ARROW RETURN COVEYOR

Assignee: Brunswick Corporation
Filed: June 6, 1969
Appl. No.: 831,081

U.S. Cl. 273/103, 198/129
Int. Cl. F41J 1/18
Field of Search 273/103, 105.6; 198/204, 129 R

References Cited
UNITED STATES PATENTS
1,691,681 11/1928 Thomson..........................198/204
2,716,296 9/1955 Johnson................................198/204
3,265,192 8/1966 Stadelman..........................198/204
3,292,772 12/1966 Rice..................................198/204
3,329,432 7/1967 Pratt.................................273/103

ABSTRACT
An automated archery range including a firing line from which arrows are shot toward a penetrable target, a backstop behind the target for stopping arrows, an arrow collector beneath the backstop, a disassemblable and removable arrow return conveyor for receiving arrows from the collector and returning them toward the firing line, and an arrow storage quiver adjacent the firing line for receiving arrows from the conveyor and storing the arrows in upright positions readily accessible to the archer. The conveyor includes a horizontal channel, an endless conveyor belt comprising a stretchable band guided in the channel, means for driving the belt, wherein the channel comprises a plurality of separable sections, arranged end to end for assembly and disassembly, and releasable means for holding the channel sections together.

4 Claims, 6 Drawing Figures
ARROR RETURN COVEYOR

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. A preferred storage container accepts arrows directly from the return conveyor, guides the arrows to an upright position and allows the upright arrows to fall directed toward a storage container adapted to maintain the arrows upright for easy access. 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, some prior approaches involve the use of a conveyor system embedded beneath the floor level of the archery range. While arrow return is accomplished in this manner, a permanent installation of the conveyor has been required.

The present invention relates to a conveyor mounted on the floor adapted to be readily disassembled and removed to allow use of the floor for other purposes.

It is an object of the invention to provide a new and improved conveyor system of the type described.

Another object is to provide means for directing movement of a target and backstop assembly.

Another object is to provide means to guide a conveyor belt within the conveyor assembly.

In a preferred embodiment, the conveyor includes a horizontal channel, an endless conveyor belt comprising a stretchable band guided in the channel, means for driving the belt, wherein the channel comprises a plurality of separable sections, arranged end to end for assembly and disassembly, and releasable means for holding the channel sections together.

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;

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 embodying the principles of the present invention;

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

FIG. 4 is a rear view partly broken away of the housing, cross conveyors, and return conveyor shown in FIG. 2;

FIG. 5 is a fragmentary side view partly broken away of a return conveyor channel section and channel holding means; and

FIG. 6 is a transverse sectional view taken at about the line 6—6 in FIG. 5.

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 dis-assembleable 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 plastic up, conveniently disposed for easy access by archers on both lanes. Targets for both lanes are provided in horizontal and 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 to the top and bottom to the housing 18. For example, the strands may be ¼-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 comprises a frame 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 side walls 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 conveyors 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 36, for example. While the arrows shown are disposed with the archer 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 post 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 in FIG. 3 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. The halves may be molded from fiber glass 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 mid-potision of the inner framework 60 on the near side the housing 63 as seen in FIG. 3 while the other side of the outer housing at the intermediate portion is similarly formed to provide a symmetrical construction, as a result of which a cross section through the intermediate portion is somewhat diamond shaped. 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, the front of the quiver lateral enlargements 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. 3, 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. Similarly, the near side frame member through which the arrows exit includes a lower side plate, an upper side plate, and an intermediate side plate, appropriately secured together, as shown in more detail in the copending Dragone et al. application Ser. No. 799,443, filed Feb. 14, 1969, assigned to the assignee of this application, the disclosure of which is incorporated herein by reference. Side members including 74, 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 cross-members, if desired, as at 87.

In order to facilitate removal of the quiver from the vicinity of the firing line, the inner framework 60 is preferably formed 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 inner frame, the lower near side plate 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 plate 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 prevent 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 laterally to strike the deflector 100 rather than to pass it. In turn, the deflector 100 directs the arrows laterally back toward the deflector 94 which guides the arrows to the bumper 86 and then downwardly to the basket.

In order to prevent arrow upper ends from being caught inaccessible 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.

Referring now in more detail to the cross conveyor drive means 36, at the back of the housing 18, below the backstop 28, there is a pulley 109 suitably driven as by a motor in a clockwise rotation as seen from the rear in FIG. 4. As illustrated, the rear of the cross conveyor drive rollers 34 carry pulleys as at 110 which receive an endless drive chain or belt.
The end loops of the belt pass around the roller pulley 110a and drive pulley 109 as shown, and the lower reach of the belt passes over the upper rim of roller pulley 110b. The arrangement is such that a clockwise rotation is imparted to roller pulley 110a and a counterclockwise rotation to roller pulley 110b by the clockwise rotation of drive pulley 109 as seen from the rear.

Considering now the construction of the arrow return conveyor 40 in detail, there is a horizontal channel structure 45 underlying the backstop 18 and extending to the arrow storage quiver 10. The channel has a pair of upright side walls 113 as seen in FIG. 6. A web 114 connects the side walls 113, and supports the lower reach 115 of conveyor belt 41. Above the web 114 are a pair of inwardly directed flanges 116 connected to upright side walls 113 to support the upper reach 117 of conveyor belt 41. The adjacent inner ends of flanges 116 are spaced to define a slot 116a through which the lower reach 115 of the conveyor belt 41 may be inserted to be positioned as seen in FIG. 4 on web 114. A pair of outwardly turned flanges 118 extend from the lower portions of upright side walls 113 to engage the floor 119 as seen in FIG. 6.

In a preferred form, the conveyor channel structure 45 is comprised of a plurality of separable sections. The channel sections are arranged end to end at joints 120 (FIG. 1), and adjacent ends of the sections are releasably held together by means of an elongated channel insert 121, having a wide U-shaped cross section, comprised of a floor plate 122, having a pair of resiliently yieldable upright side flanges 123 as seen in FIG. 6. As illustrated, the upright side flanges are provided by separate pieces welded to the floor plate 122, which is relatively rigid to remain flat on the floor. The channel insert 121 extends for a substantial distance (e.g., 12 inches) into the ends of adjacent channel sections to allow the channel insert flanges 123 to resiliently engage the inner sides of the upright side walls 113. Inserts 121 are releasably pressed into position.

The target housing 18 is mounted for movement along the archery lane toward and away from the firing line by means of a plurality of rollers or wheels, including four relatively large wheels 130 at the four outer corners of the housing (FIG. 1). The midportion of the housing is supported by four pairs of smaller rollers, including two such pairs of rollers as at 132 at the front of the housing and two such pairs as at 134 (FIG. 4) at the rear of the housing. The central rollers 132 and 134 are arranged to rest on the outwardly turned flanges 118 of the return conveyor channel 45, as shown in FIGS. 1 and 4. Normally, when the housing 18 is disposed at its fully extended position from the firing line, the housing rollers 132 and 134 transfer part of the weight of the housing to anchor the first section of the conveyor channel structure 45 to the floor 119.

Thus, when the other sections of the channel structure 45 are joined together by inserts 121, the entire channel structure is relatively rigid and held in position by the housing 18. In order to drive the conveyor belt 41, the conveyor drive motor 43 is supported on a suitable base as at 136 and rotates a drive pulley 138. The belt 41 is wrapped substantially entirely around the drive pulley 138 and held by an idler roller 140 to provide adequate frictional engagement between the belt and the pulley. Preferably, a portion of the motor support 136 is recessed into the floor and retained by the first conveyor channel section 45 so that the motor is anchored sufficiently to permit proper tension. Adjacent the firing line the conveyor belt passes over idler pulley 90 previously referred to, which is supported only at one end in order to permit the belt to be readily positioned and removed.

In practice, the channel sections 45 are approximately 11 feet long and 6 are utilized, thereby providing a total overall length on the order of 66 feet. The conveyor belt 41 is comprised of a resiliently stretchable endless band preferably made from woven Lyrc spandex fiber, a product of du Pont. In order to provide adequate tension, the belt in its relaxed state is substantially shorter than the full length of the conveyor. For example, the normal length may be 10 to 15 feet less than the full length of the conveyor, so that when the belt is stretched into position there is no need for separate tensioning devices. During assembly, the first channel section 45 is laid in place, holding the motor 43; and the housing 18 is positioned on the flanges 118 of the first channel section. Following that, the successive channel sections are joined by the inserts 121. The lower reach of the endless belt is inserted through the slot 116a as the channel sections are connected until ultimately the end of the belt is positioned on idler 90.

I claim:

1. In an archery range arrayed upon a supporting surface including a target and backstop and a quiver at a firing line, a conveyor for receiving arrows adjacent a target and backstop and for returning the arrows to a quiver at a firing line, comprising: a horizontal channel adapted to underlie and archery target and backstop and extending to the quiver, said channel comprising a readily disassemblable array of a plurality of elongated channel sections placed end to end upon the supporting surface, means extending between adjacent sections of said channel for retaining said sections in longitudinal alignment upon the supporting surface, an endless conveyor belt positioned longitudinally within the channel to transport arrows from a target area to the quiver, and means for driving the belt comprising a free turning pulley wheel and means for anchoring said wheel to the supporting surface at one end of said channel, a driven pulley wheel opposite said wheel, and said driven pulley wheel being positioned by the other end of said channel, and means for holding said channel sections together end to end comprising an elastic conveyor belt stretched between said free turning and driven pulley wheels.

2. The conveyor of claim 1 wherein the channel sections comprise a pair of upright side walls, a web connecting the walls to support the bottom reach of the belt, and inwardly directed opposing flanges on the side walls intermediate the top edges thereof and said web, said flanges to support the upper reach of the belt, said flanges being spaced apart sufficiently to permit the lower reach of said belt to be passed therethrough.

3. The conveyor of claim 2 wherein the means for retaining said sections in longitudinal alignment comprises a plate extending beneath portions of two adjacent channel sections and having a pair of resiliently yieldable upright flanges to laterally retain and align the upright side walls of contiguous channel sections, said channel sections being recessed along the bottom so as to receive said flanges therein in closely abutting relationship.

4. A combination as defined in claim 2 wherein the conveyor belt comprises a resiliently stretchable band, wherein the belt drive means comprises a drive motor and a drive pulley adjacent the target and backstop, and including an idler pulley adjacent the quiver mounted in cantilever fashion to permit the belt to be positioned and removed.

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