" motion.

8. In an apparatus of the character described, the combination of a fixed support, a carrier-platform mounted on said support and rockable upon said support, pivoted levers bearing at one end upon the underside of said platform, said levers being cam-operated at their other ends to lift the platform at its edges so as to rock the carrier-platform and its load, and automatic return members engaging the platform upon the sides of the support opposite to the levers and serving to maintain the platform in contact with said pivoted levers.

9. In an apparatus of the character described, the combination of a fixed support, a carrier mounted on said support and rockable on said support, a main frame connected with said carrier and revoluble upon said support, decks carried by said main frame and arranged on opposite sides of the carrier, means for imparting rising and falling movements to the edges of the carrier so as to rock the carrier and its load upon the support, said means comprising rocking levers operated by power-actuated cams mounted on one of said decks, and means for turning said main frame and carrier around said support, said last-mentioned means being power-operated and comprising gearing mounted partly on the main frame and partly on the other of said decks.

In testimony whereof I have affixed my signature in presence of two witnesses.

WALTER RALEIGH GILBERT.

Witnesses:

ALBERT HELLIATO,
HELEN SUTHERLAND.