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Yasuda

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[54] **SINKING VESSEL SIMULATION APPARATUS**

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[52] **U.S. Cl.** **273/101.2,** 273/105.2, 35/25

[51] **Int. Cl.** **F41j 7/01**

[58] **Field of Search** ..... 273/101.1, 101.2, 273/102.1 O, 102.1 R, 105.2, 1 E; 35/25

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Assistant Examiner—Marvin Siskind
Attorney—E. F. Wenderoth et al.

[57] **ABSTRACT**

A sinking vessel display apparatus which comprises a model of a vessel comprising two or more sections, arms for supporting the vessel sections in an assembled state to form a complete vessel in a normal phase of the display apparatus and for supporting the vessel sections in a separated state to form a destroyed vessel in a sinking phase of the display apparatus. A mechanism is supplied for driving the support arms into the sinking phase from the uppermost support position of the vessel sections in the normal phase where the assembled complete vessel is held substantially along a horizontal line. The respective vessel sections are moved downwardly as they are separated from each other and at least one of the sections is inclined with respect to the horizontal line.

6 Claims, 7 Drawing Figures

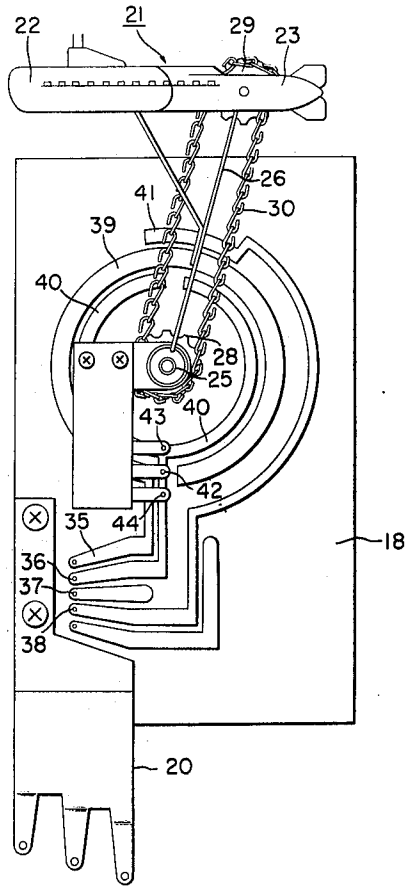

FIG. 1

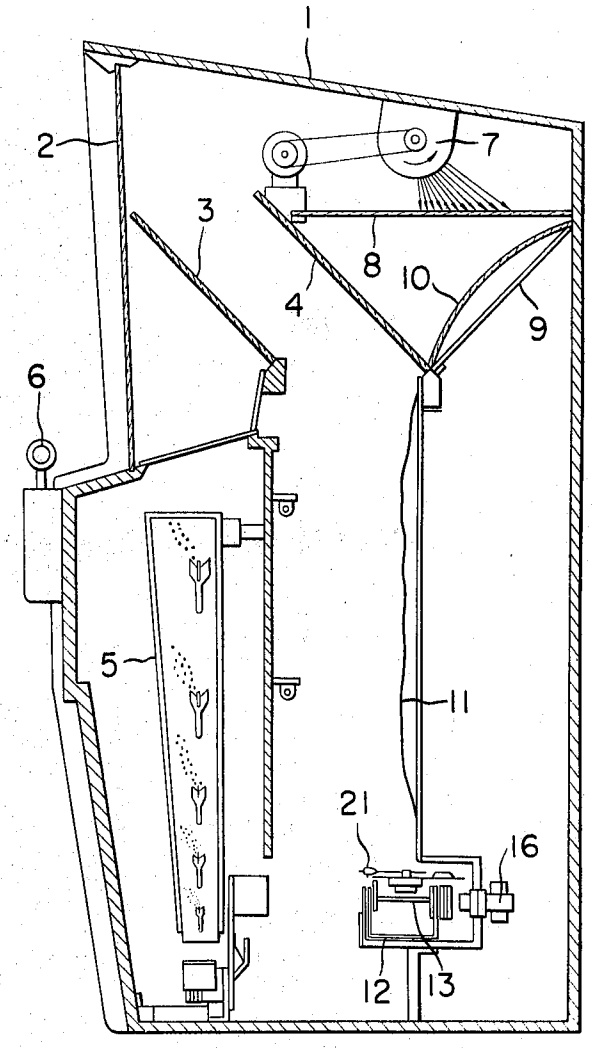

FIG. 2

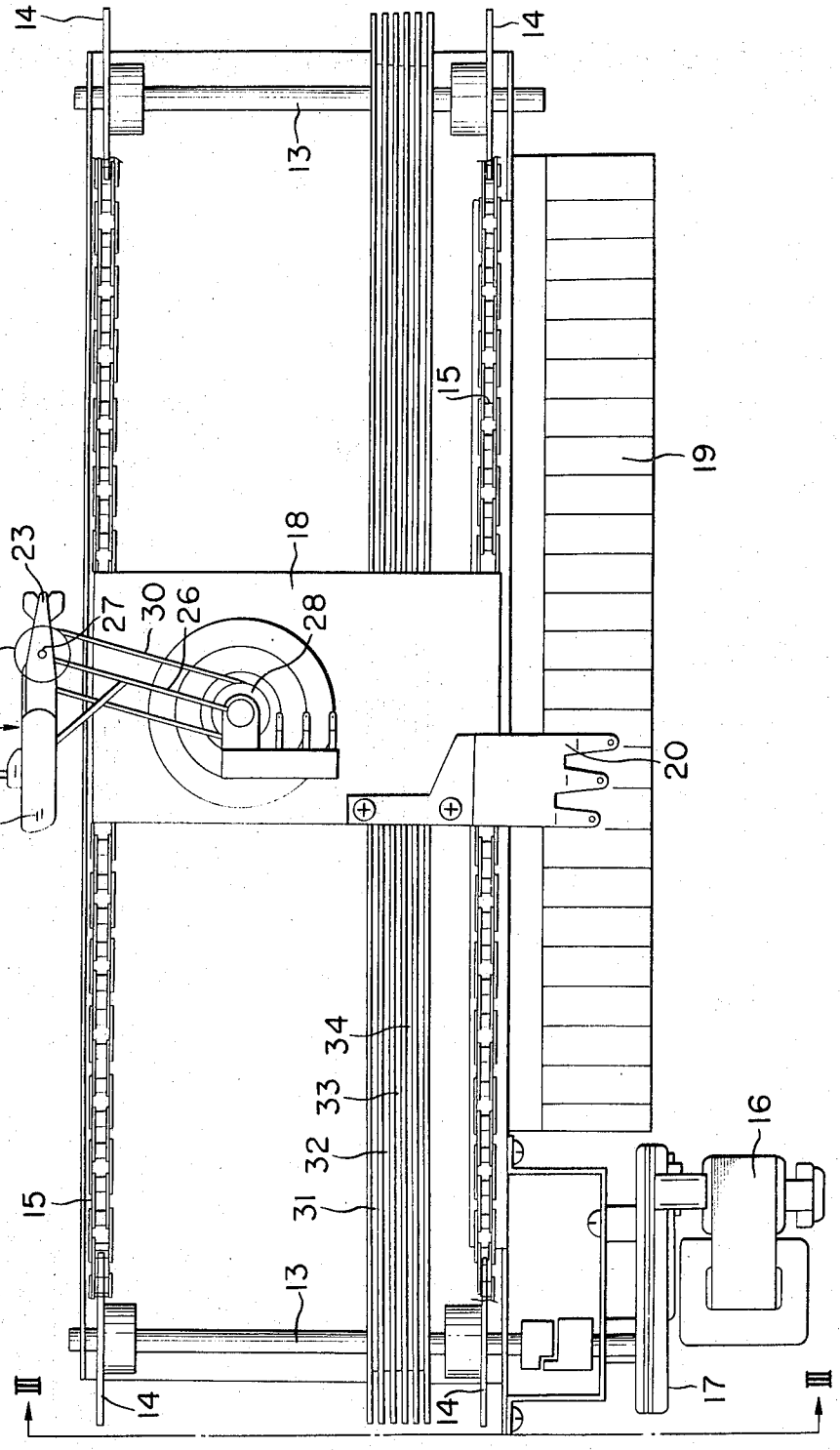
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FIG. 3

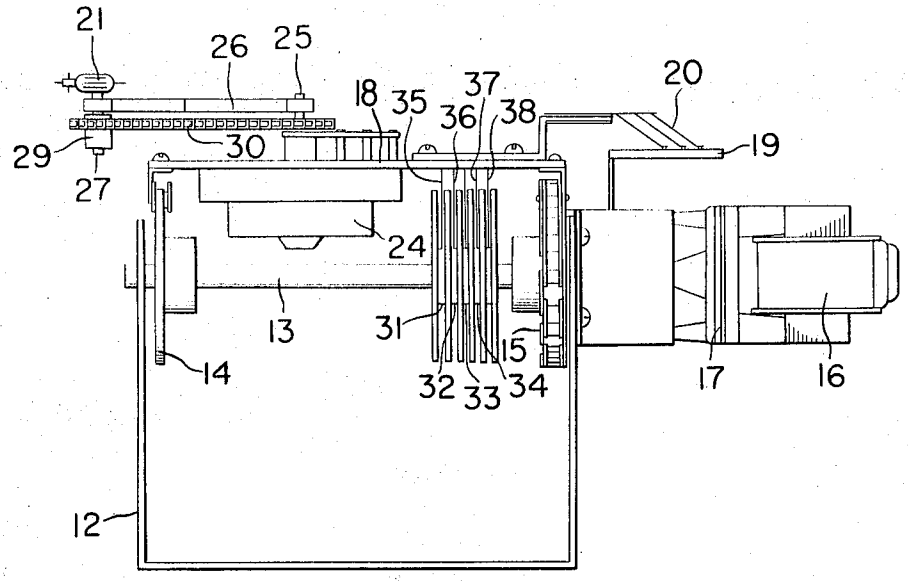
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FIG. 6

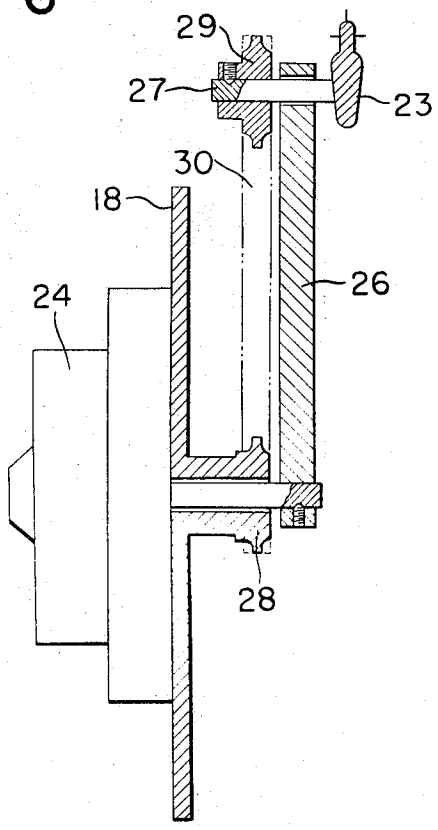
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FIG. 4

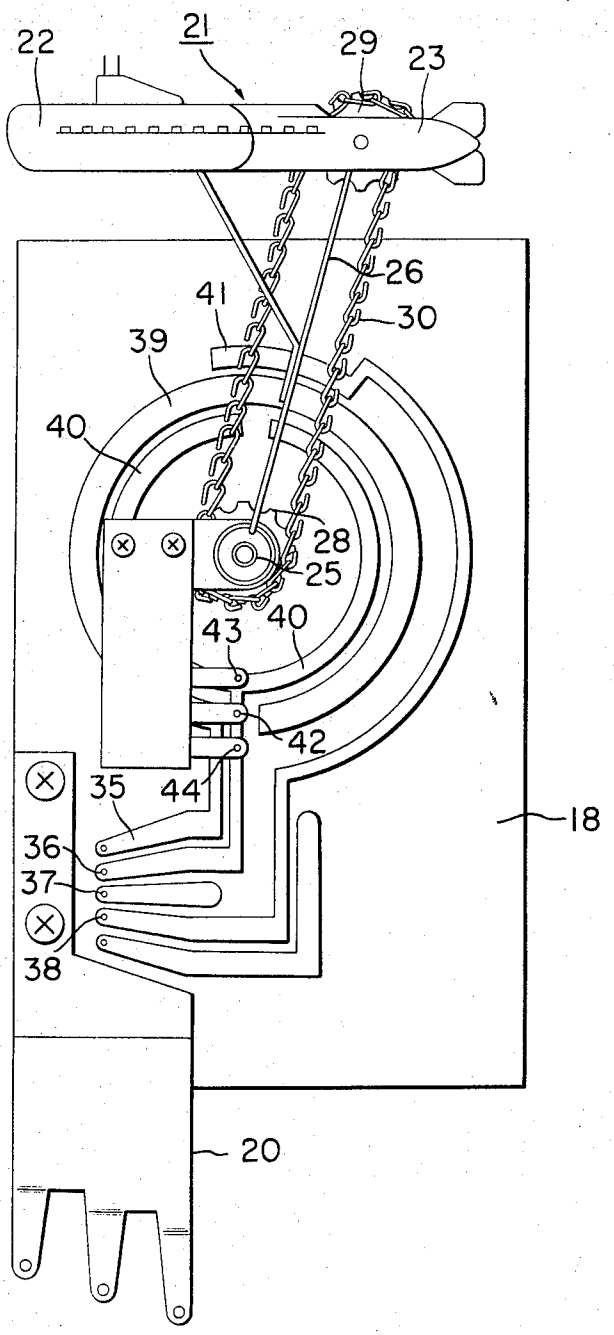


FIG. 5

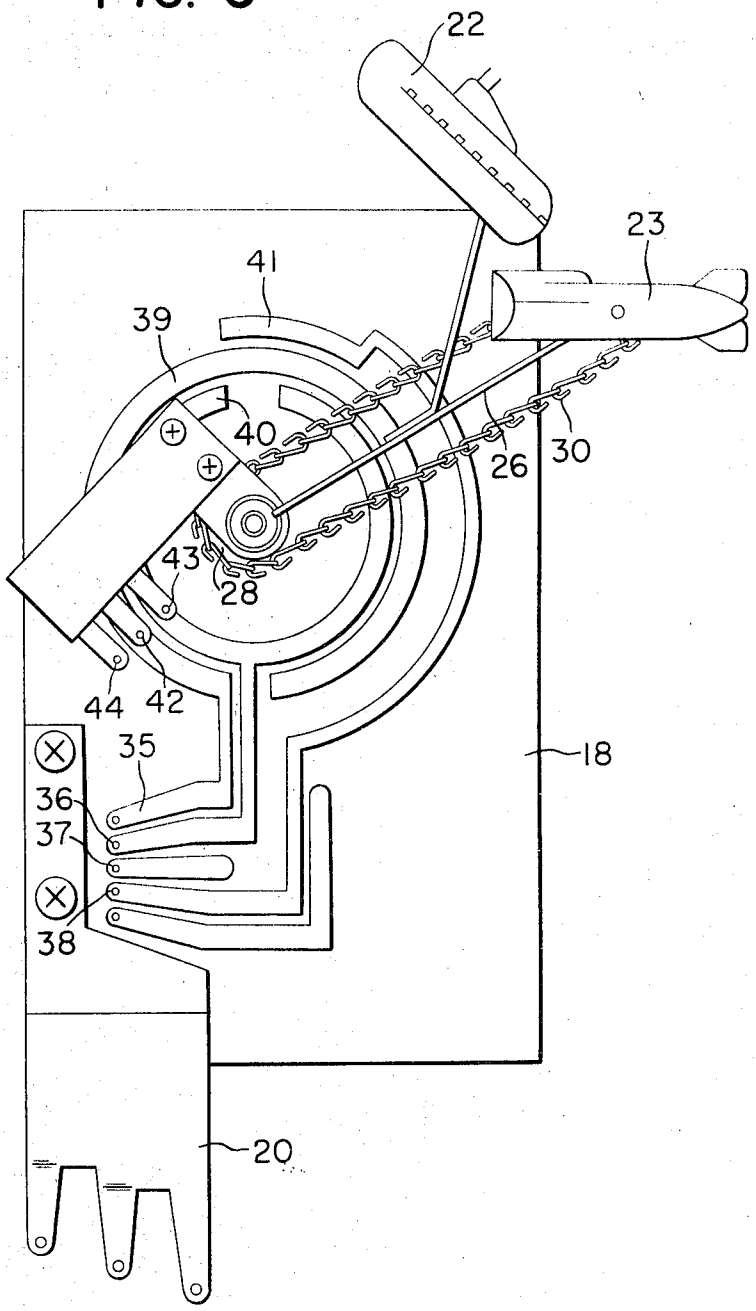
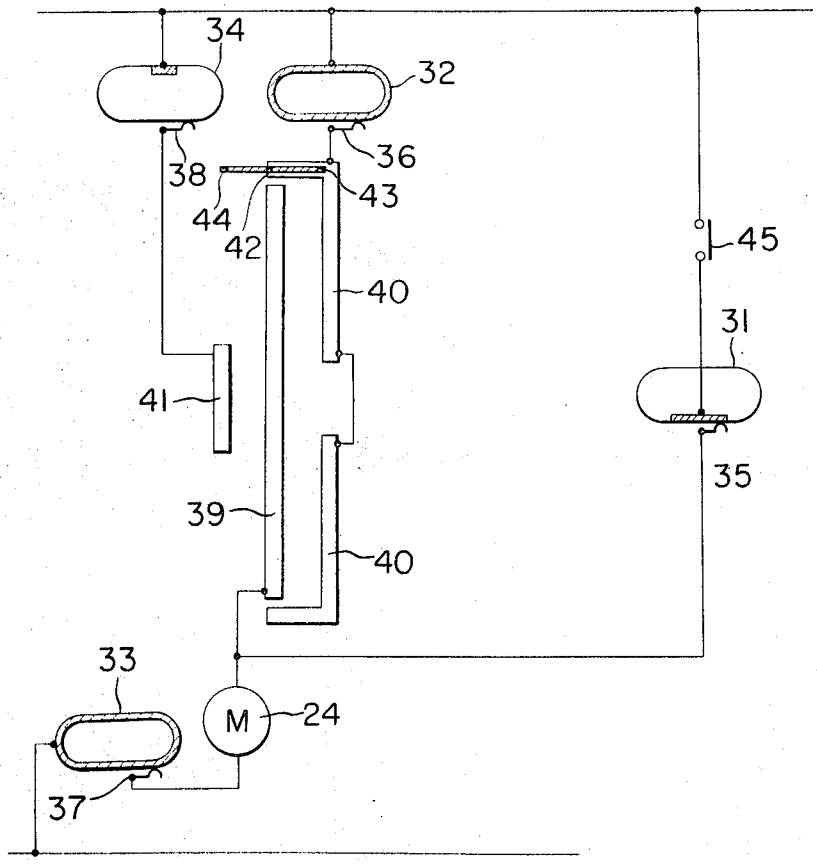


FIG. 7



SINKING VESSEL SIMULATION APPARATUS

The present invention relates to a sinking vessel display apparatus, and more particularly, to such display apparatus suitable to be applied to a playing machine although the invention is not limited that use.

Heretofore, in the art of playing machines, various display apparatuses for dummy targets such as vessels, airplanes or military ground establishments, have been developed. In order to afford a realistic impression to the machine player, the dummy targets were adapted to flash in response to his hitting the targets upon shooting a torpedo, a missile, or a bomb. In some of the playing machines using dummy targets of vessels, upon hitting a target, it was moved downwardly to be hidden by the waves in the foreground of the targets as a dummy display of a sinking vessel. However, such extent of dummy display of a sinking vessel was not satisfactory for giving the machine player a very realistic impression of a sinking vessel as destroyed by a torpedo, because vessels navigating on or in the waters would often sink as severed into two or more sections, each section being gradually inclined with respect to a horizontal line as it moves downwardly, when the vessels are destroyed by torpedoes or explosive cargoes.

Therefore, one object of the present invention is to provide a novel display apparatus for sinking vessels which affords the observer a more realistic impression than in the prior art apparatus.

Another object of the present invention is to provide a novel display apparatus for sinking vessels which can achieve three phases of operation in one cycle consisting of normal, sinking and recovering phases successively.

Still another object of the invention is to provide a novel display apparatus for sinking vessels which is constructed in a simple manner but can operate reliably.

According to one feature of the present invention, the sinking vessel display apparatus comprises a model of vessel consisting of two or more vessel sections, means for supporting said vessel sections in an assembled state to form a complete vessel in a normal phase of said display apparatus and for supporting said vessel sections in a separated state to form a destroyed vessel in a sinking phase of said display apparatus, and means for driving said support means in said sinking phase in such manner that starting from the uppermost support position of said vessel sections in said normal phase where the assembled complete vessel is held substantially along a horizontal line, said respective vessel sections may be moved downwardly as they are separated from each other and at least one of said vessel sections may be inclined with respect to the horizontal line.

Since the sinking vessel display apparatus according to the present invention is constructed as featured above, when said apparatus is in its normal phase of operation, said two or more vessel sections are integrally assembled to form a complete vessel and positioned at the uppermost support position, so that in association with appropriate background and foreground of the waters the completed vessel model displays a vessel as if it is at anchor on the waters or as if it is navigating on or in the waters depending upon whether the completed vessel model is stopped or advanced in the horizontal direction. Furthermore, when said apparatus is in its sinking phase of operation, the completed vessel model initially held at the uppermost position is severed into two or more vessel sections as it is moved downwardly and at least one of the vessel sections are inclined with respect to the horizontal line, so that in association with appropriate background and foreground of the waters the severed vessel model sections display a sinking vessel as if it were actually destroyed by torpedoes or explosive cargoes. Therefore, the observer in front of this display apparatus si given a very realistic impression of vessels that are normally navigating or that are sinking as destroyed by torpedoes or explosive cargoes.

These and other features of the present invention will become more apparent from perusal of the following specification taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a longitudinal cross-section side view of a playing machine incorporating one preferred embodiment of the sinking vessel display apparatus according to the present invention,

FIG. 2 is an enlarged partial plane view of the essential part of the playing machine in FIG. 1,

FIG. 3 is a side view taken along line III—III in FIG. 2 as viewed in the direction of arrows,

FIGS. 4 and 5 are enlarged partial plane view of the essential part shown in FIG. 2, FIG. 4 showing a target having its severed sections assembled integrally, FIG. 5 showing the same target having its severed sections separated from each other,

FIG. 6 is a transverse cross-section view taken along line VI—VI in FIG. 4 as viewed in the direction of arrows, and

FIG. 7 is a circuit diagram illustrating a power supply circuit for a driving motor used in the above embodiment.

Referring now to the accompanying drawings, the sinking vessel display apparatus according to the present invention is illustrated as incorporated in a playing machine, in which submarines navigating in the waters are shot with torpedoes. Throughout FIGS. 1 to 7, like components are designated with the same reference numerals.

In these figures, reference numeral 1 designates a casing of the playing machine, and at the upper portion of its front surface is disposed a transparent glass plate 2. Within said casing 1 and behind said glass plate 2 are mounted two semi-transparent mirror plates 3 and 4 in parallel to each other and as directed to an obliquely downward direction at 45° with respect to the horizon, said semi-transparent mirror plate functioning to permeate and reflect an incident light in a predetermined proportion.

Also within said casing 1 is disposed a torpedo imaging device 5 just beneath the fore semi-transparent mirror plate 3, in such manner that the direction of the torpedo imaging device representing a wake of the torpedo may be varied by manipulating an operating lever 6 provided in front of said casing 1.

In addition, within said casing 1 and obliquely above the rear semi-transparent mirror plate 4 is disposed a rising bubbles imaging device 7, and a screen 8 made from a frosted glass plate or the like is extended horizontally beneath said imaging device 7. Further, a reflector mirror 9 is extended from the lower edge of said rear semi-transparent mirror plate 4 to the rearmost end of the screen 8, and above said reflector mirror 9 is mounted a curved transparent plate 10 forming a

part of a cylindrical surface. Thus the image of bubbles projected upon the screen 8 with said rising bubbles imaging device 7 can be transmitted to the glass plate 2 via the reflector mirror 9 and the semi-transparent mirror plates 3 and 4, so that a machine player standing in front of the casing 1 can see the image of the rising bubbles.

Still further, within said casing 1 and just beneath the rear semi-transparent mirror plate 4 is disposed a foreground model 11 depicting the scene of bottom of the waters, and further beneath said foreground model 11 is arranged a sinking submarine display frame 12.

In said sinking submarine display frame 12, two rotary shafts 13 directed in the forth and back direction of the machine are pivotably mounted at a predetermined interval in the lateral direction, sprockets 14 are integrally fitted to the opposite ends of said rotary shafts 13, and the corresponding sprockets 14 on the respective rotary shafts 13 are coupled with each other by means of a pair of endless chain belts 15.

As will be seen in FIG. 2, one of the rotary shafts 13 is coupled to a target driving motor 16 via a transmission device 17, so that the above-described chain belts 15 may be driven in one direction by the rotation of said motor 16.

A target carrier plate 18 is mounted across said two chain belts 15 integrally therewith, current collector plates 19 are disposed along one of said chain belts 15, and a target position detector piece 20 is mounted on said target carrier plate 18 so as to make contact with said current collector plates 19, so that the position of a target 21 forming a submarine model that is mounted on the target carrier plate 18 as fully described later, may be detected by means of said current collector plates 19 and the target position detector piece 20. Since these target position detecting means are generally known and do not form a part of the present invention, we will omit a more detailed explanation thereon.

On the back side of said target carrier plate 18 is mounted a target rotating motor 24, whose rotary shaft 25 penetrates through the carrier plate 18 and projects outwardly as best seen in FIG. 6, a bifurcated (Y-shaped) target support arm 26 is integrally secured to said rotary shaft 25, and a fore target section 22 is fixedly secured to an extremity of one branch of said arm 26, while a rear target section 23 is pivotably mounted to an extremity of the other branch of said arm 26 via a shaft 27.

A fixed sprocket 28 is mounted integrally on said target carrier plate 28 concentrically with said rotary shaft 25, while on the shaft 27 that is integral with said rear target section 23 is integrally mounted another sprocket 29 that has the same diameter and the same number of teeth as said fixed sprocket 28, and an endless chain belt 30 is engaged with said respective sprockets 28 and 29.

In parallel to said chain belts 15, there are provided four trolleys 31, 32, 33 and 34 (although five trolleys are shown in the drawings, one of them is not pertinent to the subject invention and so it is there disregarded) also in an endless manner, and current collectors 35, 36, 37 and 38 which slidably make contact with said respective trolleys are provided on said target carrier plate 18.

In addition, arcuated fixed slide contacts 39, 40 and 41 are disposed on said target carrier plate 18 so as to be arranged concentrically with said rotary shaft 25 of the motor 24, the fixed slide contact 41 being positioned across the broken portion of the fixed slide contact 40, and said fixed slide contacts 39, 40 and 41 are respectively connected to said current collectors 35, 36 and 38.

Separate current collectors 42, 43 and 44 are fixedly mounted on the rotary shaft 25 of the motor 24, and these collectors are electrically connected to each other and are adapted to make slide contact with said arcuated fixed slide contacts 39, 40 and 41, respectively.

The power supply circuit for the target rotating motor 24 is wired as schematically shown in FIG. 7, in which the respective component members pertinent to the circuit connection are diagramatically and somewhat symbolically shown as designated by the same reference numerals as in other structural figures. As will be seen in FIG. 7, the trolley 31 and the associated current collector 35 can close circuit only when the target 21 is positioned on the front side, the trolley 32 and the associated current collector 35 as well as the trolley 33 and the associated current collector 37 can close circuits over the entire path of the target 21, and the trolley 34 and the associated current collector can close a circuit only when the target 21 is positioned on the back side.

Contacts 45 are hit relay contacts which are closed only when the torpedo displayed by the torpedo imaging device 5 has hit the submarine target 21, and said relay contacts 45 are connected in series to the trolley 31 and the associated current collector 35, and in turn connected to said target rotating motor 24. Since the circuit for energizing the hit relay is in itself well-known and does not form a part of the present invention, a further description thereon will be omitted here.

The operation of the playing machine constructed as described above is as follows: When a player has thrown in a predetermined amount of coins into the slot of the playing machine, the target driving motor 16 is caused to start rotation through a known control circuit (not shown), resulting in lateral movement of the target model 21 on the front side of its endless path from the right end to the left end as viewed in FIG. 2. Then the player manipulates the operating lever 6 to aim the target model 21 and discharges a torpedo, when the torpedo imaging device 5 is actuated to display the wake of the torpedo as if the torpedo is advancing in the water towards the target 21.

If the torpedo has hit the target, a hit relay (not shown) is energized through a known control circuit to close the hit relay contacts 45, and consequently, a current flows from one line of the power feed (the upper horizontal line in FIG. 7) through the hit relay contacts 45, trolley 31, current collector 35, target rotating motor 24, current collector 37 and trolley 33 to the other line of the power feed (the lower horizontal line in FIG. 7). Thus the target rotating motor 24 starts rotation to move the current collectors 42, 43 and 44 along the respective circular paths (represented as rectilinear paths in FIG. 7), and the arcuated fixed slide contacts 39 and 40 are interconnected by the mutually connected collectors 42 and 43. Therefore, once the motor 24 starts rotation, even if the relay contacts 45 are open, the energizing circuit for the motor 24 is completed through an alternative path consisting of the trolley 32, current collector 36, arcuated fixed slide contact 40, mutually connected current collectors 43

and 42 and arcuated fixed slide contact 39, so that said target rotating motor 24 is kept rotating over about 180°.

When said current collector 43 comes to the broken portion of the arcuated fixed slide contact 40, the interconncetion between the arcuated fixed slide contacts 40 and 39 is cut off. Then the current collector 38 does not make contact with the conductive portion (represented by a hatched area) of the trolley 34 because the target model 21 is positioned on the front side of its endless path. Thus all the possible paths for feeding the target rotating motor 24 are blocked, and so the motor 24 stops rotation.

Thereafter, when the target 21 has been moved to the back side of the endless chain belt 15 by the rotation of said target driving motor 16, the current collector 38 comes to the conductive portion of the trolley 34, so that a current flows through the motor 24 via a third feeding path consisting of the trolley 34, current collector 38, arcuated fixed slide contact 41, mutually connected current collectors 44 and 42 and arcuated fixed slide contact 39, and thereby the target rotating motor 24 again starts rotation. After the current collector 43 has passed the broken portion of the arcuated fixed slide contact 40, it makes contact with the latter half of said slide contact 40 and thereby the arcuated fixed slide contacts 40 and 39 are again interconnected to complete the second feeding path for the motor 24. Therefore, the motor 24 rotates further over above 180°and after making rotation of 360°the target support arm 26 and the target model 21 which are fixedly secured to the rotary shaft of the motor 24, are returned to their original positions on the target carrier plate 18.

During the above-described rotational motion of the rotary shaft of the target rotating motor 24, the target model 21 is displayed in the following manner: That is, since the fixed sprocket 28 and the pivotably mounted sprocket 29 have the same diameter and the same number of teeth, the revolutional angular velocity of the rear half section 23 of the submarine model 21 caused by the revolution of the target support arm 26 and the rotational angular velocity of the same caused via the sprocket 28, the endless chain belt 30 and the sprocket 29 are equal in magnitude but opposite in direction, so that the sprocket 21 and the rear half section 23 of the submarine model 21 are displaced backwardly in the state shown in FIG. 4 and downwardly in the state shown in FIG. 5 while maintaining their attitude in a fixed direction (the rear half section 23 being kept horizontal). On the other hand, the front half section 22 of the submarine model 21 that is fixedly secured to the front branch of the target support arm 26, is revolved about the rotary shaft of the motor 24 in the clockwised direction as viewed in FIGS. 4 and 5 integrally with the target support arm 26, while it is rotated at the same angular velocity and in the same direction as its revolution about the motor shaft. Consequently, the rear target section 23 is gradually hidden behing the foreground model 11 such as rocks at the bottom of the waters while being kept horizontal, whereas the front target section 22 is separated from the rear target section 23 and sinks as it is gradually inclined with its bow directed upwardly until it is also hidden behind the foreground model 11. This motion of the respective sections of the submarine model 21 afford the machine player a very realistic impression, as if a real submarine is destroyed by a torpedo into two sections which separately sink either as gradually inclined or as kept horizontal until they are hidden by the rocks at the bottom of the waters.

If the above-described embodiment is somewhat modified in such manner that the diameter and the number of teeth of the sprocket 28 are made two times as large as those of the sprocket 29, then the rotational angular velocity of the sprocket 29 and the rear target section 23 caused by the sprocket 28 and the endless chain belt 30 is two times as large as the revolutional angular velocity of the same but is opposite in direction. Therefore, in this case the rear target section 23 is not kept horizontal, but it is gradually inclined in the opposite direction to the front target section 22 so that the two sections 22 and 23 of the target model 21 are broken into a V-shape.

In a further modification of the embodiments, the front target section 22 is also pivotably mounted at the extremity of the front branch of the target support arm, and on this pivotal shaft is mounted another sprocket having the same diameter and the same number of teeth as the sprocket 29 and integrally secured to the front target section 22. Similarly to the just preceding modification, the diameters and the numbers of teeth of the sprockets 28 and 29 are selected to have a ratio of 2:1, and the chain belt 30 is engaged with the sprockets 28 and 29 in the same manner as described above, but another endless chain belt is engaged with the sprocket 29 and said another sprocket integrally secured to the front target section 28 to form a 8-shaped loop. Then the sprocket 29 and said another sprocket is driven in the opposite directions, and it will be obvious that the respective target sections 22 and 23 are gradually broken into a V-shape.

What is claimed is:

1. A sinking vessel diaplsy apparatus having a normal phase and a sinking phase in the operating cycle comprising:
   a. a model of a vessel consisting of two or more separate sections,
   b. support means for holding said vessel in an assembled state and in a horizontal position in the normal phase,
   c. first drive means for moving said vessel along a predetermined path in the horizontal position in the normal phase,
   d. second drive means for driving said holding means downwardly from said horizontal position and off said predetermined path in the sinking phase,
   e. said holding means also supporting said vessel in a separated state in the sinking phase of the display apparatus such that the holding means and the second means cooperate to simulate the destruction and sinking of a vessel upon a successful hit of said vessel.

2. A sinking vessel display apparatus as claimed in claim 1, in which said second drive means drives said support means in such manner that said vessel section is gradually inclined with respect to the horizontal line as it is moved downwardly.

3. A sinking vessel display apparatus as claimed in claim 1, in which subsequent to said normal and sinking phases is provided a recovering phase in one cycle of said display apparatus, said support means supporting said vessel sections in a separated state also in said recovering phase, and said second drive means drives

said support means in said recovering phase in such manner that starting from the lowermost support position of said vessel sections where said sinking phase terminates, said respective vessel sections may be moved upwardly as they are assembled together and restored to their substantially horizontal attitude until they form a complete vessel held substantially along a horizontal line at the uppermost support position when said recovering phase terminates.

4. A sinking vessel display apparatus having one operating cycle consisting of normal, sinking and recovering phases, comprising a model of vessel consisting of two or more vessel sections, first support means for supporting said vessel sections in an assembled state to form a complete vessel in said normal phase of said display apparatus and for supporting said vessel sections in a separated state to form a destroyed vessel in said sinking and recovering phases of said display apparatus, and first drive means for driving said first support means in said sinking phase in such manner that starting from the uppermost position of said vessel sections in said normal phase where the assembled complete vessel is held substantially along a horizontal line, said respective vessel sections are moved downwardly as they are separated from each other and at least one of said vessel sections is gradually inclined with respect to the horizontal line, and for driving said first support means in said recovering phase in such manner that starting from the lowermost support position of said vessel sections where said sinking phase terminates, said respective vessel sections may be moved upwardly as they are assembled together and restored to their substantially horizontal attitude until they form a complete vessel held substantailly along a horizontal lone at the uppermost support position when said recovering phase terminates.

5. A sinking vessel display apparatus as claimed in claim **4,** which further comprises a second support means for supporting said first support means and said first drive means along an endless track, a second drive means for driving said first support means and said first drive means along said endless track, a first control means responsive to an input signal for switching said display apparatus from said normal phase to said sinking phase provided that said second support means is in one part of said endless track, and a second control means responsive to the transfer of said second support means from said one part to the other part of said endless track for switching said display apparatus from said sinking phase to said recovering phase.

6. A sinking vessel display apparatus as claimed in claim **4,** in which said first support means consists of a support member fixedly secured to a horizontal rotary shaft at one point, which in turn supports said vessel sections at separated points thereon at least one fixedly and the others pivotably, and said first drive means consists of an electric motor and a transmission system for transmitting the rotary motion of said electric motor to said horizontal shaft and also to the pivotal shafts of the pivotably supported vessel sections.

* * * * *