

Dec. 21, 1965

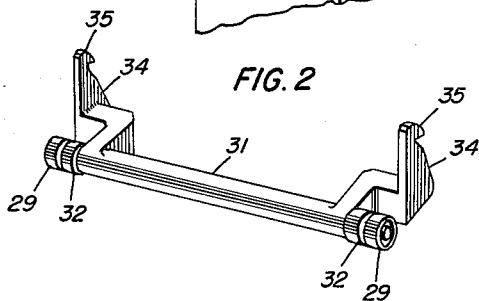
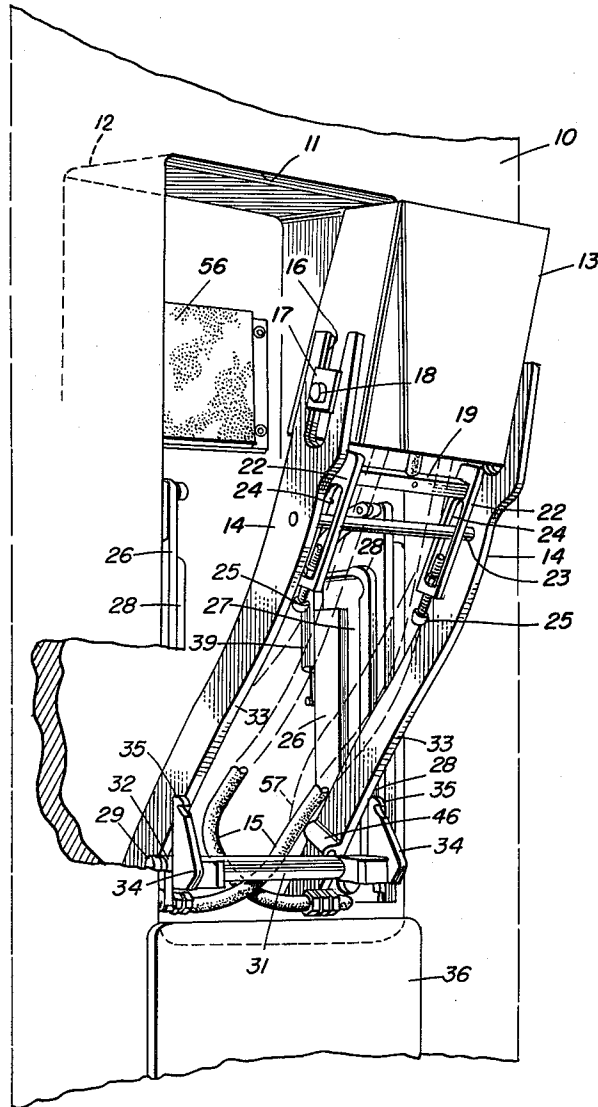
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3,224,335

UMBILICAL RETRACT MECHANISM

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FIG. 3

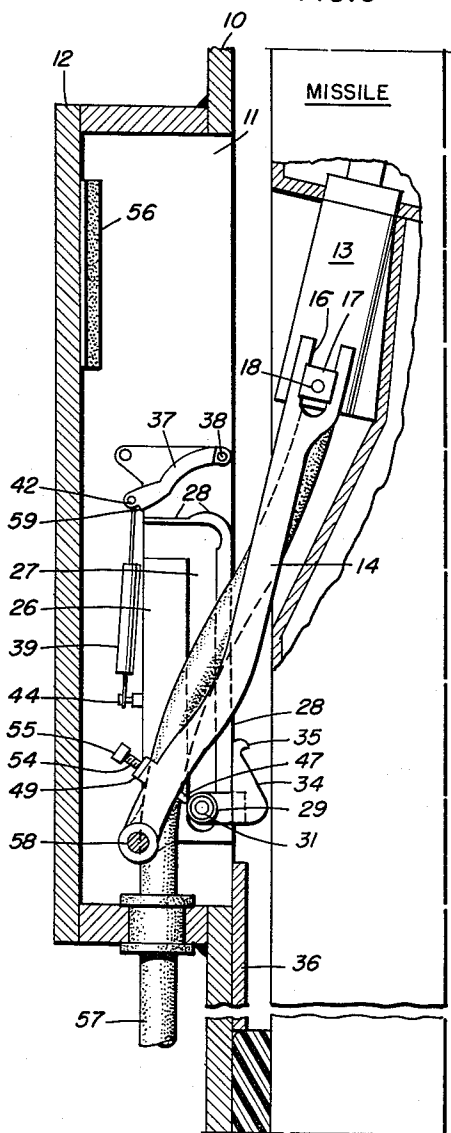


FIG. 4

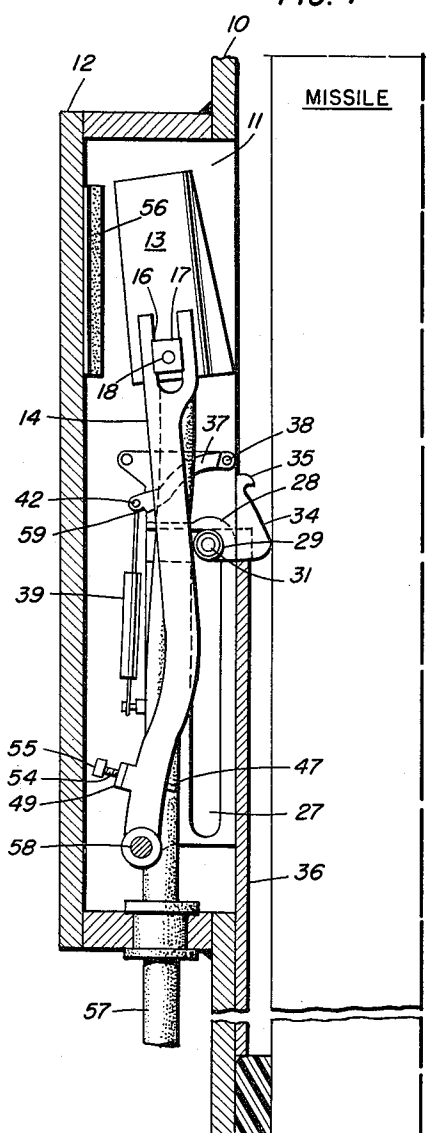
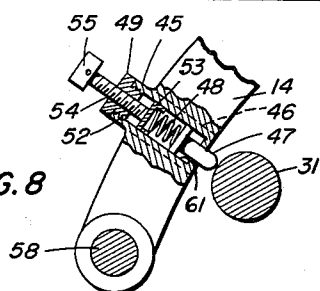


FIG. 8



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FIG. 5

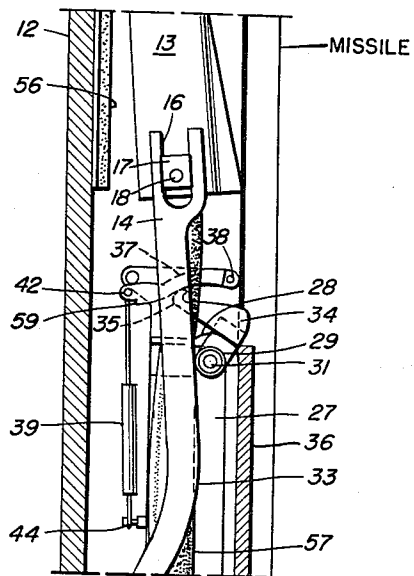


FIG. 6

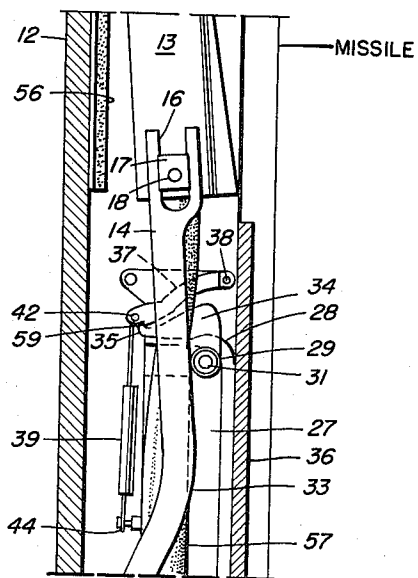
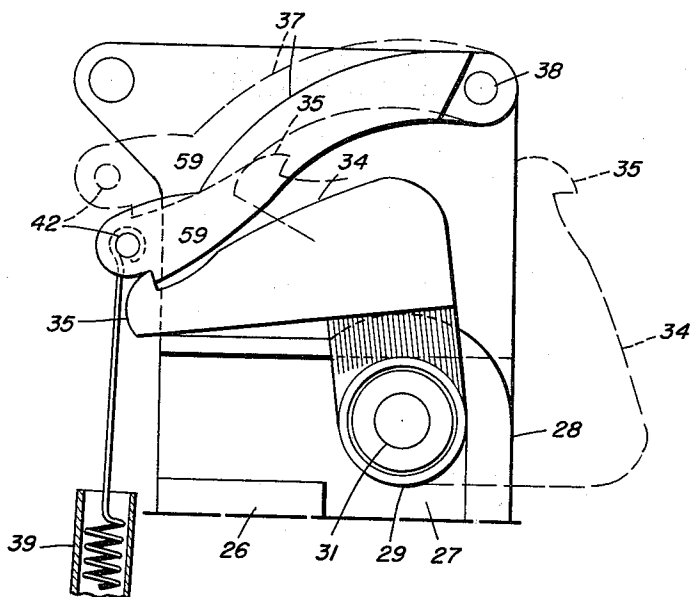


FIG. 7



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UMBILICAL RETRACT MECHANISM

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15 Claims. (Cl. 89—1.7)

The present invention relates generally to an umbilical connector retract mechanism which is utilized to disconnect an umbilical connector from a missile as the missile is launched. More particularly, the invention relates to a new retract mechanism which minimizes the transfer of unavoidable forces through the retract mechanism to the missile and also disconnects an umbilical connector from the missile and carries the connector to a remote position as the missile is launched.

Various methods are employed in launching systems presently being utilized. One widely used launching system is the one which launches a missile from within a tubular structure. An example of such a tubular launching system is the silo launcher which is a large hole in the ground from which a missile is launched.

In all launching systems it is frequently necessary that electrical power be supplied to the missile until, and sometimes after, the rocket motor is fired. In such a situation, therefore, it is necessary that an umbilical be connected to the missile until the missile lifts off the launcher. One type of umbilical connection which has been utilized is that type in which the connector is situated at the aft end of the missile and as the missile is launched it automatically pulls away from and disconnects any umbilicals which are employed. This type umbilical connector works very satisfactorily in most launchers. However, in the tube type launcher the length of the tube or the silo is a critical factor and it is therefore more expeditious and economical to locate all components on the sides of the launcher rather than to dispose them at the aft end or below the missile which increases the necessary length of the tube or silo. The desire to design a more economical and efficient tube type launching complex, by moving as many components as possible from the bottom of the tube to positions on the sides of the tube surrounding the missile thereby shortening the length of the tube, has in part been satisfied by the instant invention which enables an umbilical connector to be disposed in the side of the tube.

It is therefore the general purpose of this invention to provide an umbilical connector retract mechanism which embraces all of the operating advantages of the prior art umbilical connector assemblies and additionally possesses the advantage of being utilizable anywhere along the length of the launch tube and anywhere about the circumference of a launch tube. To attain these desired results the present invention contemplates a unique arrangement of components to provide an umbilical connector retract mechanism which transmits a minimum of forces between the launch tube and the missile, which allows for a predetermined amount of relative movement between the missile and the launching tube without disconnecting the connector from the missile, and which disconnects the umbilical connector from the missile and removes the umbilical connector from within the launch tube as the missile is launched.

Accordingly it is an object of the present invention to provide an umbilical connector retract mechanism for utilization with a missile launching system which will not operate to disconnect the umbilical connector from the missile unless the missile is actually being launched.

Another object of the present invention is to provide an umbilical connector retract mechanism for utilization

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with a missile launching system which prevents any transfer of forces along the retract mechanism between the missile and the missile launching tube in a direction normal to the missile surface.

A further object of the invention is to provide an umbilical connector retract mechanism for utilization within the missile launch system which provides for considerable relative movement between the missile and the missile launching tube without disconnection of the umbilical connector from the missile.

Still another object is to provide an umbilical connector retract mechanism which utilizes a positive latching apparatus to maintain the retract mechanism in a locked position when the mechanism is not being utilized to support the umbilical connector in connecting relationship with the missile.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 shows a generally diagrammatic view of the umbilical connector retract mechanism;

FIG. 2 shows a generally diagrammatic view of the cam roller assembly;

FIG. 3 is an elevational view of the retract mechanism showing the umbilical connector connected to the missile;

FIG. 4 is an elevational view showing the connector removed from the missile launcher tube and the cam roller assembly at the end of the cam track, at which point the latch assembly is activated;

FIG. 5 is an elevational view of the retract mechanism showing the umbilical connector removed from the missile launching tube at a point in the sequence where the latch assembly has moved midway along its path of travel;

FIG. 6 is an elevational view of the retract mechanism showing the sequence of retraction completed with the latch mechanism locked, thereby securing the retract arms in a position removed from the missile launcher tube;

FIG. 7 is an enlarged view of the latch mechanism showing the latch in a locked position with phantom lines showing different positions during the sequence of operation of the latch assembly; and

FIG. 8 is an enlarged cross-sectional view of the shock absorber mechanism which is disposed in each arm of the retract mechanism.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a general view of the retract mechanism. The missile launcher tube is shown generally at 10. Situated along the circumference of the missile launcher tube is an opening or recess 11 which allows for movement of the retract mechanism into a housing 12 which is attached to the outside of the launcher tube. The umbilical connector 13 is supported by two retract arms 14. The retract arms are pivotally supported by shaft 58 within the housing 12. Electrical signals are transmitted to the umbilical connector 13 by the umbilicals 15.

Each retract arm 14 has a fork at its upper end to provide a shoe track 16 along which slides a connector shoe 17. The umbilical connector 13 is supported by the retract arms 14 through pins 18 which are secured in the connector shoes 17. Also secured to the umbilical connector 13 is the trigger link connecting T-bar 19 which interconnects trigger links 22. A connector retaining pin or spar 23 interconnects the retract arms 14 and passes through slots 24 in the trigger links 22. Also associated with the trigger links 22 are the trigger assembly adjusting screws 25 which pass through one end of the trigger links 22 and extend into the slots 24 to provide a stop

in the movement of the trigger links 22 along the connector pin or spar 23.

Secured to opposing side walls of the housing 12 are the cam plates 26. The cam plates have disposed therein the cam tracks 27 and the outer cam surface 28. The roller assembly, which is more clearly shown in FIG. 2, moves along the track 27 and is comprised of the rollers 29 which move along tracks 27, rollers 32 which roll along the innersurface 33 of the retract arms 14, and the missile actuated runners 34 which ride along the outer cam 28. Each runner 34 has a hook portion 35 which forms a part of the latch mechanism assembly. Secured to the inner wall of the missile launching tube 10 is a missile actuated plate 36. The plate 36 is connected to the missile launcher in such a manner that when the missile is launched, the plate 36 will move upward along the tube wall to cover the recess 11. During this movement the plate 36 engages the runners 34 to move the roller assembly upward which in turn forces the retract arms 14 to move into the housing 12.

The cam plates 26 also support a latch assembly in a recessed area at their respective upper ends. The latch assembly is comprised of an arcuate runner latch 37 secured to the cam plate 26 by the pin 38 and a spring assembly 39 which biases the latch 37 in a downward direction. The spring 39 is connected to one end of the latch 37 by the spring retaining stud 42 and secured to the cam plate 26, or alternatively, housing 12, by the retaining screw 44.

A shock absorbing device 46 is associated with each retract arm 14 to absorb forces which are transmitted to the retract mechanism due to relative movement between the missile and the missile launching tube 10 while the missile is being prepared for launch. The shock absorbing device generally shown at 46 is more clearly shown in the enlarged view of FIG. 8. Each retract arm 14 has a bore 61 which extends therethrough. Disposed in a reduced portion of the bore 61 is a rod or pin 47 which is biased toward the roller assembly 31 by a spring 48. The shock absorbing device need not have an adjustment means but the embodiment illustrated in FIG. 8 provides for adjustment of the spring 48 tension. A cap 49 is threadedly secured in the bore 61 of the retract arm 14 by threads 52. The cup 53 is secured to the threaded screw 54 and is moved along the bore 61 when the knob 55 is turned.

There is provided within the housing 12 a pad 56 which will cushion the umbilical connector 13 in the event the connector comes in contact with the wall of the housing 12. The umbilical 57 illustrated in FIGS. 3 and 4 is different from the umbilicals illustrated in FIG. 1 in that it is of different size and enters the housing 12 at a different point. It is to be recognized, however, that the manner in which the umbilical, or any other means for transporting electrical signals, is connected to the umbilical connector 13 is a matter to be determined by the necessities of the launcher with which the instant retract assembly is used. Furthermore, in some launching complexes utilizing this retract mechanism it would be necessary to establish a sealing relationship between the plate 36 and the wall of the launcher tube 10 so that no fluids might pass from within the launcher tube to the interior of the recess 11, i.e., into the housing 12.

The operation of the retract mechanism is illustrated by FIGS. 3 through 7. FIG. 3 shows the mechanism in a position where the umbilical connector 13 is connected to the missile and the retract arms 14 are riding against the roller assembly 31 through the rods 47. When the motors of the missile are ignited and the missile begins to rise upward to leave the launch tube 10, the plate 36 begins upward movement and as is noted in FIG. 3 there is an initial distance which the plate 36 must travel before it contacts the runners 34. This initial movement allows the missile to rise a certain distance while remaining connected to the umbilical connector 13 since the connector

may move relative to the retract arms by way of the shoes 17 and the trigger links 22. The distance the missile rises upward in the launcher tube before the connector 13 is pulled from the missile is determined by the positioning of the adjustment screws 25. The adjustment screws 25 will be positioned so that the connector 13 will be disconnected from the missile before the plate 36 strikes the runners 34.

As the plate 36 strikes the runners 34 the roller assembly moves upward in a motion which is determined by the movement of the cam track followers 29 along the tracks 27. As the cam track followers 29 move along the tracks 27, the retract arm rollers 32 move along the innersurface 33 of the retract arms 14 to rotate the retract arms about the pivot 58 so as to move the connector 13 into the housing 12. As the roller assembly is moved upward by the plate 36 the runners 34 ride along the outer cam 28.

FIG. 4 shows the connector 13 fully removed from the interior of the launch tube 10 and the runners 34 moved to a point where the cam track 27 ends and limits further upward movement of the cam track followers 29 so as to force the rotation of the runners 34 about the shaft of the roller assembly 31.

FIG. 5 shows the retract mechanism in a position where the plate 36 forces the rotation of the runner 34 about the roller assembly 31 axis. At this position the hook 35 forces the arcuate latch 37 to rotate upwardly about the pin 38.

FIG. 6 shows the retract mechanism fully retracted with the connector 13 removed from within the missile tube 10. The plate 36 is illustrated in the position where the runners 34 are fully rotated so that the hook 35 of each runner rests on the upper end portion of the outer cam 28 and is engaged by the lip 59 of the latch 37. The spring assembly 39 holds the latch in engagement with the runner 34 so that the runner 34 is held in place thereby holding the roller assembly 31 in place which in turn secures the retract arms 14 within the housing 12.

As is apparent from the foregoing description, the present invention provides an umbilical connector retract mechanism especially applicable to missile launching systems which utilize a launch tube arrangement to launch a missile.

While the invention has been described in its preferred embodiment, it is to be understood that the terminology used herein is intended to be in the nature of words of description rather than words of limitation.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An umbilical retractor assembly for moving an umbilical connector away from a missile during the launching sequence of the missile, said retractor assembly comprising:
 - a housing,
 - two mutually spaced parallel retract arms,
 - said retract arms being pivotally supported at a first end thereof by said housing,
 - an umbilical connector attached to the second end of said retract arms,
 - a cam track means secured within said housing,
 - a cam follower means slidably disposed in said cam track means,
 - missile actuated means attached to said cam follower means for moving said cam follower means along said cam track means, and
 - retract arm engaging means attached to said cam follower means for rotating said retract arms about their respective first ends to move said umbilical connector into said housing.
2. An umbilical retractor assembly as claimed in claim 1 wherein;

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a latch means is disposed within said housing for securing said missile actuated means when the umbilical connector has been fully retracted into said housing.

3. An umbilical retract assembly to be utilized in conjunction with a missile which is launched from an enclosure which comprises;

two mutually spaced parallel retract arms pivotally supported at a first end thereof within a recess in the missile launcher enclosure wall, said arms supported for rotation out of said recess into said missile launcher enclosure, two cam plates supported within said recess in parallel relationship with the plane of rotation of said retract arms,

each of said cam plates being disposed in juxtaposition to one of said retract arms, each cam plate having a cam track means, a cam track follower secured for movement along each of said cam track means,

a shaft interconnecting said cam track followers so as to bear against said retract arms, two runner means attached to said shaft and disposed so as to extend from said recess and slide along the edges of said respective cam plates,

said cam track follower movable along said cam track means to a predetermined position at which position said retract arms are fully retracted into said recess, and

an actuation means for engaging and moving said runner means during the launching sequence of a missile.

4. An umbilical retract assembly as set forth in claim 3 wherein;

each of said retract arms has a shock absorber means disposed between said retract arm and said shaft for cushioning rotational movement of said retract arm.

5. An umbilical retract assembly as set forth in claim 3 wherein;

each of said retract arms has a bore therein which is disposed generally transverse to the longitudinal axis of said retract arm,

said bore being disposed substantially near the first end of said respective retract arms,

a rod disposed in each bore and extending from each of said respective retract arms for bearing against said shaft when said shaft is in a position whereby said retract arms are substantially fully rotated out of said recess in the missile launcher enclosure, and a spring means disposed within an enlarged portion of each bore for biasing said rod out of said retract arm against said shaft.

6. An umbilical retract assembly as claimed in claim 3 wherein said actuation means comprises;

a panel disposed in sealing and sliding relationship with the missile launcher enclosure wall, and

said panel being disposed so as to slide along the wall of said missile launcher enclosure wall during the launch sequence of a missile and engage said runner means and to seal said recess from said missile launcher enclosure.

7. An umbilical retract assembly as set forth in claim 3 wherein;

said cam plates have a recessed area for permitting said runner means to rotate about said cam track followers into said recess upon movement of said cam track followers to said predetermined position.

8. An umbilical retract assembly as claimed in claim 3 wherein;

an umbilical connector is supported by the second ends of said retract arms.

9. An umbilical retract assembly as set forth in claim 7 wherein;

a latch means is pivotally attached on the respective recessed areas of each of said cam plates for securing said runner means when said runner means have been rotated into said respective recessed areas.

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10. An umbilical retract assembly as set forth in claim 9 wherein;

said latch means comprises an arcuate member, a latch retaining pin for securing said arcuate member, at a first end thereof, in pivotal relationship with said recessed area of said cam plate,

said latch retaining pin being disposed through said cam plate in juxtaposition to the juncture of said recess and said missile launcher enclosure, and

a spring means interconnecting said cam plate and the second end of said arcuate member for biasing said arcuate member toward the flange in said cam plate formed by said recessed area.

11. An umbilical retract assembly as set forth in claim 3 wherein;

connector track means are longitudinally disposed on each respective retract arm in juxtaposition to the second end thereof,

a connector shoe means is disposed in sliding relationship with each of said connector track means, and an umbilical connector is connected to each of said connector shoe means whereby said umbilical connector is movable with respect to said retract arms along the longitudinal axis of said retract arms.

12. An umbilical retract assembly as set forth in claim 11 wherein;

a trigger means interconnects said retract arms and said umbilical connector for maintaining the movement of said umbilical connector shoe means within predetermined limits.

13. An umbilical retract assembly as set forth in claim 12 wherein said trigger means comprises;

a spar interconnecting said retract arms, at least one trigger link having a slot therein, said trigger link and said spar disposed so that said spar passes through said slot in said link whereby said trigger link is movable with respect to said spar in a direction parallel to the longitudinal axes of said retract arms,

securing means for connecting said trigger link to said umbilical connector, and

adjustment screw means disposed in said trigger link and extending in a longitudinal direction along said slot.

14. An umbilical retract assembly as claimed in claim 12 wherein said trigger means comprises;

a trigger link connecting bar attached to said umbilical connector,

two trigger links mutually spaced and respectively connected at a first end thereof to either end of said trigger link connecting bar,

each of said trigger links having a slot therein disposed in substantially parallel relationship with the longitudinal axes of said retract arms,

a spar interconnecting said retract arms and disposed so as to pass through the respective slots in said trigger links,

an adjusting screw means threadedly disposed in the second end of each respective trigger link to extend into said slot for maintaining the movement of said trigger links with respect to said spar within predetermined limits whereby the movement of said umbilical connector along the longitudinal axes of said retract arms is likewise maintained within predetermined limits.

15. An umbilical retract assembly for use in association with a missile which is launched from within a missile launcher tube which comprises;

a housing attached to the missile launcher tube and opening into the missile launcher tube,

two mutually spaced parallel retract arms pivotally supported at a first end thereof within said housing for rotation into the missile launcher tube,

two cam plates disposed in parallel relationship to said missile launcher tube walls and respectively secured

to said housing in juxtaposition to each retract arm, said cam plates each having a cam track therein, said cam tracks having upper and lower ends, a cam track follower disposed in each of said cam tracks for sliding movement therealong, 5
 a shaft interconnecting said cam track followers and disposed for limiting the rotational movement into the missile launcher tube of said retract arms, two runners attached to said shaft and disposed so as to extend into said missile launcher tube, 10
 each of said runners being disposed so as to slide along the edge of one of said cam plates, said cam plates having a recessed area on the upper end thereof for permitting said runners to rotate about said cam followers and into said recessed area 15
 when said cam followers have reached the upper ends of the respective cam tracks, a latch retaining pin attached to said cam plate in said recessed area and in juxtaposition to said missile launcher tube wall, 20
 an arcuate latch member pivotally secured at a first end thereof to said cam plate by said latch retaining pin, a spring means interconnecting the second end of said latch member and said housing for biasing said latch member toward the axis of rotation of said retract arms, 25
 a connector track is longitudinally disposed on each respective retract arm in juxtaposition to the second end thereof, 30
 a connector shoe is disposed in sliding relationship with each connector track, an umbilical connector is connected to each connector shoe, 35
 a trigger link connecting bar disposed between said retract arms and attached to said umbilical connector,

a trigger link attached by a first end thereof to each end of said trigger link connecting bar, said trigger links each having a slot disposed therein in substantially parallel relationship with the longitudinal axes of said retract arms, 5
 a spar interconnecting said retract arms and disposed so as to pass through said slots in said trigger links, an adjusting screw threadedly disposed in the second end of each respective trigger link for movement into and along said slot to limit the movement of the respective trigger links with respect to said spar, 10
 a rod disposed in a bore in each retract arm so as to bear against said shaft when said cam track followers are substantially at the lower ends of the respective cam tracks, said bore having an enlarged diameter within said respective retract arms, 15
 a spring means disposed in the enlarged portion of each bore for biasing said rod toward said shaft, a panel disposed in sealing and sliding relationship with the wall of said missile launcher tube, and said panel disposed so as to slide along the wall of said missile launcher tube during the launching sequence of a missile to engage said runners and to seal the opening of said housing from the missile launcher tube. 20

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