July 4, 1961 E. A. BENDER 2,990,556

SWIMMING POOL COVER

Filed May 29, 1959 7 Sheets-Sheet 1

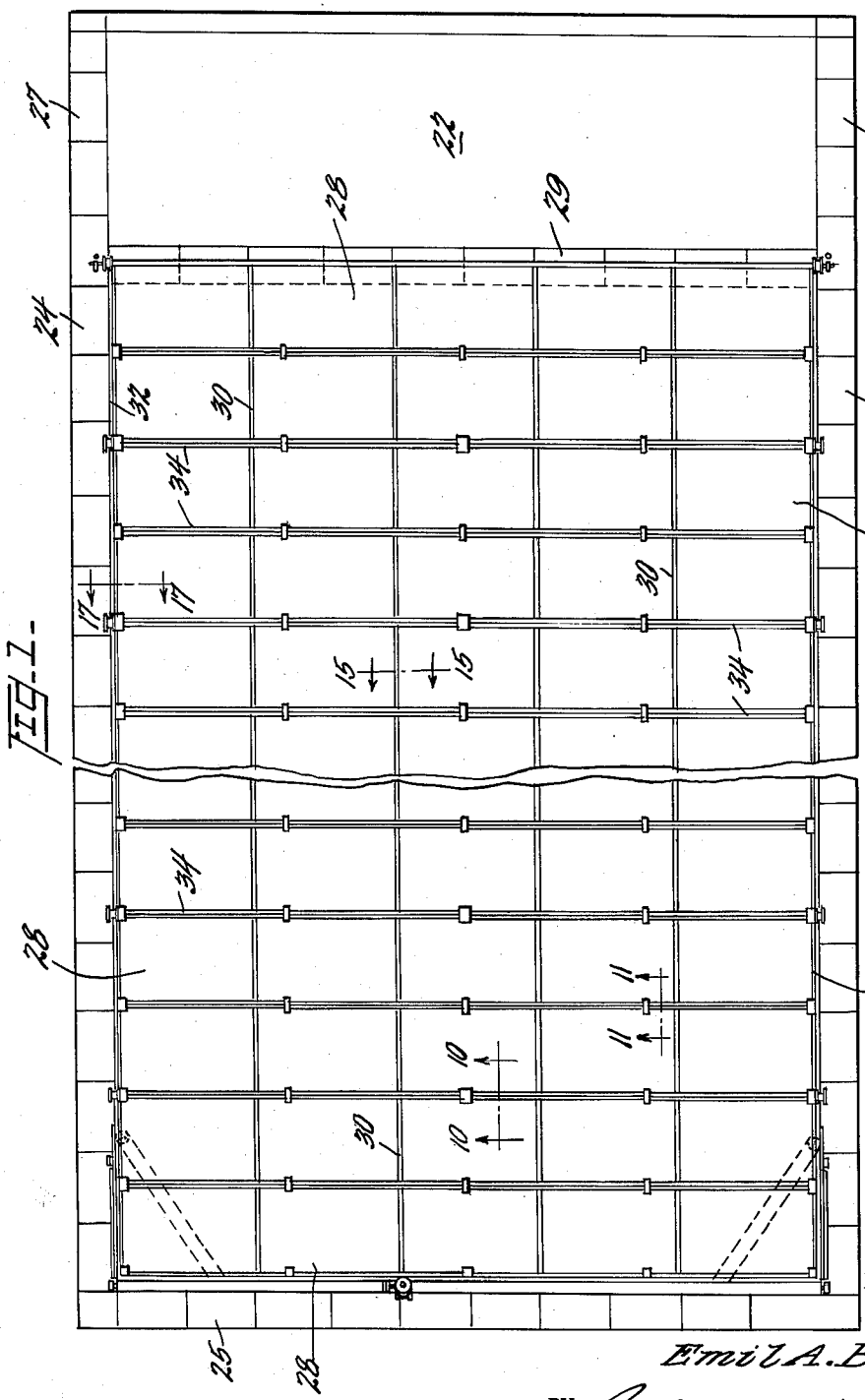


FIG. 1.

INVENTOR

Emil A. Bender,

BY Parker and Wheeler

ATTORNEYS

July 4, 1961 E. A. BENDER 2,990,556

SWIMMING POOL COVER

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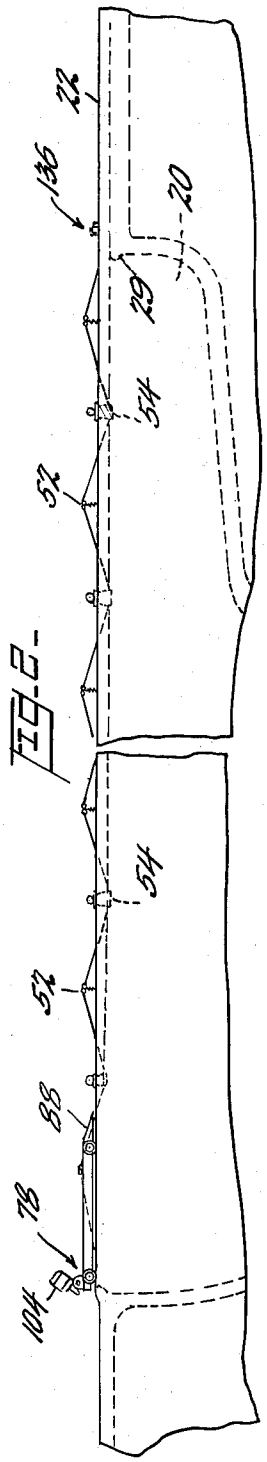


FIG. 2.

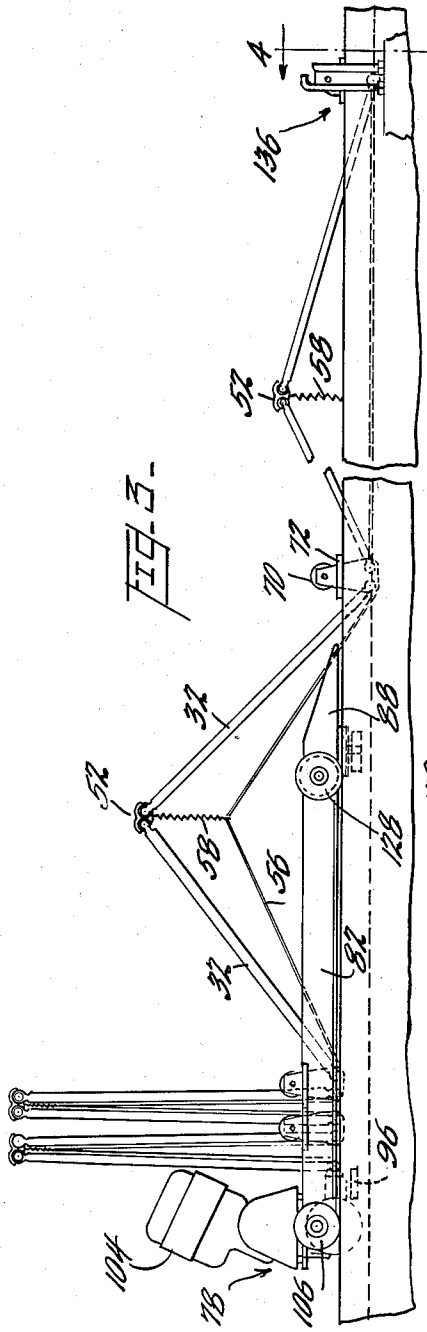


FIG. 3.

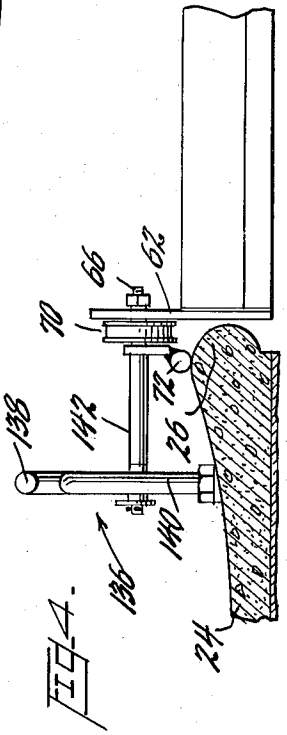


FIG. 4.

INVENTOR

Emil A. Bender,

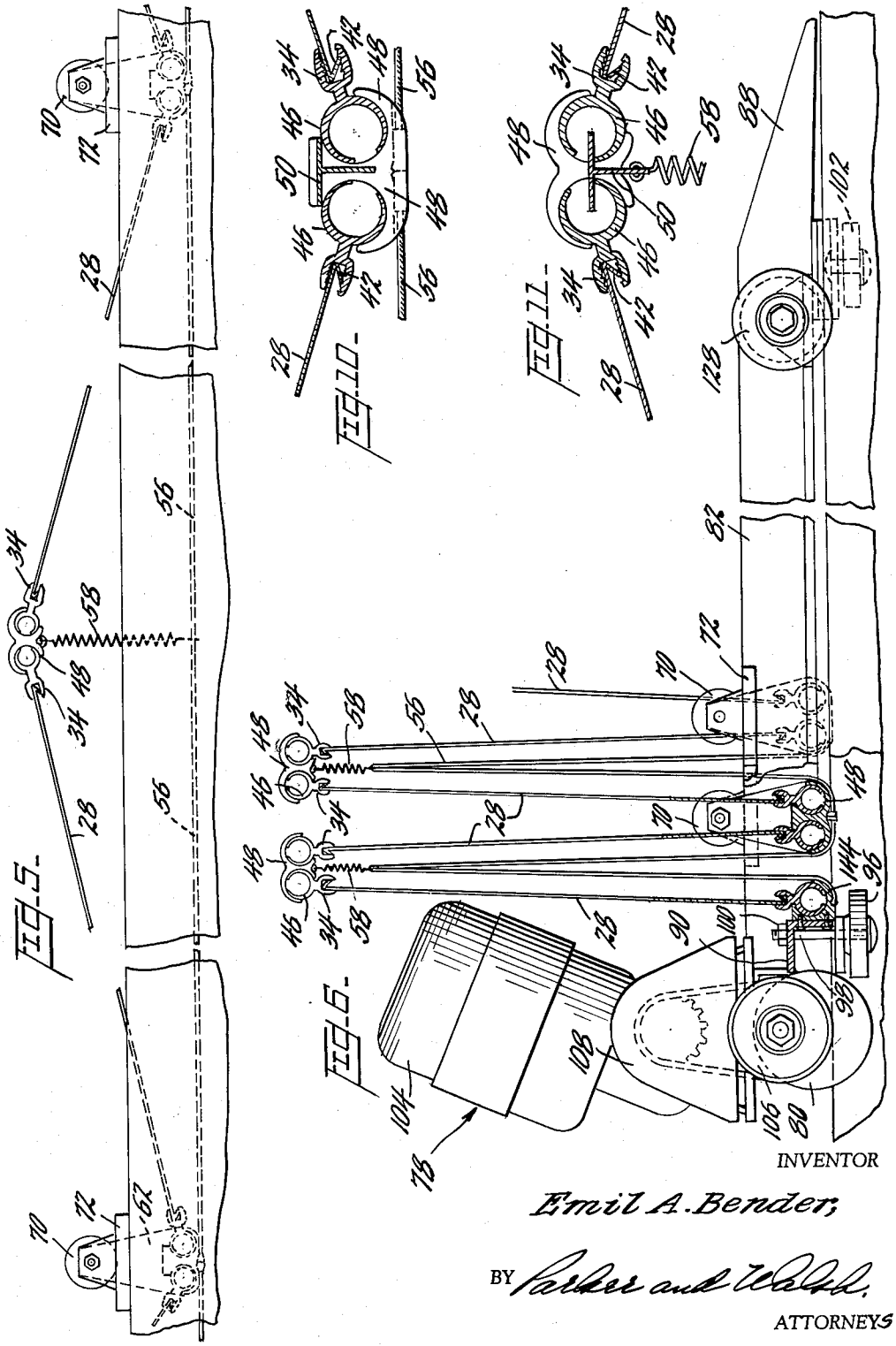
BY Parker and Walsh.

ATTORNEYS

July 4, 1961 E. A. BENDER 2,990,556

SWIMMING POOL COVER

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INVENTOR

Emil A. Bender,

BY Parker and Walsh

ATTORNEYS

July 4, 1961 E. A. BENDER 2,990,556

SWIMMING POOL COVER

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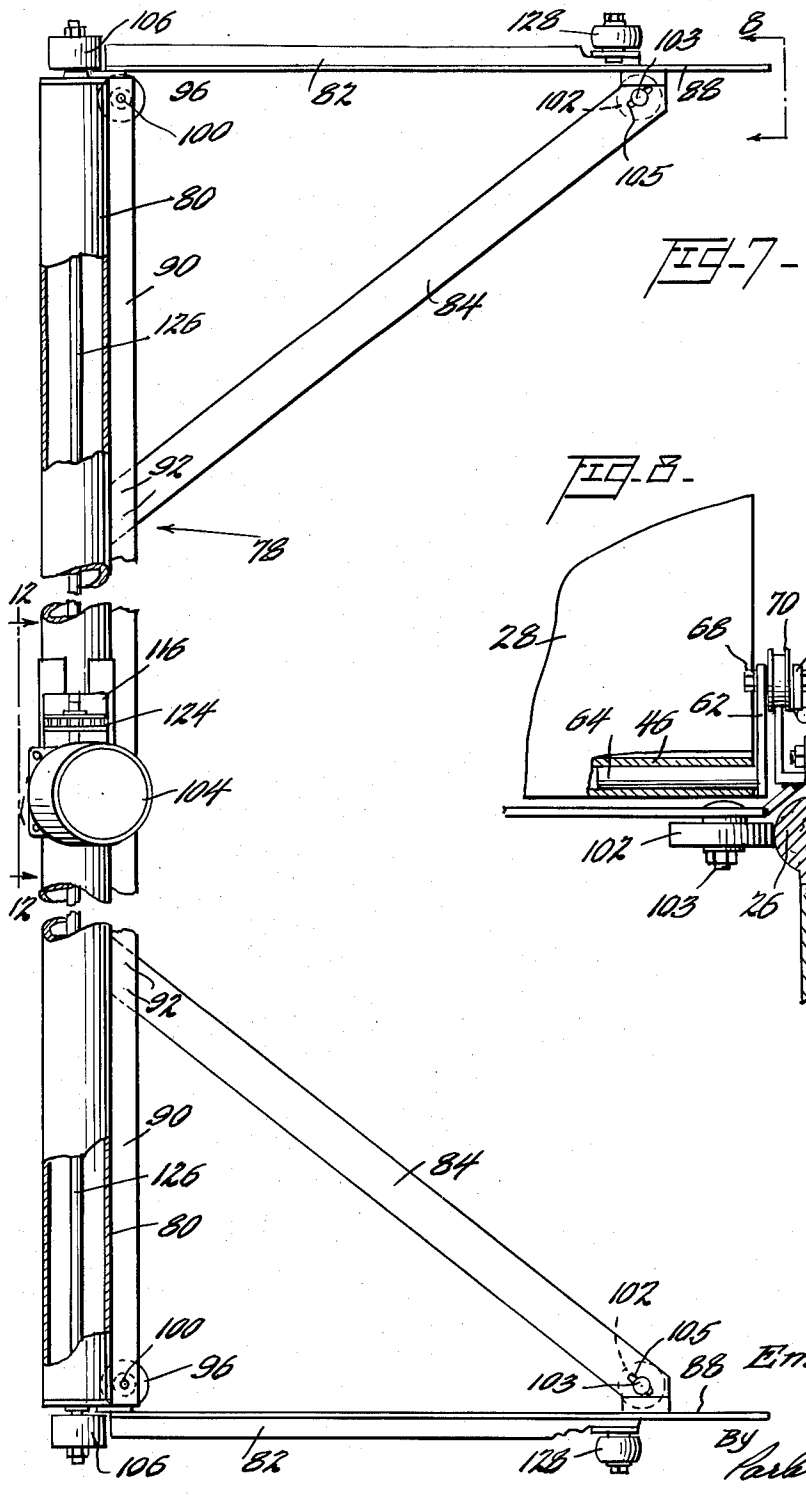


FIG-7-

FIG-8-

INVENTOR
Emil A. Bender,
BY Parker and Wheeler
ATTORNEYS

July 4, 1961 E. A. BENDER 2,990,556

SWIMMING POOL COVER

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FIG. 9.

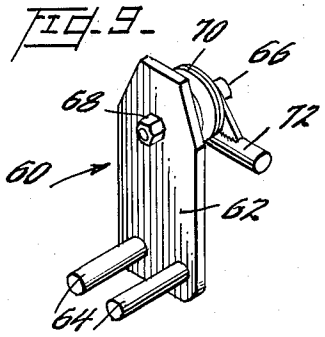


FIG. 12.

FIG. 13.

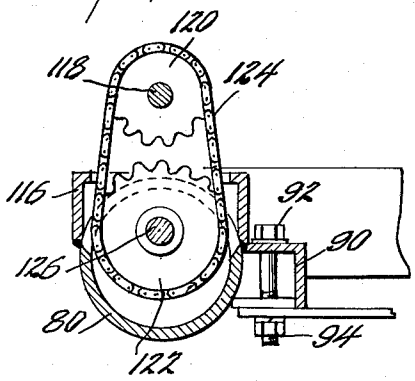
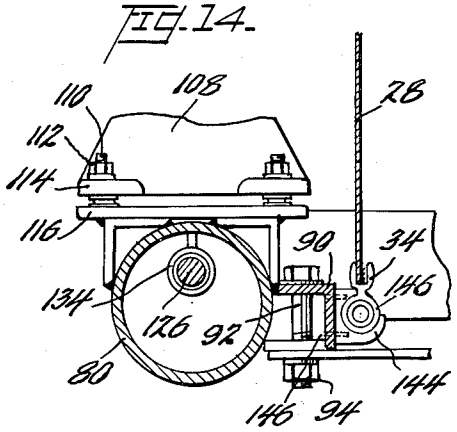


FIG. 14.



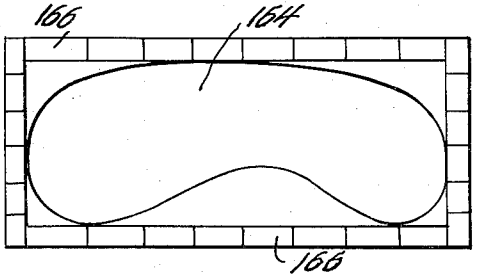


FIG. 26.

INVENTOR

Emil A. Bender

BY Parker and Walsh

ATTORNEYS

July 4, 1961 E. A. BENDER 2,990,556

SWIMMING POOL COVER

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FIG. 15.

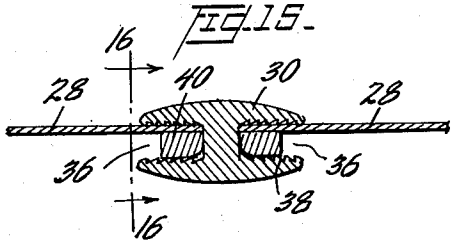


FIG. 16.

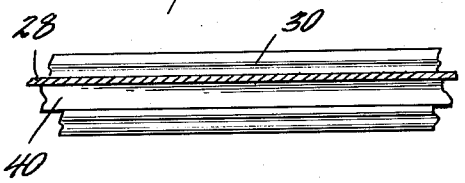


FIG. 17.

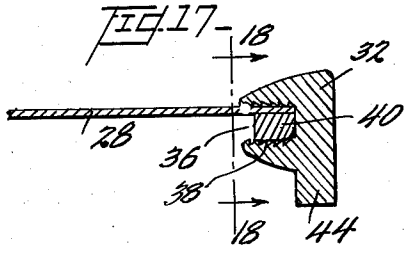


FIG. 18.

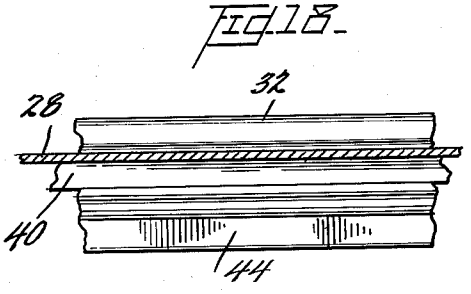
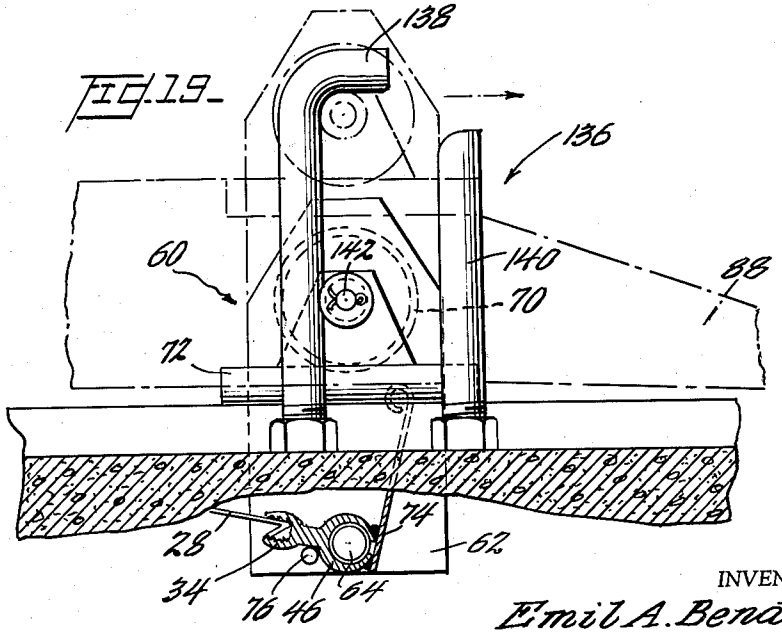


FIG. 19.



INVENTOR

Emil A. Bender,

BY Parker and Tebbets.

ATTORNEYS

July 4, 1961 E. A. BENDER 2,990,556

SWIMMING POOL COVER

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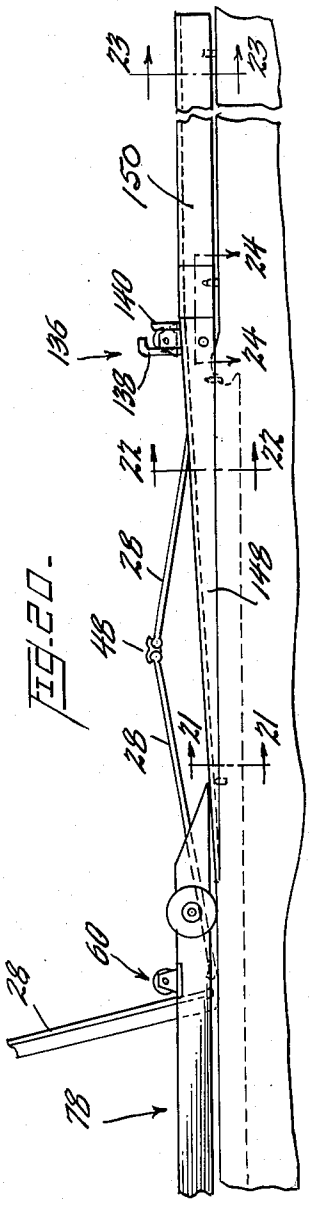


FIG. 20.

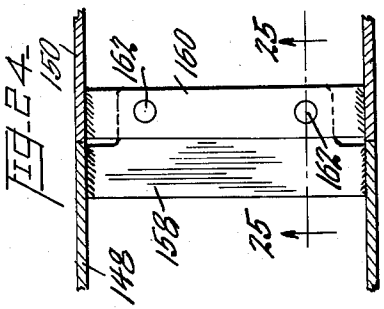


FIG. 24.

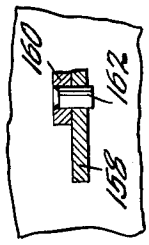


FIG. 25.

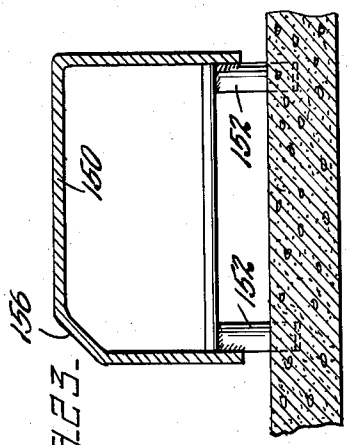


FIG. 23.

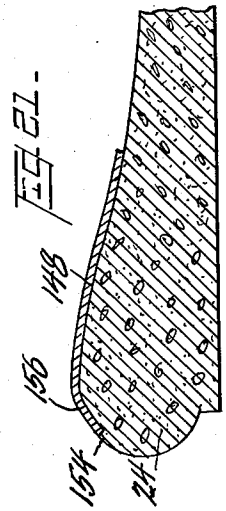


FIG. 21.

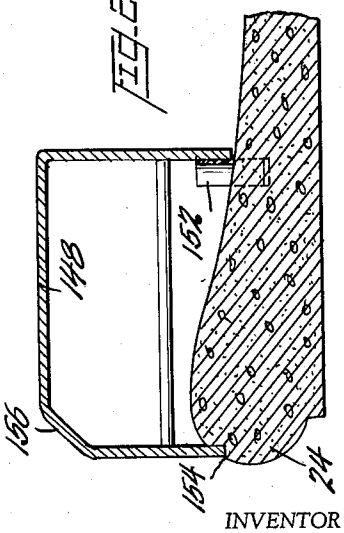


FIG. 22.

INVENTOR

Emil A. Bender,

BY Parker and Wakeland

ATTORNEYS

United States Patent Office 2,990,556 Patented July 4, 1961

2,990,556

SWIMMING POOL COVER

Emil A. Bender, P.O. Box 52, Bakersfield, Calif.

Filed May 29, 1959, Ser. No. 817,440
21 Claims. (Cl. 4—172)

The present invention relates generally to protective apparatus for covering and uncovering a swimming pool or the like and is more particularly directed to an improved cover structure together with novel power actuated apparatus for operating the cover.

In recent years, particularly in the United States, there has been a tremendous increase in the construction and use of the relatively small private or residential type swimming pool as contrasted with the larger public or group operated type of pool. In the case of the larger pools, the safety problem in preventing accidental drownings is generally handled through the employment of professional guards during normal hours of use together with restricted access at such times as the pool is not in use. However, in the case of the smaller or so-called private pool, it is not generally feasible to employ professional guards in view of the relatively limited periods of use and, in addition, the construction of adequate fencing or other security measures preventing access to the pool is both expensive and unsightly in a residential neighborhood.

It is, accordingly, a principal object of the present invention to provide a protective cover for a swimming pool of the so-called private type which is fully effective in preventing the hazard of accidental drowning and yet is fully power actuated for simplicity and ease of operation.

Another object of the invention is to provide a cover of the type described which cannot be removed by trespassers and yet requires no special tracks, chains or cables or unsightly fencing which might disfigure the appearance of the pool.

A further object of the invention is to provide a cover of the type described which is highly effective in reducing the amount of cleaning of leaves or other debris from the pool, reducing the amount of bactericidal chemicals required, reducing the filter load and lessening the expense of maintaining a heated pool and yet may be completely removed from the pool in a very short time and run off as far as may be desired for washing or storage.

An additional object of the invention is to provide protective apparatus of the type described which is both strong and free from maintenance expense and which can be inexpensively produced in relation to the overall cost of a private type swimming pool.

Yet another object of the invention is to provide protective apparatus of the type described in which the cover constitutes a relatively rigid truss structure supported by the edges of the pool when in place and is operatively associated with a self-propelled carrier which lifts, folds and carries the cover in uncovering the pool and performs a reverse sequence of operations in covering the pool.

A still further object of the invention is to provide an improved cover construction for use with the protective apparatus of the type described.

Another object of the invention is to provide an improved self-propelled carrier for use with protective apparatus of the type described.

An additional object of the invention is to provide an improved locking arrangement for use with protective apparatus of the type described.

Still another object of the invention is to provide a novel structural member for use as part of a cover of the type described as well as a novel method of constructing such a member.

A final object of the invention is to provide a novel

hinge construction possessing the requisite strength characteristics for use with a panel assembly of the type described.

The foregoing together with other and further objects and advantages of the invention will become more readily apparent to those skilled in the art from a consideration of the following detailed specification taken in conjunction with the accompanying figures of the drawing in which:

FIGURE 1 is a top plan view, largely schematic and to a vastly reduced scale, illustrating protective apparatus in accordance with the present invention in operative position covering a typical private type swimming pool;

FIGURE 2 is a side elevational view of the protective apparatus illustrated in FIGURE 1;

FIGURE 3 is a side elevational view of the left hand portion of the apparatus shown in FIGURE 2 but to a somewhat enlarged scale and illustrating the relative positions of the parts at an intermediate stage in the operation of the device;

FIGURE 4 is a transverse cross-sectional view illustrating a fragment of the cover and lock taken substantially along the line 4—4 of FIGURE 3;

FIGURE 5 is a fragmentary side elevational view similar to FIGURES 2 and 3 but illustrating the manner in which a pair of panel assemblies are connected together to form a relatively rigid truss structure;

FIGURE 6 is a side elevational view of the left hand portion of the apparatus illustrated in FIGURE 3 but to a somewhat larger scale and with parts broken away to illustrate the interior construction;

FIGURE 7 is a top plan view of the carrier illustrated to a smaller scale at the left in FIGURES 2 and 3 with parts broken away to reveal the interior construction;

FIGURE 8 is a front elevational view at one side of the carrier of FIGURE 7, taken substantially along the line 8—8 and showing an edge of the swimming pool in cross-section and a portion of the cover being positioned to indicate the manner in which the individual hangers are connected to the cover panel assemblies;

FIGURE 9 is a detail perspective view illustrating one of the hangers per se which support the cover;

FIGURE 10 is a fragmentary longitudinal vertical cross-sectional view taken substantially along the line 10—10 of FIGURE 1 and illustrating the construction of one of the valley hinge assemblies;

FIGURE 11 is a longitudinal vertical cross-sectional view similar to FIGURE 10 but taken along the line 11—11 of FIGURE 1 and illustrating the construction of one of the ridge hinge assemblies;

FIGURE 12 is a fragmentary end elevational view with parts broken away, taken from the left hand end of FIGURES 2 and 3 and illustrating the carrier drive to a somewhat larger scale;

FIGURE 13 is a transverse vertical cross-sectional view taken substantially along the line 13—13 of FIGURE 12;

FIGURE 14 is a transverse vertical cross-sectional view taken substantially along the line 14—14 of FIGURE 12;

FIGURE 15 is a fragmentary transverse vertical cross-sectional view taken substantially along the line 15—15 of FIGURE 1 and illustrating one of the panel splices;

FIGURE 16 is a vertical cross-sectional view taken substantially along the line 16—16 of FIGURE 15;

FIGURE 17 is a fragmentary transverse vertical cross-sectional view taken substantially along the line 17—17 of FIGURE 1 and illustrating one of the panel edge frames;

FIGURE 18 is a vertical cross-sectional view taken substantially along the line 18—18 of FIGURE 17;

FIGURE 19 is a fragmentary side elevational view of the lock assembly shown at the right hand end of FIGURES 2 and 3 but with parts broken away and in section to reveal the interior construction and with the end hanger shown in two different positions in full and broken lines;

FIGURE 20 is a side elevational view illustrating a modified form of latch of the type illustrated in FIGURE 19 but showing the same incorporated in a removable track which may be employed in certain cases in applying the improved cover to existing pool constructions;

FIGURE 21 is a transverse vertical cross-sectional view taken substantially along the line **21—21** of FIGURE 20;

FIGURE 22 is a transverse vertical cross-sectional view taken substantially along the line **22—22** of FIGURE 20;

FIGURE 23 is a vertical transverse cross-sectional view taken substantially along the line **23—23** of FIGURE 20;

FIGURE 24 is a horizontal transverse cross-sectional view taken substantially along the line **24—24** of FIGURE 20;

FIGURE 25 is a vertical transverse cross-sectional view taken substantially along the line **25—25** of FIGURE 24; and

FIGURE 26 is a schematic top plan view showing how the principles of the present invention may be adapted to pools of other than rectangular shape.

Referring now in somewhat greater detail to the various figures of the drawing and in particular to FIGURES 1 and 2 thereof, an improved protective apparatus in accordance with the present invention is illustrated in the position it would occupy in covering a typical private swimming pool. The pool is designated by reference numeral **20** in FIGURE 2 and is rectangular in plan form, measuring approximately 20 by 40 feet. At one end of the pool there is illustrated a conventional lounge deck **22** which may be of concrete or other desired construction and a tile border **24**, which also may be of concrete or other desired material, surrounds the top edge of the pool. As illustrated in FIGURES 4 and 8, the tile border **24** is generally given an ornamental form for decorative reasons and, as illustrated in these views, the tiles **24** are rounded at their inner ends to provide a coping **26** completely around the top inner edge of the pool **20** as well as the deck **22**. It will be particularly noted that, in the pool illustrated in FIGURES 1 and 2, the copings **24** along the longitudinal sides of the pool **20** are in the same horizontal plane as the coping **25** at the left hand edge of the pool (FIGURE 1) and the copings **27** along the side edges of the deck **22** whereas the coping **29** at the right hand edge of the pool proper is slightly depressed below the horizontal level of the copings **24**, **25** and **27**. By reason of the slight depression of the coping **29**, the cover assembly to be hereinafter more fully described may be readily run away from the pool without obstruction or hindrance and this type of construction is generally preferred where the pool is originally built in contemplation of the use of a cover in accordance with the present invention. As will be hereinafter more fully described, auxiliary track extension equipment of the type illustrated in FIGURES 20–25 may be employed in adapting the cover to existing pools wherein the coping **29** occupies the same horizontal plane as the copings **24**, **25** and **27**.

As illustrated in FIGURE 1, the cover portion of the apparatus is formed of a plurality of panel assemblies extending transversely of the pool and hingedly connected together in such manner that they may be folded in accordion fashion. Each panel assembly includes a plurality of rectangular metal panels **28**, in the present case **5** in number, secured within interconnected metal frames **30**, **32** and **34**. The frame members are given different reference numerals since they differ in shape depending upon their position in the assembly although all are preferably formed as extrusions of a metal such as aluminum or the like. The cross-sectional shape of the frames **30** is illustrated in FIGURE 15, that of the frames **32** in FIGURE 17, and that of the frames **34** in FIGURES 10 and 11.

The individual panels **28** are preferably made of a light weight metal such as aluminum alloy sheet and the top sides of the panels may be painted with an epoxy type resin offering a wide choice of colors to blend with patio and pool surroundings in a most attractive manner. The panels **28** may be assembled into the frame members in a variety of ways. As shown in FIGURES 15 and 17, the frame members **30** and **32** are provided with slots **36** into which the edges of the panels **28** may be inserted and retained against serrations **38** by means of aluminum or other metal rods **40**. However, a simpler method of assembly is illustrated in FIGURES 10 and 11 in which the edges of the panels **28** are folded back as indicated by reference number **42**, the reversely folded edge **42** engaging with the serrations **38** in the slots **36** to retain the panels **28** firmly engaged therein. After the individual panels **28** have been assembled into their respective frames **30**, **32** and **34**, the frames are preferably welded together to form complete panel assemblies; as mentioned above five such panels in the present case are assembled together to form the individual panel assemblies extending transversely across the entire width of the swimming pool **20**.

It will be noted by reference to FIGURE 1 that the frame members **30** extend longitudinally of the pool **20** and, as shown in FIGURE 15, each of the frames **30** is provided with two slots **36** thus serving to interconnect two adjacent panel sheets **28**. However, the frames **32**, which also extend longitudinally of the pool **20**, have only a single slot **36** and thus are connected to only a single panel **28**. The frames **32** thus constitute the end or edge frames of the complete cover and, for this reason, may be provided with vertically depending ribs or flanges **44** which serve to strengthen the cover edges, reduce the open space between portions of the cover and the pool edges, and also enhance the appearance of the assembly.

Referring now particularly to FIGURES 10 and 11, the frame members **34**, in addition to retaining the edges **42** of the panels **28** also include eccentrically hollow rounded portions **46** which serve as the male portions of the hinges which interconnect the adjacent panel assemblies. In order to accomplish this function, there are provided a plurality of female hinge members **48** having partially open rounded apertures therein within which the male hinge elements **46** may rotate to a limited extent. In assembling the cover, the female hinge members **48** may be slipped over the ends of a pair of adjacent male hinge members **46** and slid lengthwise of the latter (transversely of the pool **20**) and held in spaced relation by means of spacers **50**.

As previously mentioned, and as will be apparent from FIGURES 2, 3, 5 and 6, the cover made up of a plurality of panel assemblies in the manner just described may be folded in accordion fashion and includes alternate ridges **52** and valleys **54** as indicated in FIGURE 2. In order to provide a substantial degree of rigidity to the structure when it is assembled in operative position as illustrated in FIGURES 1 and 2, the adjacent valley hinges are interconnected by a plurality of cables **56** which may be staked or otherwise suitably secured to the valley female hinge members **48** at the time of assembly as indicated in FIGURE 10. It will be noted that alternate hinges as shown along the longitudinal center line of the cover in FIGURE 1 are slightly enlarged to indicate that these are the particular hinges to which the cables **56** are secured. It will be apparent that as the panel assemblies are unfolded to the position as indicated in FIGURE 5, the cables **56** will become taut so that the resultant of the tension in the cables **56** and the compression

in the panel assemblies will form a relatively rigid truss structure. Springs 58 are connected between the cables 56 and the female hinge elements 48 along the ridges of the cover for the purpose of urging the cables 56 upwardly and holding them out of contact with the water in the pool or surface of the ground when the panel assemblies are folded to uncover the pool as indicated in FIGURE 6. It will be understood that the number of cables 56 which may be employed in any given installation will vary in accordance with the overall dimensions of the pool. In an ordinary pool 20 by 40 feet in size, I have found that a line of cables along the side edges of the cover together with a single line of cables along the longitudinal center line of the cover will be adequate.

As indicated above, the panel assembies preferably extend transversely of the swimming pool and are hingedly connected together for folding in a direction longitudinally of the pool. In order to effectively utilize the panel trusses previously described for this purpose and at the same time prevent access to the pool when the cover is is place, it will be noted in FIGURES 2, 3 and 5 that the panel assemblies are so dimensioned as to just fit within the pool with the valleys 54 lying beneath the top edge of the pool and the ridges 52 extending above the top edge by an amount which is insufficient to permit access. To this end, the cover is supported by means of a plurality of hangers one of which is illustrated in FIGURE 9 and designated generally by reference numeral 60. As shown in this view, each of the hangers 60 includes a vertical metal strap 62 having a pair of horizontal pintles 64 projecting inwardly from one side of the strap 62 at the lower end thereof. A rod 66 projects from the opposite or outer side at the upper end of the strap 62 and is held in place thereon in any convenient manner as by means of a lock nut 68. A roller 70 is rotatably mounted on the rod 66 at the inner end of the latter and a foot piece 72 depends from the outer end of the rod 66.

When the cover is in place as shown in FIGURES 2, 4 and 5, at the right hand portion of FIGURE 3, and in full lines in FIGURE 19, the hangers 60 extend downwardly a short distance into the pool, the foot pieces 72 resting upon the top side edges of the pool, and the pintles 64 are pivotally engaged with their respective adjacent valley hinges. Although I prefer to employ a pair of pintles 64 on each hanger, it will be noted that only a single pintle is employed in the hanger illustrated in FIGURE 19 since this particular hanger is at the extreme right hand end of the cover and, instead of interconnecting two adjacent panel assemblies, is merely connected to a single frame element 34 and a strengthening rib 74, the end frame 34 being limited in movement in any convenient way as by means of a stop pin 76.

The cover is placed into and out of operative position by means of a self-propelled, power actuated carrier designated generally by reference numeral 78 and particularly illustrated in FIGURES 7, 12, 13 and 14 and also shown in assembled condition in FIGURES 2, 3 and 6. As shown in these views, the carrier 78 comprises a tubular housing 80 which extends transversely of the pool and is movable longitudinally thereof. At its outer ends, the housing 80 is rigidly secured in any convenient manner to a pair of lifting arms 82 which extend forwardly and are held in position by means of braces 84. It will be particularly noted that the forward or leading ends of the lifting arms 82 are wedge-nosed as indicated by reference numeral 88 in FIGURES 2, 3 and 6 for a purpose which will hereinafter become more readily understood. The lifting arms 82 are preferably of angle shape although the horizontal flange of the angle is cut away at the wedge-nose portions 88 of the arms.

As illustrated particularly in FIGURES 6 and 7, the transverse housing 80 of the carrier 78 is secured in any convenient manner as by welding or the like to a box frame 90 which also extends transversely of the carrier along the front of the housing 80. The frame 90 serves as an attachment point for the inner ends of the braces 84 which may be attached thereto by means of bolts 92 and nuts 94. The frame 90 also serves as a mounting fixture for a pair of guide wheels 96 which are rotatably mounted upon spindles 98 held in place by nuts 100. A similar pair of guide wheels 103 is mounted upon spindles 102 adjustably secured in slots 105 adjacent the front ends of the lifting arms 82 and it will be apparent that the guide wheels 96 and 102, being mounted for rotation in a substantially horizontal plane, are adapted to contact the inner vertical pool edges, for example the coping 26 as indicated in FIGURE 8, in order to serve as guides during movement of the carrier 78 longitudinally of the pool.

The carrier 78, as prevoiusly mentioned, is power actuated and, to this end, a motor 104 is mounted centrally of the carrier and serves to drive a pair of driving wheels 106 at the opposite rear sides of the carrier. The motor 104 preferably is secured to and forms a part of a reduction gear housing 108 which is secured in any suitable manner as by means of bolts 110, nuts 112 and flanges 114 to a suitable platform 116 welded to the upper central portion of the housing 80 as shown in FIGURE 14. As shown in FIGURES 7, 12, 13 and 14, the output shaft 118 from the reduction gear housing 108 is connected to a driving sprocket 120 connected to a driven sprocket 122 by means of a sprocket chain 124, the driven sprocket 122, in turn, being connected to a drive shaft 126 connected at its outer ends to the driving wheels 106.

From the description thus far it will be apparent that the motor 104, upon being energized, causes the driving wheels 106 to move the carrier 78 in one direction or the other longitudinally of the pool, the driving wheels and motor being interconnected by means of the drive shaft, sprocket chain and wheel assembly and reduction gear train. It will also be understood that the driving wheels 106 are so dimensioned as to run along the top edges of the pool 20 and, to this end, are preferably made of a suitable rubber or plastic compound thereby eliminating the necessity for any special tracks or other unsightly equipment. An additional pair of guide wheels 128 is provided adjacent the forward ends of the lifting arms 82 and serve to support the front end of the carrier 78. The lead wheels 128 are also preferably made of a moldable material and, as shown in FIGURE 8, the lead wheels 128 may be rotatably mounted upon stub axles 130 secured to the lifting arms 82. It will also be understood that suitable bearings will be provided for the support of the drive shaft 126 within the housing 80 as indicated by reference numerals 132 and 134 in FIGURE 12. It will also be understood that while I have selected as a preferred embodiment an electric motor for driving the carrier 78, an hydraulic or other power source would be equally effective. Furthermore, while I have not illustrated in detail any particular circuit or switching arrangement for actuating the electric motor 104, it will be understood that such details and expedients are well understood by those skilled in the art and thus, per se, form no part of the present invention.

As best shown in FIGURES 3, 4 and 19, I have provided an automatic locking device at one end of the pool 20 which is shown at the right hand side of FIGURE 3 and designated generally by reference numeral 136. The locking device 136 simply comprises a pair of rods 138 and 140 rigidly secured in the concrete or other structure of the pool at opposite sides of the latter and at one end thereof. It will be noted in FIGURE 19 that the rods 138 extend upwardly a greater distance than the rods 140 and are bent at substantially a right angle at their tops. The vertical distance between the top of the rods 140 and the bent portions of the rods 138 provides a space sufficient to accommodate the ends of the rods 66 which, in the case of the end hangers, are extended

outwardly a sufficient distance to engage the lock as indicated by reference numeral **142** in FIGURE 4.

Referring to FIGURES 6 and 14, it will be noted that the end panels **28** and male hinge fittings **34** at that end of the assembly opposite from the lock **136**, namely, at the left in FIGURE 6, are connected to the frame **90** of the carrier **78**, and capable of limited rotation relative thereto, by means of a special female hinge fitting **144**. The special fitting **144** is actually one half of one of the valley hinges **48** as shown in FIGURE 10 and a suitable number of these female hinges **144** are secured to the frame **90** as by means of bolts **146** and are spaced transversely of the pool to match the other female hinges **48**. It will thus be apparent that the cover is attached at one end to the carrier **78** and capable of limited rotation relative thereto and is releasably engageable at its opposite end with the lock **136**.

In the description thus far, it has been assumed that the cover in accordance with the present invention has been applied to a pool of the type illustrated in FIGURES 1 and 2 in which the coping **29** at the right hand edge of the pool is slightly depressed below the horizontal plane containing the copings **24**, **25** and **27**. In the case of certain existing pools, however, the right hand end coping **29** may lie in the same horizontal plane as the copings **24**, **25** and **27** and, where such is the case, it will be apparent that certain depending structure on the carrier **78** extends downwardly below the coping level so that the coping **29** would obstruct movement of the carrier and cover onto the copings **27**. In order to prevent such obstruction, I have provided auxiliary track extensions as illustrated in FIGURES 20–25 which serve to elevate the carrier and its contained load when the latter reaches the right hand end of the pool.

As shown in FIGURES 20–25, the track extensions referred to above include wedge shaped or inclined track sections **148** located immediately adjacent the end of the pool and matching sections of uniform height **150** which may be used in any desired number. In this form of the device, the automatic locking device **136** is preferably formed as a part of the track extensions **148**, the rods **138** and **140** being rigidly secured to the track extensions in any suitable manner as by means of locking bolts or the like. The end hanger **60** will thus cooperate with the lock **136** as shown in FIGURE 20, in precisely the same manner as previously described in connection with FIGURE 19 although the engaged position of the hanger will be somewhat higher. It will be understood that the lead wheels **128** and drive wheels **106** of the carrier **78** will travel over the inclined top surface of the track extension **148** in the same manner as previously described in connection with travel of the carrier along the coping **24**.

Still referring to FIGURES 20–25, the track extensions **148—150** are preferably held in place by means of suitable locating pins **152** which may be welded or otherwise suitably secured to the lower edges of the track extensions and which may be removably engaged within suitable locating holes bored or otherwise provided in the top surface of the coping. The inner edge of the track extension **148** is given a variable contour as will be noted from a comparison of FIGURES 21 and 22 and, as shown in both these views, the inner edge of the coping **24** is preferably cut away as indicated by reference numeral **154** to engage and support the inner edges of the track extensions. The top inner surfaces of all of the track extensions are also preferably beveled as indicated by reference numeral **156** in order to provide ample clearance for the structure which depends from the carrier **78** as previously mentioned.

It will be apparent that the track extensions may be made in any desired length depending upon the individual wishes of the user. Preferably, the additional track extensions **150** are joined to the track extensions **148** and to each other in a removable manner such as indicated in FIGURES 24 and 25. As shown in these views, the track **148** is provided with a transverse tongue or bracket **158** welded or otherwise suitably secured therein and the track extension **150** carries a similar bracket **160** located so as to overlie the bracket **158** when the track extensions are placed together. When thus located, a pair of pins **162** mounted on the bracket **160** drop into matching holes provided in bracket **158** thereby serving to hold the track sections together against longitudinal or horizontal displacement.

As mentioned above, it is an object of the present invention to provide an automatic cover which does not require any special tracks or fittings and it will be understood that such is true with respect to that form of the device illustrated in FIGURES 1 and 2 and as described in the statement of operation which follows. However, the provision of the track extensions as illustrated in FIGURES 20–25 renders the apparatus suitable for existing pools whereas these track extensions themselves are relatively small and, in addition to being readily removable, at no time obstruct the edges of the pool proper.

Where the device is employed in connection with a pool of irregular shape such as that illustrated in FIGURE 26 and indicated by reference numeral **164**, a rectangular coping **166** may be constructed around the pool to serve as a track for the carrier **78**.

Operation

With the cover in operative position as shown in FIGURES 1 and 2, the swimming pool **20** is completely protected with the possible exception of the very small spaces between the ridges **52** and the top pool edges. Under these conditions, the extensions **142** of the rods **66** are engaged with the rods **138** as shown in full lines in FIGURE 19 and cannot be lifted upwardly to release the cover by reason of the horizontally bent portion of the rods **138**. The right hand end of the cover thus cannot be lifted to permit unauthorized access to the pool. At the same time, the left hand end of the cover is attached to the carrier **78** and, by reason of the weight and bulk of the latter, the cover also may not be lifted at this end. Also, at this time the cables **56** are fully extended and taut and, in conjunction with the panels **28** form rigid truss structures capable of supporting the weight of even heavy individuals.

In order to uncover the pool, a suitable switch is operated to cause the motor **104** to rotate the wheels **106** through the reduction gear **108**, shaft **118**, sprockets **120** and **122**, sprocket chain **124** and drive shaft **126**, in such manner as to cause the entire carrier **78** to move to the right. At the beginning of the operation, the cover is supported partially within the edges of the pool **20** by means of the foot pieces **72** which rest upon the copings **26**. However, as the carrier **78** moves to the right, the wedge-nosed portions **88** of the lifting arms **82** at the sides of the carrier successively engage the rollers **70** of the hangers **60**. Since the hangers also support the cover panel assemblies through the engagement of the pintles **64** and the male hinge members **46**, as the rollers **70** move upwardly over the wedge-noses **88**, the hangers and panel assemblies will be lifted upwardly onto the lifting arms **82**. During this operation the panel assemblies are successively folded in accordion style so that as the carrier continues to move to the right, eventually all of the panel assemblies will be supported on and carried by the carrier **78**.

As the carrier **78** continues to move to the right, the hangers and panel assemblies occupy sequential positions somewhat as illustrated in FIGURE 3. It is to be particularly noted that, during this entire operation, the carrier is supported and guided upon the coping of the swimming pool by means of the drive wheels **106**, the lead wheels **128**, and the horizontally disposed guide wheels **96** and **102**. When the wedge-nosed portions **88**

of the carrier **78** reach the extreme right end of the swimming pool and contact the rollers **70** on the end rods **66**, the rod extensions **142** will be lifted upwardly between the rods **138** and **140** of the lock **136**, that is, from the full to the dotted line positions as shown in FIGURE 19. As soon as the rod extensions **142** reach their uppermost or dotted line positions in FIGURE 19, continued movement of the carrier **78** causes the rods **142** to move horizontally to the right through the open space between the horizontal portion of rod **138** and the top of rod **140**. It will be particularly noted that once the lock has been disengaged in this manner, the carrier **78**, which now supports and carries the entire cover, may be run any desired distance away from the pool thereby removing any obstruction to full enjoyment of the facility and also making it possible to wash the cover or repair the apparatus at a distance sufficiently removed from the pool proper.

In order to cover the pool, the operation is exactly the reverse of that just described. In this case, a suitable switch is actuated to operate the motor **104** in a reverse direction and as the carrier **78** approaches the end of the pool moving from right to left, the rod extensions **142** pass over the rods **140** and engage the rods **138** to hold the right hand end of the cover. Continued movement of the carrier **78** causes the rollers **70** at the right hand end of the cover to drop down the incline of the wedge-noses **88**, the hangers **60** moving from the dotted to the full line position as shown in FIGURE 19. The same sequence of operations is followed as the carrier **78** moves to the left, the successive hangers and panel assemblies rolling down the inclines **88** to permit the shoe pieces **72** to support the cover in operative position.

While there is disclosed herein a preferred embodiment of the invention solely for the purpose of illustration, it will be obvious that numerous modifications, alterations and deviations will occur to those skilled in the art without departing from the spirit or scope of the invention as defined by the following claims.

I claim:

1. Protective apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers for supporting said panel assemblies each including a vertical strap having a horizontal pintle projecting from one side of the lower end thereof pivotally engaged with its respective adjacent valley hinge and a rod projecting from the opposite side at the upper end of said strap having a roller rotatably mounted at its inner end and a foot piece depending from its outer end, locking means at one end of said pool releasably engageable with one end panel assembly, and a self-propelled carrier pivotally connected to the opposite end panel assembly and extending transversely of said pool and movable longitudinally thereof, said carrier having a motor mounted centrally thereon, a pair of driving wheels at the opposite rear sides of said carrier engageable with the top edges of said pool, a drive shaft, a sprocket chain and wheel assembly and a reduction gear train operatively interconnecting said motor and said driving wheels, a pair of wedge-nosed lifting arms extending forwardly at opposite sides of said carrier and engageable with said rollers for alternately lifting and lowering said hangers to raise and lower said foot pieces relative to the top edges of said pool, and lead wheels and guide wheels rotatably mounted adjacent the forward ends of said lifting arms and engageable respectively with the horizontal and vertical surfaces at the top side edges of said pool.

2. Protective apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers for supporting said panel assemblies each including a vertical strap having a horizontal pintle projecting from one side of the lower end thereof pivotally engaged with its respective adjacent valley hinge and a rod projecting from the opposite side at the upper end of said strap having a roller rotatably mounted at its inner end and a foot piece depending from its outer end, locking means at one end of said pool releasably engageable with one end panel assembly, and a self-propelled carrier pivotally connected to the opposite end panel assembly and extending transversely of said pool and movable longitudinally thereof, said carrier having a motor mounted centrally thereon, a pair of driving wheels at the opposite rear sides of said carrier engageable with the top edges of said pool, a drive shaft, a sprocket chain and wheel assembly and a reduction gear train operatively interconnecting said motor and said driving wheels, and a pair of wedge-nosed lifting arms extending forwardly at opposite sides of said carrier and engageable with said rollers for alternately lifting and lowering said hangers to raise and lower said foot pieces relative to the top edges of said pool.

3. Protective apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers for supporting said panel assemblies each including a vertical strap having a horizontal pintle projecting from one side of the lower end thereof pivotally engaged with its respective adjacent valley hinge and a rod projecting from the opposite side at the upper end of said strap having a roller rotatably mounted at its inner end and a foot piece depending from its outer end, locking means at one end of said pool releasably engageable with one end panel assembly, and a self-propelled carrier pivotally connected to the opposite end panel assembly and extending transversely of said pool and movable longitudinally thereof, a pair of driving wheels at the opposite rear sides of said carrier engageable with the top edges of said pool, means for rotating said driving wheels, and a pair of wedge-nosed lifting arms extending forwardly at opposite sides of said carrier and engageable with said rollers for alternately lifting and lowering said hangers to raise and lower said foot pieces relative to the top edges of said pool.

4. Protective apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers for supporting said panel assemblies each including a vertical strap having a horizontal pintle projecting from one side of the lower end thereof pivotally engaged with its respective adjacent val-

ley hinge and a rod projecting from the opposite side at the upper end of said strap having a roller rotatably mounted at its inner end and a foot piece depending from its outer end, locking means at one end of said pool releasably engageable with one end panel assembly, and a self-propelled carrier pivotally connected to the opposite end panel assembly and movable longitudinally of said pool, and a pair of wedge-nosed lifting arms extending forwardly at opposite sides of said carrier and engageable with said rollers for alternately lifting and lowering said hangers to raise and lower said foot pieces relative to the top edges of said pool.

5. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers pivotally connected to said valley hinges for supporting said panel assemblies each having a roller at its upper end, locking means at one end of said pool releasably engageable with one end panel assembly, and a self-propelled carrier pivotally connected to the opposite end panel assembly and movable longitudinally of said pool, said carrier including a pair of wedge-nosed lifting arms extending forwardly at opposite sides thereof and engageable with said rollers to lift said hangers and to fold and carry said panel assemblies as the pool is uncovered.

6. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers pivotally connected to said valley hinges for supporting said panel assemblies each having a roller at its upper end, and a self-propelled carrier pivotally connected to an end panel assembly and movable longitudinally of said pool, said carrier including a pair of wedge-nosed lifting arms extending forwardly at opposite sides thereof and engageable with said rollers to lift said hangers and to fold and carry said panel assemblies as the pool is uncovered.

7. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers connected to said panel assemblies, and a self-propelled carrier pivotally connected to an end panel assembly and movable longitudinally of said pool, said carrier including a pair of wedge-nosed lifting arms extending forwardly at opposite sides thereof and engageable with said hangers to fold and carry said panel assemblies as the pool is uncovered.

8. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, a plurality of hangers connected to said panel assemblies, and a carrier movable longitudinally of said pool and engageable with said hangers to fold and carry said panel assemblies as the pool is uncovered.

9. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames, and a carrier connected to said panel assemblies for lifting, folding and carrying the same as the pool is uncovered.

10. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, springs connecting said cables to their respective adjacent ridge hinges, and a carrier connected to said panel assemblies for lifting, folding and carrying the same as the pool is uncovered.

11. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies, and a carrier connected to said panel assemblies for lifting, folding and carrying the same as the pool is uncovered.

12. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies, hinge means interconnecting said panel assemblies in accordion fold arrangement, means limiting unfolding movement of said panel assemblies, and a carrier connected to said panel assemblies for lifting, folding and carrying the same as the pool is uncovered.

13. Apparatus for covering and uncovering a swimming pool comprising a cover foldable in accordion arrangement, and a carrier operatively associated with said cover for folding and carrying the same as the pool is uncovered.

14. A cover for swimming pools and the like comprising a plurality of panel assemblies adapted to extend transversely across a pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies and springs connecting said cables to their respective adjacent ridge hinges, each of said panel assemblies including a plurality of rectangular metal panels secured within interconnected metal frames.

15. A cover for swimming pools and the like comprising a plurality of rigid panel assemblies adapted to extend transversely across a pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies and springs connecting said cables to their respective adjacent ridge hinges.

16. A cover for swimming pools and the like comprising a plurality of rigid panel assemblies adapted to extend transversely across a pool, a plurality of hinges

interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, and cables interconnecting adjacent valley hinges to limit unfolding movement of said panel assemblies.

17. Apparatus for covering and uncovering a swimming pool comprising a plurality of panel assemblies extending transversely of the pool, a plurality of hinges interconnecting said panel assemblies in accordion fold arrangement providing alternate ridges and valleys, a plurality of hangers connected to said panel assemblies adjacent said valley hinges outwardly of the hinge axis, and a carrier pivotally connected to an end panel assembly and movable longitudinally of said pool, said carrier including a pair of lifting arms extending forwardly at opposite sides thereof and engageable with said hangers to fold and carry said panel assemblies as the pool is uncovered.

18. The combination of claim 17 including support wheels for said carrier.

19. The combination of claim 17 including guide means extending below said carrier for contacting the side walls of the swimming pool.

20. The combination of claim 17 including locking means pivotally connected to the end panel assembly remote from the carrier, for securing the apparatus to a fixed point adjacent one end of said pool.

21. The combination of claim 20 wherein the locking means includes means positively effective to engage said fixed point, operative with the cover in partially and completely extended position and inoperative with the cover in retracted position.

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