United States Patent

[11] **3,563,549**

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[21] Appl. No. **799,443**
[22] Filed **Feb. 14, 1969**
[45] Patented **Feb. 16, 1971**
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[54] **ARROW STORAGE QUIVER AND CONVEYOR BELT FOR TRANSPORTING ARROWS TO THE QUIVER**
14 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **273/103**
[51] **Int. Cl.** **F41b 5/06**
[50] **Field of Search** ..... 271/68, 86; 273/47, 49, 103, 125, 127 (C)

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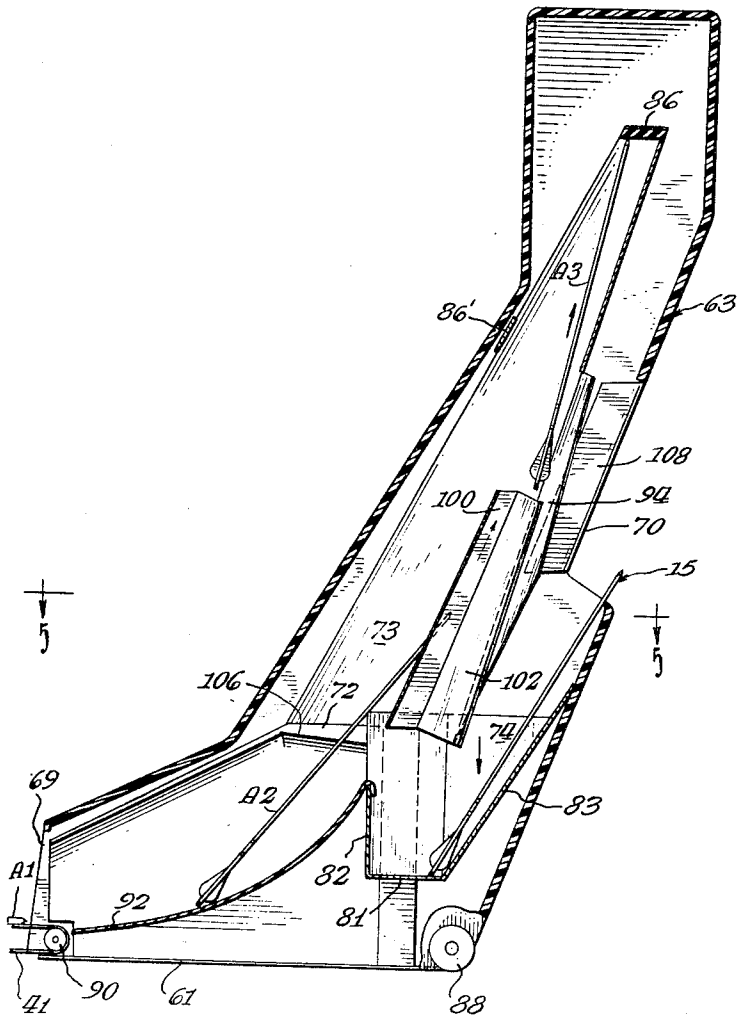
ABSTRACT: An arrow storage quiver adjacent the firing line of an archery range which receives arrows from a conveyor belt running from the target to the firing line. The storage quiver stores arrows in an upright position which is readily accessible to an archer.



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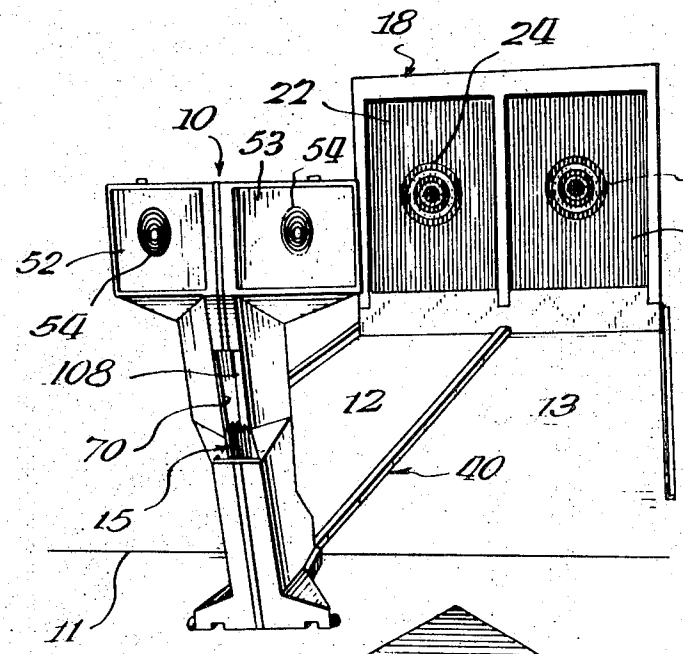

Fig. 1

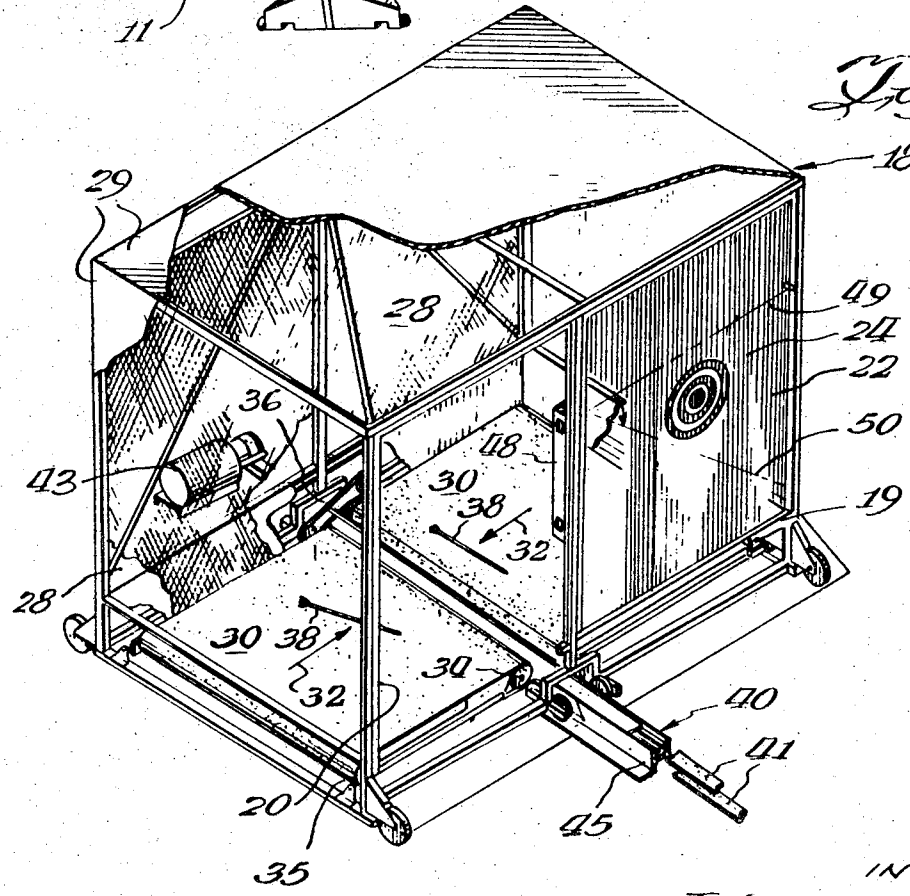

Fig. 2

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Fig. 5

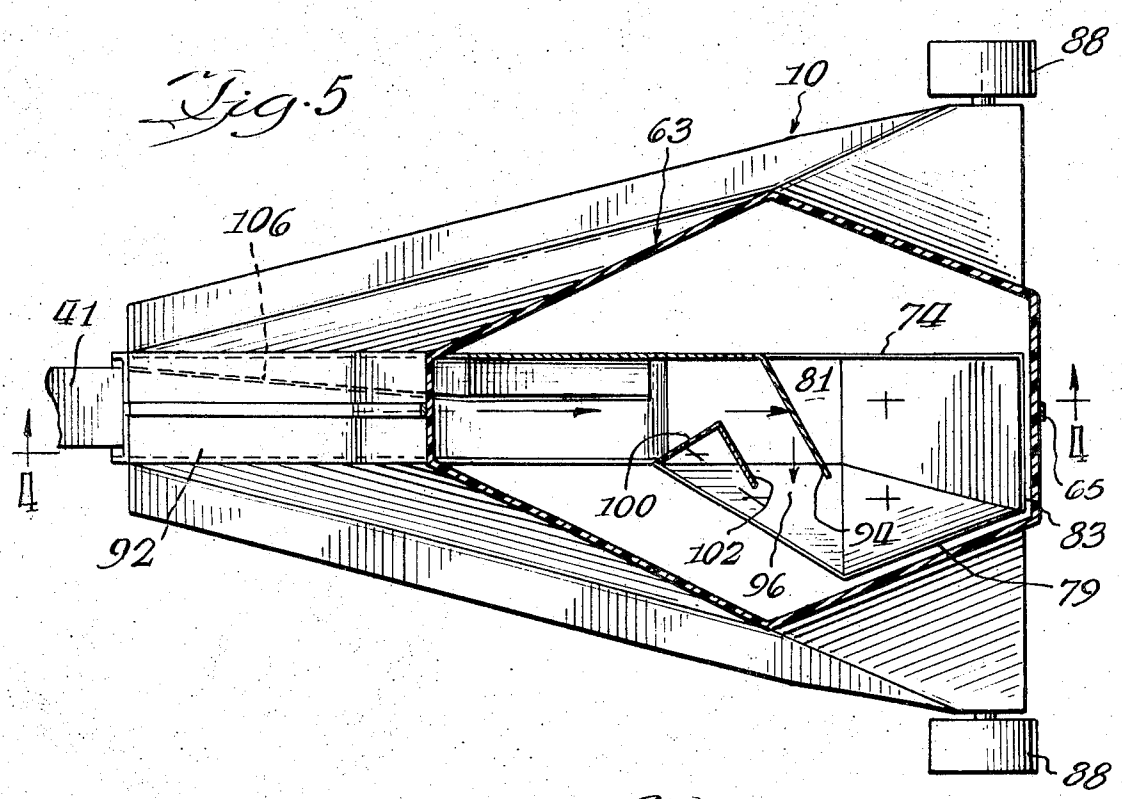


Fig. 6

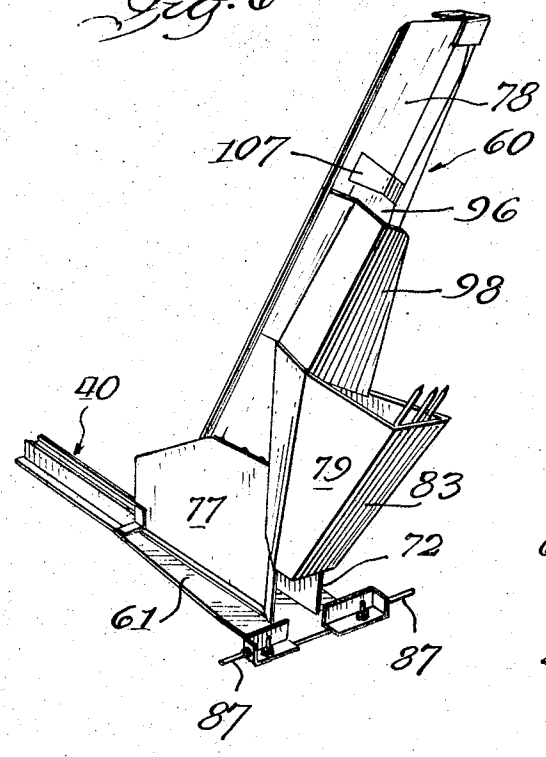


Fig. 3

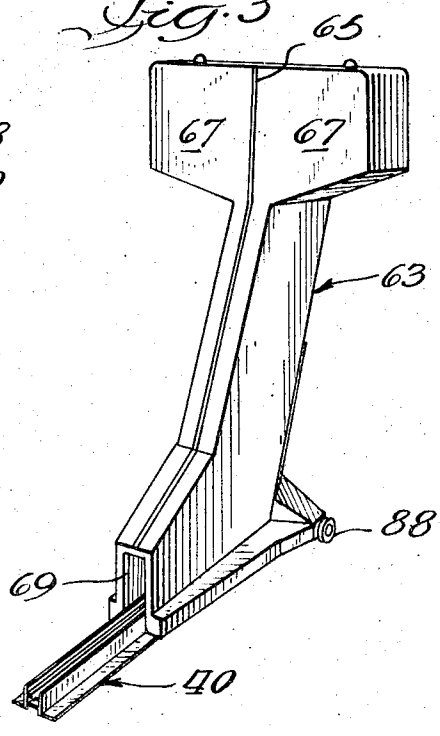
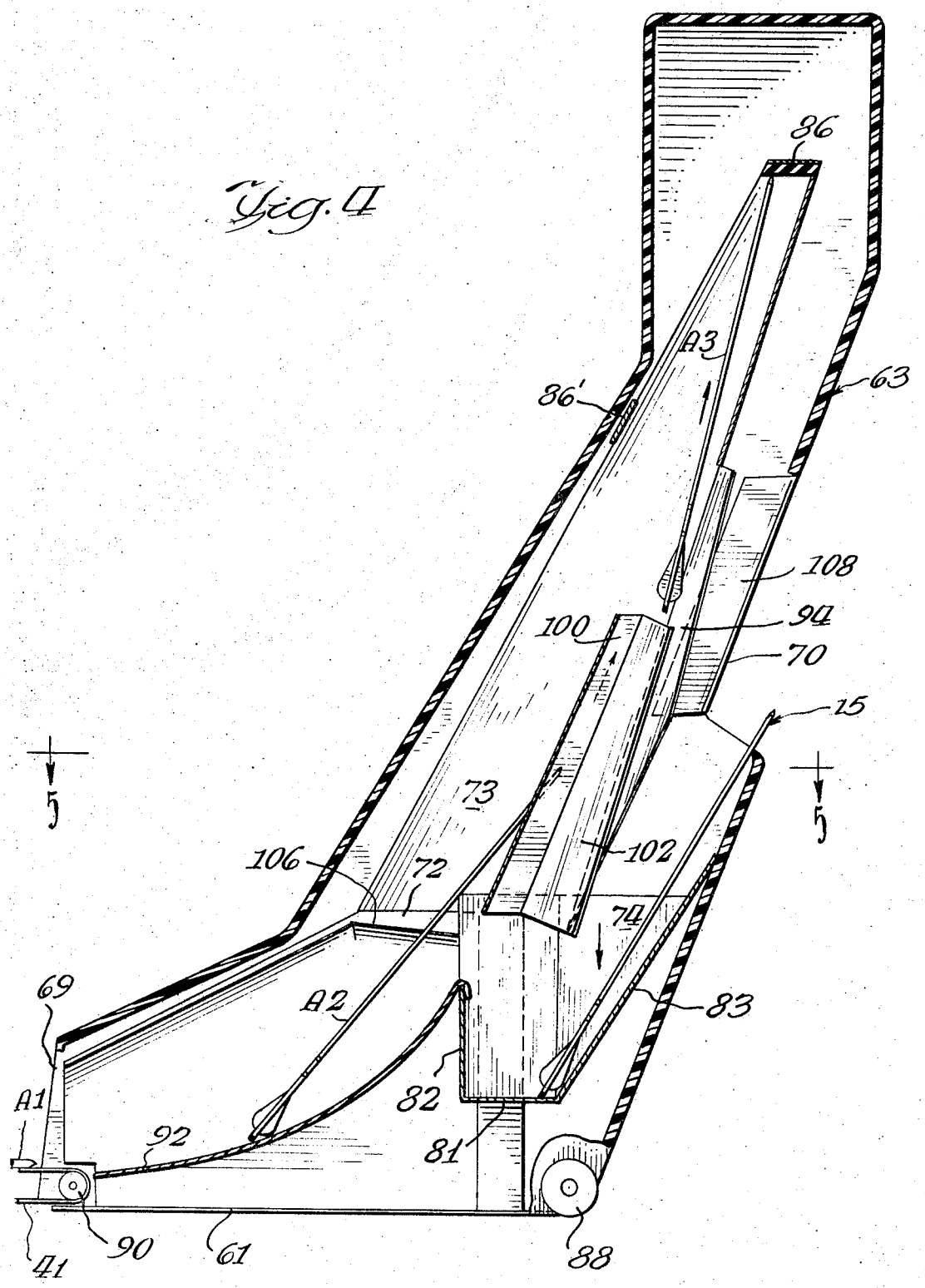


Fig. 4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ARROW STORAGE QUIVER AND CONVEYOR BELT FOR TRANSPORTING ARROWS TO THE QUIVER

BRIEF SUMMARY OF THE INVENTION

In the recent past, efforts have been directed toward provision of automated archery lanes, particularly for indoor use, involving a target remote from a firing line constructed in a way such that arrows do not remain impaled in the target but fall free for collection to be returned automatically to the archer at the firing line. In preferred systems, the target is constructed to be penetrable so that neither the target nor the arrow is substantially damaged by target penetration. Behind the target there is a suitable backstop which is usually yieldable in a way to absorb the energy of the arrow so that the latter stops and falls downwardly to an appropriate means for directing the arrow to a return conveyor. The return conveyor has preferably been in the form of a conveyor belt means which delivers the arrows to a container adjacent the firing line and accessible to the archer so that he merely has to remove an arrow from the storage container, fire at the target and await return of the arrow to the storage container. The return may be accomplished in a matter of a few seconds so that the archer may effectively practice his sport with only one or two arrows, if desired. Because the arrows do not remain impaled in a target for inspection by the archer, it has been contemplated in such systems that there would be a sensing apparatus for determining the location of the arrow hit in the target and controlling an indicating means adjacent the firing line for showing the archer where the arrow struck the target.

Various forms of arrow return means have been considered in the past but for various reasons there have been some disadvantages associated with them. For example, one approach involves the use of a conveyor which merely deposits the returned arrows horizontally disposed in a trough in the floor adjacent the firing line. While arrow return is accomplished in this way, the arrows are not stored in positions convenient for the archer to remove them. While one prior system has provided for storage of arrows in upright positions such that upper ends are reasonably accessible, it has required an intermediate conveyor for taking arrows from the return conveyor and standing them in the storage quiver.

The present invention relates to an arrow storage quiver adapted to accept arrows directly from a return conveyor, guide the arrows to an upright position and allow the upright arrows to fall directed toward a storage container adapted to maintain the arrows upright for easy access.

It is an object of the invention to provide a new and improved arrow storage quiver of the type described.

Another object is to provide a new and improved quiver of the character mentioned, together with conveyor means for delivering the arrow to the quiver with sufficient speed to assure the desired movements of the arrow from the conveyor to the storage position as described.

In a preferred embodiment, the quiver includes a pair of upright side members, means defining an arrow entrance between lower portions of the side members, and upwardly curved guide adjacent the entrance for turning arrows upwardly, a bumper between upper portions of the side members for stopping arrows, a storage basket at the rear of the side members including side walls for holding arrows in standing positions with the upper ends accessible, an exit opening through the lower portion of one side member for passing arrows falling from the bumper to the basket, a deflector for directing arrows falling from the bumper laterally through the exit opening, a baffle between the entrance and the exit deflector for directing entering arrows laterally toward the exit deflector and preventing arrows from passing directly from the entrance to the exit opening, and an entrance deflector alongside the guide at the entrance for directing arrows laterally toward the baffle and preventing arrows passing directly from the entrance to the exit opening.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of an archery installation, looking down a pair of lanes toward a pair of targets from a position adjacent a quiver embodying the principles of the present invention;

FIG. 2 is a perspective view partly broken away, demonstrating a housing for the targets, backstops and arrow collectors for delivering arrows to a return conveyor;

FIG. 3 is a perspective view of the outside of the quiver housing opposite from that shown in FIG. 1;

FIG. 4 is a central vertical section through the quiver looking toward the right in FIGS. 1 and 3;

FIG. 5 is a transverse sectional view taken at about the line 5–5 in FIG. 4; and

FIG. 6 is a perspective view of the internal quiver parts with the outer housing shown in FIGS. 1 and 3 removed.

DETAILED DESCRIPTION

Referring now particularly to FIGS. 1 and 2, there is illustrated a substantially complete installation for two automated archery lanes side by side in which the entire apparatus is disassemblable and/or portable to permit removal from the floor surface utilized in order to leave it free for use for other purposes. As shown, the installation includes an arrow storage quiver 10 adjacent a firing line 11 adapted to serve two adjacent lanes 12 and 13 in that it is constructed to hold arrows as at 15 in upright positions, either point up or fletching up, conveniently disposed for easy access by archers on both lanes. Targets for both lanes are provided in housing 18 located remotely from the firing line 11 and supported on wheels which facilitate adjustment of the housing toward and away from the firing line to permit adjustment in the length of the range.

In order to provide a target on each lane, the wall of the housing 18 facing the firing line is formed with a pair of large rectangular openings as at 19 and 20 and each aperture is closed by a penetrable screen 22 adapted to carry a target pattern as at 24 and constructed in a manner to permit arrows to pass through the screen without substantial damage to the screen or to the arrows. In a preferred form, the penetrable screen 22 comprises a plurality of vertically disposed closely adjacent flexible strands anchored at the top and bottom to the housing 18. For example, the strands may be one-eighth inch natural rubber or vinyl strands which provide both a suitable surface for the target and also long life with repeated arrow penetration. The target 24 may be painted on the screen 22 or may be an image projected onto the screen. The latter form has the advantage that the form of the target may be readily changed as desired.

At the rear of the housing 18, behind the target screens 22 there are suitable backstop means as at 28. As illustrated, each of the backstop means 28 is in the form of a free hanging net disposed in front of a fixed net in a manner such that the energy of the arrows fired through the target screens is absorbed by the backstop means in a manner to stop the arrow without damage to the arrow or the backstop, as a result of which the arrow falls downwardly for return toward the firing line. Other backstop means may be utilized and one acceptable form includes the use of a free hanging bed of many strands of flexible material such as plastic tubing in sufficient numbers to provide a relatively thick barrier to the passage of arrows and yet have sufficient flexibility to absorb the energy of the arrows without rebound of the arrows.

The sidewalls and the top of the housing 18 may be suitably covered with appropriate material as at 29.

From the backstop means 28, the arrows fall downwardly toward suitable means for directing arrows from both lanes toward a central common return conveyor. As illustrated, the arrow gathering or collecting means in each lane comprises an endless conveyor as at 30 having a width substantially equal to the distance between the screen 22 and the backstop 28 and disposed to travel from the outer edge of the housing toward

the center of the housing as represented by indicating arrows 32. The cross conveyor belts 30 are each arranged to pass about a pair of long support and drive rollers as at 34 and 35 on housing 18 at least one of which is arranged to be rotated by suitable drive means as at 36. Arrows fall from the backstop means 28 to the cross conveyors 30 as illustrated at 38, for example. While the arrows shown are disposed with the pointed ends leading for return to the firing line, some of the arrows fall from the backstop with the fletched end disposed toward the firing line, and the arrow return system is adapted to handle either arrangement easily. In practice, substantially more arrows return point first than fletching first.

The cross conveyors 30 deliver fallen arrows to a centrally disposed common arrow return conveyor 40 including an endless conveyor belt 41 supported adjacent the firing line on an idler roller associated with the quiver 10, and adjacent the housing 18 by a drive pulley on a motor 43. Intermediate the idler roller and the drive pulley, the long upper and lower reaches of the arrow return conveyor are supported by a channel structure 45. The arrangement is such that the conveyor belt 41 is driven at a relatively rapid rate so that arrows are returned in a matter of a few seconds and are thrown into the quiver 10 with sufficient force to reach the storage positions 15.

In order to detect the position of an arrow relative to the target 24 as the arrow passes through the penetrable screen 22, there is an arrow detection system in the housing 18 including a housing 48 located centrally between the apertures 19 and 20 and including a light and optical system for sweeping two beams of light across each target area to provide two angular measurements in the forms of angular coordinates for indicating the position of the arrow. For example, as seen in FIG. 2, one beam of light is swept across the right-hand target area from an effective starting position represented by line 49 to an effective finish position represented by line 50. Each light beam is directed toward a reflective strip on housing posts 51. Preferably the detection system is used for purposes of controlling an indicating means associated with the quiver 10 and including an indicator face for each lane as at 52 and 53 bearing an image as at 54 simulating the target 24. In a preferred form the indicator includes an indicator light movable about the indicating face and controlled by the arrow detection system. The arrow detection and indication systems form no part of the present invention and need not be described in detail herein.

Considering now the construction of the arrow storage quiver 10 in detail, there is an inner structure 60 seen best in FIG. 6 and including a base plate 61 adapted to be suitably secured removably in position on the floor adjacent the firing line 11. The inner framework 60 contains most of the arrow directing and storage structure as described in detail shortly. It is substantially surrounded by an outer housing 63 of appropriate attractive appearance and of a configuration adapted to enclose the inner framework 60 and to house the computing apparatus and indicating mechanism responsive to the arrow detecting system for indicating arrow hit location relative to each target. In a preferred form, the outer housing 63 is made of two halves which are substantially mirror images of each other and appropriately secured together at a joint or seam 65. The halves may be molded from fiberglas reinforced plastic.

The lower portion of the outer housing 63 is formed relatively thin to fit approximately about the lower portion of the inner framework 60. The intermediate portion of the outer housing is somewhat enlarged at one side to fit about an outwardly extending midportion of the inner framework 60 on the near side in FIGS. 4, 5 and 6 while the opposite side of the outer housing at the intermediate portion is similarly formed to provide a symmetrical configuration, as a result of which a cross section through the intermediate portion is somewhat diamond shaped as seen in FIG. 5. While the upper portion of the inner framework 60 is relatively thin, the upper portion of the outer housing 63 is enlarged laterally in order to provide a housing for the computation and indicating mechanism. In this regard, as seen in FIG. 3, at the front of the quiver lateral enlargements as at 67 are substantially normal to the length of the lanes and facing toward the targets. The backsides of the lateral enlargements are angularly disposed, facing in part toward the respective archer positions and include the indicating faces 52 and 53.

The outer housing may also be secured to the base plate 61 and is substantially closed except for an entrance aperture as at 69 facing toward the targets and an arrow access aperture as at 70 at the rear which allows arrows to fall into a storage basket with upper ends as at 15 accessible to the archers, leaning against the edge of the outer housing adjacent aperture 70.

The inner framework 60 includes a pair of generally similar upright spaced side members attached at lower ends to the base plate 61 and extending upwardly to positions near the top of the outer housing. As seen best in FIG. 4, the far side member through which the arrows do not exit is formed of a lower side plate 72, an upper side plate 73 and an intermediate side plate 74, all suitably secured together in a manner which leaves the inside surfaces relatively free of obstructions which would interfere with proper movement of the arrows. As best seen in FIG. 6, the near side frame member through which the arrows exit includes a lower side plate 77, an upper side plate 78, and an intermediate side plate 79, appropriately secured together. The side members 74 and 79, together with a bottom 81, a front wall 82 and a rear wall 83, form an arrow receiving basket. The side members are appropriately secured to each other by a crosspiece at the top as at 86 and other intermediate joining crossmembers, is desired, as at 86'.

In order to facilitate removal of the quiver from the vicinity of the firing line, the inner framework 60 is preferably formed as best seen in FIG. 6 with a pair of axles at the rear end of the base plate as at 87 for supporting a pair of rollers 88 which permit the quiver to be rolled when disconnected from the floor.

Adjacent the front end of the frame, the lower near side plate 77 is formed to support a cantilevered idler pulley 90 about which the arrow return conveyor 41 is trained in a manner such that the belt may be readily removed from the free end of the idler.

Adjacent the entrance aperture 69 in the outer housing and between the lower side plates 72 there is an upwardly and rearwardly curved deflector or guide 92 adapted to receive horizontally entering arrows as shown at A1 and direct the arrows to assume an upwardly inclined direction of travel as shown at A2. From the position A2, the arrows move upwardly to strike a deflector or guide as at 94 suitably secured to the side plate 73 and extending laterally and rearwardly therefrom to direct the entering arrows upwardly toward the top of the inner framework as shown at A3.

The upper crosspiece 86 is formed to function as an arrow stop or bumper and if desired, may be resiliently covered on the lower surface, In operation, the conveyor belt 41 is driven at a rapid rate on the order of 22 feet per second so that the arrow entering the quiver has sufficient speed to attain contact with the bumper 86 where it falls back downwardly. The arrow strikes the bumper while nearly vertical, for example, within about 15° of vertical, and may pivot more toward vertical before falling. During the descent, the arrow is guided by the deflector 94 laterally toward the near side frame member and through an exit aperture 96 sufficient to let the arrow out from between the side frame members. In order to facilitate entry of the falling arrow into the storage basket, the central portion of the sidewall 79 of the storage basket is bulged upwardly and outwardly. In order to prevent the falling arrow from moving far enough outwardly to miss the storage basket, there is a guard 98 around the exit opening extending first rearwardly and outwardly and then rearwardly and inwardly above the basket sidewall 79.

In order to prevent an arrow from passing directly from the entrance to the exit, there is a deflector 100 upwardly and rearwardly from the deflector 92. As shown, the deflector 100

is formed out of the material of upper side plate **78** and bent out of the plane thereof. The deflector, together with a return flap **102**, leaves the exit aperture **96** defined between members **94** and **102**.

In order to aid in preventing an arrow from passing directly from the entrance to the exit, and to prevent arrows from becoming lodged, there is a deflector **106** secured to the lower side plate **72**, extending in a front to rear direction and inclined toward the deflector **100** for the more specific purpose of directing each arrow to strike the deflector **100** rather than to pass it. In turn, the deflector **100** directs the arrows toward the deflector **94** which guides the arrows to the bumper **86** and then downwardly to the basket.

As mentioned elsewhere, the returning arrows may come point first or fletching first and the quiver is adapted to readily handle either. In order to prevent the rising arrows in the inner framework **60** from catching on the framework at the top of the exit aperture **96**, particularly when the fletched end is leading, the side plate **78** is flared as at **107** just above the aperture **96**.

In order to prevent arrow upper ends from being caught inaccessibly inside outer housing **63** adjacent aperture **70**, between the outer housing and the inner housing, the outer housing includes a forwardly directed deflector as at **108** extending toward deflector **94**.

We claim:

1. In an arrow storage quiver for receiving arrows entering horizontally disposed and directing the arrows to upright storage positions, a frame, means defining an entrance for receiving the leading end of a horizontally disposed arrow adjacent lower portions of the frame, an upwardly turned guide disposed adjacent the entrance in the path of entering arrows for turning the leading end of an arrow upwardly, a bumper disposed adjacent the upper portion of the frame at a height relative to the upper portion of the guide greater than the length of a conventional arrow and in the path of the leading end of an upright arrow for stopping the arrow, and a basket at the rear of the frame into which an upright arrow drops from the bumper.

2. A combination as defined in claim **1** including means for guiding the travel of an entering arrow from the entrance guide to the bumper.

3. A combination as defined in claim **1** including means for propelling arrows into the quiver with sufficient speed to reach the bumper, thereby to fall into the basket.

4. In an arrow storage quiver for receiving arrows entering horizontally disposed and directing the arrows to upright storage positions, a frame, means defining an entrance for receiving the leading end of a horizontally disposed arrow adjacent lower portions of the frame, an upwardly turned guide adjacent the entrance in the path of entering arrows for turning the leading end of an arrow upwardly, a bumper adjacent the upper portion of the frame in the path of the leading end of an upright arrow for stopping the arrow, a basket at the rear of the frame into which an upright arrow drops from the bumper, and means for guiding a falling arrow from the bumper to the basket.

5. In an arrow storage quiver for receiving arrows entering horizontally disposed and directing the arrows to upright storage positions, a frame including a pair of spaced upright side plates, means defining an entrance for receiving a horizontally disposed arrow between lower portions of the side plates, an upwardly turned guide adjacent the entrance for turning the leading end of an arrow upwardly, a stop disposed between upper portions of the side plates in the path of the leading end of an upright arrow, means for guiding the travel of an arrow from the entrance guide to the stop, a basket at the rear of the side plates into which the upright arrow drops from the stop, and means for guiding a falling arrow from the stop to the basket.

6. A combination as defined in claim **5** including means defining an exit opening through the lower portion of one side plate for passing falling arrows from the stop to the basket.

7. A combination as defined in claim **6** including a generally upright exit deflector disposed for directing falling arrows from the stop laterally through the exit opening.

8. A combination as defined in claim **6** including a guard around the exit opening for directing falling arrows in to the basket.

9. A combination as defined in claim **5** wherein the basket includes upright sidewalls adapted to hold arrows in standing positions with the upper ends accessible.

10. A combination as defined in claim **5** including a generally upright baffle between the entrance and the exit deflector for directing entering arrows laterally toward the exit deflector.

11. A combination as defined in claim **10** including an entrance deflector alongside the entrance guide for directing arrows laterally toward the baffle.

12. In an archery installation, an arrow storage quiver adjacent a firing line for receiving arrows horizontally disposed and directing the arrows to upright storage positions, comprising, a pair of spaced upright side plates, means defining an entrance for receiving an entering arrow between lower portions of the side plates, an upwardly turned guide adjacent the entrance for turning the leading end of an arrow upwardly, a bumper extending between upper portions of the side plates in the path of the leading end of an upright arrow for stopping the arrow, a basket at the rear of the side plates into which an upright arrow drops from the bumper including walls for holding arrows in standing positions, an exit opening through the lower portion of one side plate for passing falling arrows from the bumper into the basket, and guide means for directing arrows from the entrance to the bumper and from the bumper to the exit and providing baffle means preventing an arrow from passing directly from the entrance to the exit.

13. A combination as defined in claim **12** including an endless belt for returning arrows and means for driving the belt at a speed sufficient to throw arrows into the quiver with enough force to reach the bumper, thereby to fall into the storage basket.

14. In an arrow storage quiver for receiving arrows entering horizontally disposed and directing the arrows to upright storage positions, a pair of upright side members, means defining an arrow entrance between lower portions of the side members, an upwardly curved guide adjacent the entrance for turning arrows upwardly, a bumper between upper portions of the side members for stopping arrows, a storage basket at the rear of the side members including sidewalls for holding arrows in standing positions with the upper ends accessible, an exit opening through the lower portion of one side member for passing arrows falling from the bumper to the basket, a deflector for directing arrows falling from the bumper laterally through the exit opening, a baffle between the entrance and the exit deflector for directing entering arrows laterally toward the exit deflector and preventing arrows from passing directly from the entrance to the exit opening, and an entrance deflector alongside the guide at the entrance for directing arrows laterally toward the baffle and preventing arrows passing directly from the entrance to the exit opening.