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BOWLING PIN IMPACT CURTAIN

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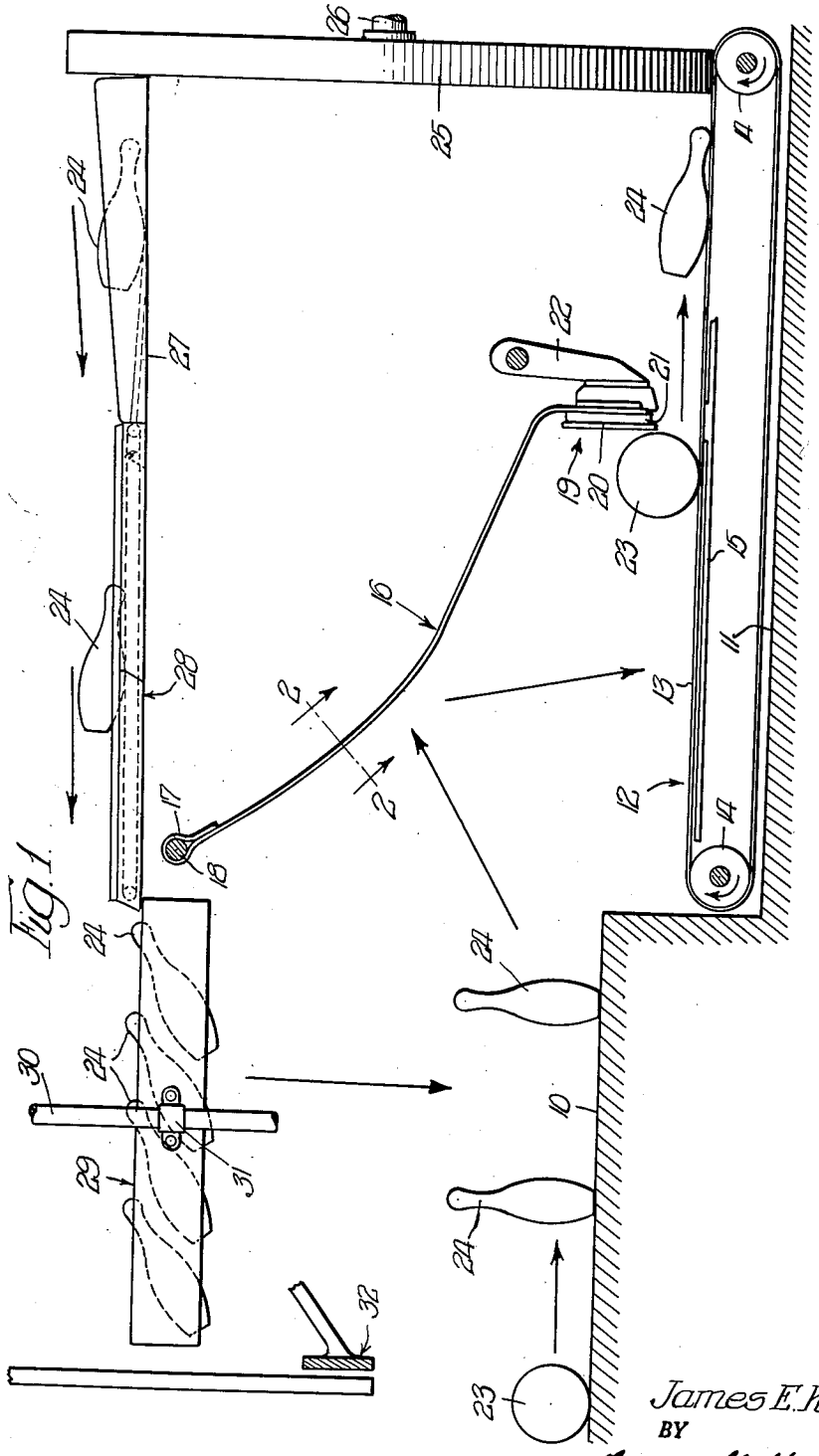


Fig. 1.

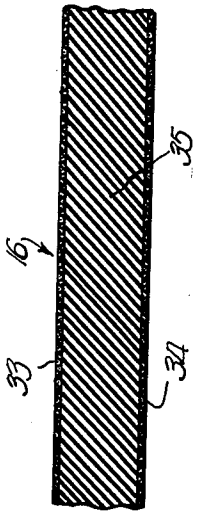


Fig. 2.

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BOWLING PIN IMPACT CURTAIN

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The present invention relates to a new and improved curtain of high impact strength adapted for use with bowling equipment. More specifically, the invention is directed to a high impact strength curtain of new and improved structure adapted to control bowling pin travel by absorbing pin impact without undesirable pin marking, the curtain being particularly adapted for use with automatic pin setting equipment.

With the advent of automatic pin setting equipment, it has been necessary to provide means controlling pin travel following the striking of bowling pins by a bowling ball. The pins will normally be hurtled from the pin setting end of a bowling alley at substantial speeds and great force as a result of being struck by a hard, fast moving bowling ball. In the operation of automatic pin setting equipment, it is essential that pin travel be confined and contained in a relatively small area with the impact force of the pins being dampened or absorbed virtually immediately and the pins deposited on a conveyor system for fast re-setting. Close control of pin travel reduces pin re-setting time and protects equipment components from pin damage.

Generally, an automatic pin setting unit includes a conveyor system which delivers displaced pins collected in the pit of a bowling alley to a pin setting rack which then replaces the pins on the target end of the alley. In order to provide for controlled collection of displaced pins on the portion of the conveyor system in the pit, a pin impact curtain has been mounted in the pit across the adjacent end of the alley and arranged to catch the pins hurtling from the end of the alley, absorb the hurtling force of the pins and cause the same to drop downwardly onto the conveyor system.

A curtain must be flexible for this purpose and yet capable of absorbing the high impact forces of the pins. Rubber base curtains have been used but the particular designs of such curtains have been found undesirable particularly where the pins actually contact the rubber material. Bowling pins are normally white for ease of viewing by the bowler and the curtain being positioned directly behind the pins must supply a contrasting background for this purpose. Accordingly, rubber curtains have been fabricated from black pigment rubber but it has been found that the white pins are marked upon striking the black pigment rubber of the curtain. Furthermore, it is customary to coat the alley with an oil or other protective and friction reducing material. The alley coating is picked up by the bowling ball, transferred to the pins struck by the ball and transferred from the pins to the curtain surface. The general type of oils or coating materials used have an adverse effect on the rubber of the curtain.

It is an object of the present invention to provide a new and improved curtain of high impact strength adapted for use with bowling equipment.

A further object is to provide a new and improved curtain design for use with automatic bowling pin setting equipment, the curtain being capable of absorbing high impact forces delivered thereto by hurtling pins without marking the pins and without being adversely effected by bowling alley surface treating materials transferred from the pins thereto.

Other objects not specifically set forth will become apparent from the following detailed description of the

present invention made in conjunction with the accompanying drawing wherein:

FIG. 1 is a diagrammatic and schematic illustration of the general layout of automatic pin setting equipment at the target end of a bowling alley illustrating the operative positioning of the curtain of the present invention; and

FIG. 2 is an enlarged fragmentary cross section of a portion of the curtain of the present invention illustrating the structural components thereof, this view being taken generally along line 2—2 in FIG. 1.

Referring first to the general illustration of FIG. 1, the target area 10 of a conventional bowling alley has associated therewith a recessed pin and ball collection pit 11. Mounted in the pit 11 is an endless conveyor 12 including a belt 13 operated by rollers 14, one of which is power driven. Associated with the conveyor 12 is a belt supporting surface 15 which aids in backing up the belt 13 to carry the weight of pins and balls delivered thereto.

Mounted above the conveyor 12 in the pit area is the flexible impact curtain 16 of the present invention, this curtain being provided with a fabric loop portion 17 along the top surface thereof through which is received a curtain supporting rod 18 suitably mounted in a manner not shown. The marginal base of the curtain 16 is suitably attached to a bowling ball cushion assembly 19 which includes an impact plate 20 backed up by a rubber cushion 21 to absorb the impact force of bowling balls striking the same. The cushion assembly 19 is suitably supported by arms 22 in the known manner.

As illustrated, the curtain 16 extends diagonally across the pit area as viewed in cross section and adequate slack is supplied to the curtain 16 in the mounting thereof to permit a substantial degree of flexible movement to aid in absorbing the impact forces of pins striking the same. At the left to FIG. 1 a bowling ball 23 is illustrated in its movement along the bowling alley toward the target area 10 as indicated by the associated arrow. The ball 23 may strike an upstanding pin 24 in the target area 10 resulting in the hurtling of the pin 24 upwardly toward the curtain 16. The direction of travel of the pin 24 is illustrated by the arrow associated therewith. The pin 24 strikes the curtain 16 with susbtantial force, this force being absorbed by the curtain 16 with the result that the pin 24 then drops downwardly into the pit 11 and onto the conveyor 12 as indicated by the arrow. The ball 23 moves directly into the pit 11 along the surface of the target area 10 and due to its weight does not travel upwardly to strike the curtain 16. The ball strikes the cushion assembly 19 with the impact force of the ball being absorbed by this assembly. The ball then is desposited on the conveyor 12 and moves past the cushion assembly 19 in the known manner for suitable return to the other end of the alley.

The displaced pin 24 is delivered by the conveyor 12 to a known type of conveyor wheel 25 which is rotated on a shaft 26 or other suitable means. The wheel 25 operates to pick up the pin 24 and deliver it upwardly to an overhead chute 27 along which the pin 24 moves in the direction of the arrow onto a special telescopic conveyor structure 28. The conveyor structure 28 is designed to deliver the pins into various pin rack openings and thus distribute the same throughout an automatic pin setting rack assembly 29.

The rack assembly 29 is mounted to operate vertically relative to the target area 10 by any suitable means such as including a guide 30 and guide bracket 31. After the first bowling ball is thrown, the rack assembly 29 is lowered in the direction of the arrow associated therewith to pick up any pins remaining standing and the area 10 is swept clean of any pins knocked over and remaining thereon by a suitable sweeping mechanism 32 of known type. The rack assembly 29 is then again lowered to

replace the pins that were not knocked over by the first ball and the bowler may then throw the second ball. Following the throwing of the second ball the area **10** is swept clean of all pins and the rack assembly is operated to re-spot a complete complement of pins.

The new and improved structural features of the curtain **16** are shown in FIG. 2. This curtain basically includes the use of a high strength fabric laminated with rubber, the fabric defining the impact surface of the curtain and having a sufficiently close weave to prevent any substantial rubber extrusion therethrough upon impact. Preferably, the curtain is formed from outer fabric layers **33** and **34** and an inner layer of rubber **35**. The layers are bonded to one another by a suitable adhesive.

Each fabric layer **33** and **34** is preferably formed from high count nylon using multiple strand monofilaments. Nylon is not adversely effected by any known alley oil or coating and exhibits the requisite high impact strength properties. For proper white pin background purposes, the fabric layers are preferably dyed with a black non-transferable dye. Thus in view of the weave and strength properties of the fabric as well as the dyeing characteristics thereof, a white pin striking the curtain will not be marked by rubber pigment or by the fabric itself.

Further with regard to the preferred form of curtain structure, it has been found that a nylon strand woven fabric having a thread count of about 60 by 46 per square inch and exhibiting a frabric thickness of approximately 0.014 of an inch with a fabric weight of approximately 6.4 ounces per square yard is capable of efficiently performing as the impact surface in overlying relation with the rubber layer. The close weave of the fabric in conjunction with the strength of the strands thereof is sufficient to prevent rubber marking of the pins therethrough. A monofilament bonded cord type of nylon strand when woven on the order of the high count described forms a fabric capable of withstanding appreciable impact forces. By way of example, the bursting strength of the fabric may be on the order 700 pounds per square inch whereas the tensile strength is on the order of 600 by 500 pounds per square inch.

The curtain **16** will preferably include front and back fabric layers as illustrated with any adequate adhesive being used to laminate the fabric layers with the rubber layer **35**. Adhesive such as polychloroprene dissolved in toluene and isocyanate may be used. By way of example, it has been found desirable that the adhesion of the nylon fabric to the rubber layer conform to the rating of 180° peeling at 12 inches per minute exerting a 25 pound pull over a strip one inch wide. Natural or synthetic rubber may be used and a suitable natural rubber will exhibit a tensile strength of about 2200 pounds, plus or minus 500 pounds, and have a durometer reading of approximately 45, plus or minus 5.

As described above in connection with FIG. 1, the fabric layers **33** and **34** may suitably extend beyond the inner rubber layer **35** along at least one margin of the curtain **16** to be used in forming the loop **17** by means of which the curtain is suspended along its top margin during operative use. Nylon filaments are especially suitable for use in forming the fabric as they are capable of retaining a black non-marking dye, exhibit adequate impact strength and general flexibility, and can be closely woven to an extent that rubber extrusion through the weave is prevented. An suitable thickness of the rubber layer **35** may be used and it has been found that a thickness of approximately 0.096 of an inch, plus or minus 0.010 of an inch, forms a very useful curtain.

Obviously certain modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. In automatic bowling pin setting equipment wherein conveyor means are arranged to receive struck bowling pins thereon for removal and reuse, and a bowling pin impact curtain is supported by means forming a part of said equipment in relation to said conveyor means to be impacted by said bowling pins and direct the same onto said conveyor means, the improvement comprising said curtain being formed from a lamination of high strength fabric and rubber, said fabric defining the impact surface of said curtain and having a sufficiently close weave to prevent any substantial rubber extrusion therethrough upon impact.

2. In automatic bowling pin setting equipment wherein conveyor means are arranged to receive struck bowling pins thereon for removal and reuse, and a bowling pin impact curtain is supported by means forming a part of said equipment in relation to said conveyor means to be impacted by said bowling pins and direct the same onto said conveyor means, the improvement comprising said curtain being an adhesive lamination of high strength woven monofilament nylon fabric and ruber, said fabric defining the impact surface of said curtain and having a sufficiently close weave to prevent any substantial rubber extrusion therethrough upon impact.

3. The curtain of claim 2 in which the fabric is approximately 0.014 of an inch thick.

4. The curtain of claim 2 wherein the fabric is approximately 0.014 of an inch thick with the rubber being approximately 0.096 of an inch thick.

5. In automatic bowling pin setting equipment wherein conveyor means are arranged to receive struck bowling pins thereon for removal and reuse, and a bowling pin impact curtain is supported by means forming a part of said equipment in relation to said conveyor means to be impacted by said bowling pins and direct the same onto said conveyor means, the improvement comprising said curtain being flexible and formed from outer layers of fabric and an inner layer of rubber, said layers being bonded together by an adhesive, each fabric layer being formed from woven strands of material which are sufficiently close to one another to prevent any substantial rubber extrusion therethrough upon impact, said fabric being looped along at least one margin thereof for curtain mounting.

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