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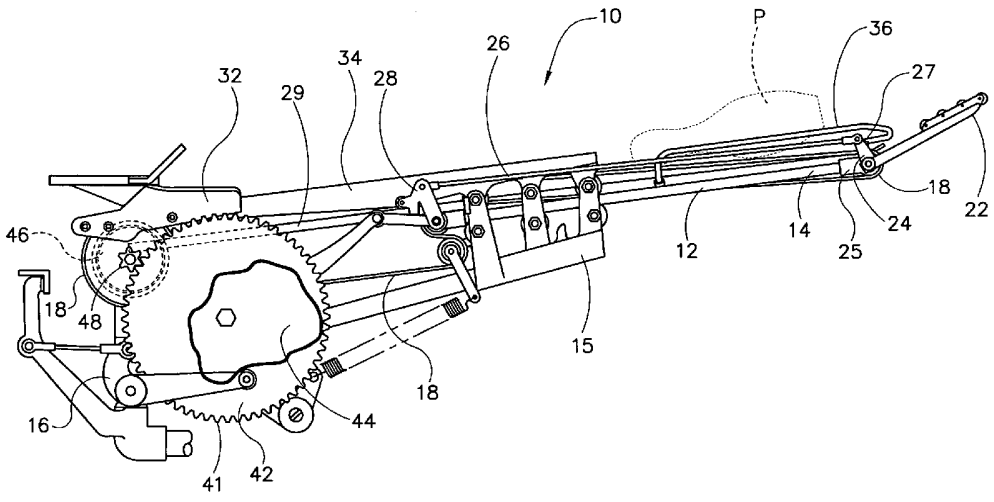
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[Continued on next page]

(54) **Title:** DISTRIBUTOR INDEXING DEVICE



(57) **Abstract:** A distribution indexing device (50, 60) is attachable to bowling pin-setting machines and replaces certain mechanical components within the distributing mechanism (10) that are prone to wear and require constant maintenance. The device (50, 60) includes a drive structure (50) and an electrical contact structure (60). The drive structure (50) is attachable to the distributing mechanism (10) such that a drive gear (54) engages an indexing gear (42). The contact structure (60) includes two contacts (64, 66), one (64) that is attachable to a stationary component (15) of the distributing mechanism (10) and one (66) that is attachable to a moving component (26) of the distributing mechanism (10). As a bowling pin (P) is lowered into a pin magazine (4) by trip arms (22), the arms (22) cause the movable contact (66) to engage the stationary contact (64), thus generating an electrical signal to the drive structure (50). Following a short time delay, the drive structure (50) moves the indexing gear (42) a pre-determined amount such that the indexing cams (44) are allowed to function as intended.

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APPLICATION FOR PATENT COOPERATION TREATY PATENT

SPECIFICATION

DISTRIBUTOR INDEXING DEVICE

This invention claims the benefit of, and the priority date of, U.S. Provisional Patent Application No. 60,581,408 filed June 21, 2004.

FIELD OF THE INVENTION

This invention relates generally to automatic pin-setting machines used in the sport of bowling. Such machines are also referred to as pin-spotting machines.

The present invention also relates generally to pin distribution systems that are used in such machines for filling a generally triangular-shaped pin storage magazine that is disposed above that portion of the bowling lane where the bowling pins are set or "spotted" after they have been knocked down by a bowling ball. More particularly, it relates to a distribution indexing device, an electro-mechanical device that can be added to such a machine to replace a portion of the mechanical structure of the pin distribution system and, in particular, the mechanical clutch thereof.

BACKGROUND OF THE INVENTION

In the sport of bowling, a bowling lane is provided where one end of the lane is used by the bowler as the point at which a bowling ball is released. The opposite end of the lane is used for placement of a set of ten bowling pins, the pins being arranged in a generally triangular-shaped pattern as viewed from above the lane, with the pins being the target of the released bowling ball. The goal is to knock down as many pins as possible with each release of the ball. After the pins have been knocked down, and particularly following a given frame, a pin sweeper pushes all of the pins towards the rear of the machine and into a pit. The downed bowling pins are then delivered, one at a time, to an elevating conveyor. At the uppermost portion of the elevating conveyor, the pins are distributed, also one by one, into a pin-storage magazine for placement of the pins onto the lane. This process is repeated many times over, for as long as the lane continues to be used.

In at least two particular models of pin-setting machine, referred to here as the AMF 82/70 and the AMF 82/90 pin-spotters, the pin-distributing mechanism comprises an elongated arm or boom which is constructed and mounted for limited side-to-side movement above the pin-storage magazine. The boom of this pin-distributing mechanism is also extended or retracted in order that pins can be delivered, one by one, from the end of the boom into selected pockets or compartments according to a predetermined delivery pattern. This side-to-side and inward-outward movement of the boom is purely mechanical and is brought about by means of a gear with two cams, preferably formed integrally with the gear, one cam being formed on each face of the gear. These cams can be considered as pin delivery program cams because they effect the delivery of pins to pockets of the magazine as described above. This camming action is essentially purely mechanical in design.

The boom of the distributing mechanism also includes a longitudinally-extending and continuously-driven belt along which pins are received at a proximal end, foot-end first, and delivered to a distal end of the boom, also foot-end first. The distal end of the boom includes a pair of parallel trip arms. The trip arms are mounted pivotally at the end of the boom which results in movement of a rod and actuation of a trip lever along the boom as the arms are rotated downwardly. As each pin reaches the distal end of the boom and is urged onto the trip arms, the weight of the pin gently moves the trip arms downwardly toward a pocket or compartment such that the pin can slide into that assigned magazine pocket or compartment. This action is also purely mechanical in design.

There is also an electro-mechanical component to the above-described distributing mechanism. That is, towards the proximal end of the boom is a transversely-disposed 115 volt AC electric motor. The motor accomplishes two very important functions. First, it insures the movement of the continuously-driven belt along which pins are delivered. Second, it allows for the actuation of a friction-driven, mechanical clutch and for the rotation of a pinion gear. The mechanical clutch and pinion gear are also actuated when the trip arms are rotated downwardly, which results in movement of a rod and actuation of a trip lever along the boom as mentioned above. When the mechanical clutch is actuated by a bowling pin being lowered off of the distal boom end, this causes the pinion gear to engage the gear and move the cams as previously mentioned. That is, the friction-drive clutch is used to index the boom of the

distributing mechanism from one location to another throughout the ten pin distribution cycle.

In the experience of these inventors, problems are frequently experienced with use of the friction-drive clutch as identified above. The friction-drive clutch has been an unreliable system because of many factors. Ambient temperatures, as well as humidity, along with dirt and grease in the working environment, together with poor housekeeping, are the main reasons for failure of the friction-drive clutch. The friction-drive clutch is also a part of the distributing mechanism that requires wholesale replacement from time to time. What is needed is an alternative device or mechanism which would minimize these problems, or avoid them altogether. What is also needed is such a mechanism that uses the current distributing mechanism as is and with a minimal amount of alteration to it.

Accordingly, it is an object of the present invention to provide a new and useful bowling pin distribution indexing device that allows for the indexing of the distributing mechanism as intended. It is another object to provide such a device which also allows for the replacement and elimination of certain mechanical components within the distributing mechanism that are prone to wear and which require constant maintenance. It is still another object of the present invention to provide such a device that runs off of the primary electrical power supply provided with the pin-setting machines of current manufacture. It is yet another object to provide such a device that uses a minimal number of parts and elements to accomplish the intended structure. It is still another object of the present invention to provide such a device that requires a minimal number of steps to use the structure for its intended purpose. It is yet another object to provide such a method and apparatus that is easily adaptable for use with pin-setting machines of current and existing manufacture.

SUMMARY OF THE INVENTION

The device of the present invention has obtained these objects. It provides for a distribution indexing device that is attachable to pin-setting machines of current manufacture. This device allows for the indexing of the distributing mechanism as originally designed and intended. The device of the present invention accomplishes this by allowing for the replacement and elimination of certain mechanical components within the distributing mechanism that are prone to wear and which require constant maintenance. In the preferred embodiment of the present invention, the device includes

a drive structure and an electrical contact structure. The drive structure is attachable to the distributing mechanism at a point at which a drive gear engages the indexing gear. The electrical contact structure includes two contacts, one that is attachable to a stationary component of the distributing mechanism and one that is attachable to a moving component of the distributing mechanism. As a pin moves onto and is lowered into the pin magazine by the trip arms, the trip arms cause the movable contact to engage the stationary contact, thus generating an electrical signal to the drive structure. Following a short time delay, the drive structure moves the indexing gear a pre-determined amount such that the indexing cams are allowed to function as intended.

The foregoing and other features of the present invention will be apparent from the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a left side elevational view of a bowling pin distributing mechanism constructed in accordance with prior art.

Fig. 2 is a left side elevational view of the mechanism illustrated in Fig. 1 and showing the mechanism as modified by the addition of the distribution indexing device of the present invention to it.

Fig. 3 is a top plan view of the mechanism illustrated in Fig. 2 and showing other components of a pin-setting machine in which the distributing mechanism and the distribution indexing device is used.

Fig. 4 is an enlarged top, front and left side elevational view of that portion of the mechanism and device shown in Fig. 2.

Fig. 5 is a further enlarged and exploded top, front and left side perspective view of the drive structure for the distribution indexing device of the present invention.

DETAILED DESCRIPTION

Referring now to the drawings in detail wherein like numbers represent like elements throughout, Fig. 1 illustrates a side elevational view of a bowling pin distributing mechanism, generally identified 10, that is constructed in accordance with the prior art. The distributing mechanism 10 shown is essentially the same in construction and operation as element D shown in U.S. Pat. No. 3,526,401, which is described in substantially greater detail starting at Col. 3, Line 64 to Col. 7, Line 47 thereof and which is incorporated herein by reference, but with element numbers as

assigned herein. For brevity, the essential elements and function of the distributing mechanism 10 will be presented here for purposes of understanding the relation between component parts that remain the same in the preferred embodiment of this invention, as well as those that are replaced by it.

As shown, the distributing mechanism 10 includes a boom 12 having a proximal portion 16 and a distal portion 14. The proximal portion 16 of the distributing mechanism 10 is that part of the boom 12 at which pins P, shown in phantom view, are received one by one from the pin elevating conveyor 6. See Fig. 3. Each pin P is transported longitudinally along the boom 12 by means of a continuously-moving and endless belt 18. Moving from the point of initial placement of the pin P onto the belt 18, guide means are provided to ensure that the pin P does not roll sideways off of the belt, the pins P being circular in cross-section. Specifically, a pin guide 32 and a pair of opposing pin guide plates 34 are provided at the proximal portion 16 of the boom 12 and a pair of opposing guide rails 36 are provided at the distal portion 14 of the boom 12. The guide rails 36 are longitudinally movable, together with other structure, in relative position to the other guide means 34, 36 as will be seem further in this detailed description.

At the distal portion 14 of the boom 12, each pin P engages a pair of parallel-disposed trip arms 22 which are provided for the purpose of gently lowering the pin P into a pocket 8 of a pin magazine 4, all of which is contained within a frame 2. Again, see Fig. 3. The trip arms 22 are spring-loaded such that the normal position of the arms 22 is as shown in Fig. 1. As a pin P is advanced forwardly and outwardly between the trip arms 22, the weight of the pin P overcomes the pre-loaded spring force and the arms 22 are allowed to rotate slightly downwardly, thereby lowering the pin P into a desired pocket 8. This action is mechanical and occurs with the re-setting of each pin P into a respective pocket 8 until the pin magazine 4 is fully loaded with the ten pins P that are required to begin a new frame.

The trip arms 22 of the distributing mechanism 10 are attached to a trip arm lever 24, the arm lever 24 being rotatable about a front connecting member 25 and also having an upwardly-extending and pivotally-mounted extension member 27. The front connecting member 25 is secured to one end of a pair of longitudinally-extending and parallel support rods 20. A boom carriage 15 is also provided, the carriage 15 being capable of travel along the support rods 20 to extend and retract the distal end 14 of the

boom 12 as required for proper pocket 8 indexing. It will also be seen that the extension member 27 of the arm lever 24 is secured to one end of a longitudinally-extending connecting rod 26. As each of the trip arms 22 moves downwardly under the weight of a pin P, the extension member 27 is rotated forwardly, thereby pulling the connecting rod 26 with it.

Moving towards the proximal portion 16 of the boom 12, it will be seen that the connecting rod 26 is also connected, at its other end, to a trip lever 28. Thus, as each of the trip arms 22 moves downwardly under the weight of a pin P, the extension member 27 is rotated forwardly, thereby pulling the connecting rod 26 with it and thereby pulling the trip lever 28 forwardly as well.

Also disposed at the proximal portion 16 of the boom 12 is a circular indexing gear 42 having gear teeth 41 defined within its outer perimeter. The indexing gear 42 is that part of the distributing mechanism 10 that is responsible for coordinating the side-to-side and inward-outward movement of the boom 12 for desired delivery of pins P to the pockets 8 of the pin-setting magazine 4. This movement is purely mechanical in nature and is brought about by means of two cams 44, each preferably formed integrally with the indexing gear 42, one cam 44 being formed on each face of the gear 42. These cams 44 can be considered as pin delivery program cams because they effect the delivery of pins P to pockets 8 of the magazine 4 as described above.

In the model AMF 82/70 and the model 82/90 pin-setting machines, a 115 volt AC drive motor 7 is provided and is secured to a portion of the machine frame 2, as is shown in Fig. 3. The drive motor 7 is disposed transversely relative to the boom 12 and includes a drive shaft 9. The drive motor 7 is provided for two primary purposes. First, the drive motor 7 insures the movement of the continuously-driven belt 18 along which pins P are delivered as described above. Second, it allows for the actuation of a friction-driven, mechanical clutch 46 and for the rotation of a pinion gear 48. See Fig. 1. As previously alluded to, the mechanical clutch 46 and the pinion gear 48 are also actuated when the trip arms 22 are rotated downwardly, which results in movement of the connecting rod 26, actuation of the trip lever 28, and movement of the trip rod 29 along the boom 12. When the mechanical clutch 46 is actuated by a bowling pin P being lowered off of the distal boom end 14, this causes the pinion gear 48 to engage the teeth 41 of the indexing gear 42 and move the cams 44 as previously mentioned.

That is, the friction-drive clutch 46 is used to index the boom 12 of the distributing mechanism 10 from one location to another throughout the ten pin distribution cycle.

Referring now to Figs. 2, 4 and 5, it will be seen that the distribution indexing device 50, 60 in the preferred embodiment of the present invention is affixed to the distributing mechanism 10. The device includes a drive structure 50 and an electrical contact structure 60, each being mounted to the distributing mechanism 10, but at different points. In the preferred embodiment, the drive structure 50 is generally mounted underneath the boom 12 and in close proximity to the indexing gear 42. The contact structure 60 is mounted to one side of the boom 12 and in close proximity to the connecting rod 26. When the distribution indexing device 50, 60 is secured to the distributing mechanism 10, the need for the clutch 46, the pinion 46, and the trip rod 29 is eliminated and those parts can be disconnected and removed.

The drive structure 50 of the distribution indexing device 50, 60 is mounted to the distributing mechanism 10 by use of a support frame or bracket assembly 56. See Fig. 5. The support frame 56 includes a number of structural elements connected together by fasteners 59. A control box 58 which contains the solid state circuitry (not shown) required for indexing of the distributing mechanism 10 is also secured to the support frame 56. Electrical connections 52, 53 supply power from the distributing mechanism 10 to the control box 58. The drive structure 50 includes a drive motor (not shown) that is contained within a housing 51. Other electrical connections 55, 57 are provided to connect the control box, and the control circuitry contained therein, to a drive motor 51 and to the contact structure 60, respectively. Connected to the drive motor, but disposed to the outside of the housing 51 is a pinion drive gear 54. In the preferred embodiment, the drive structure 52 is mounted in such a way that the pinion drive gear 54 meshes with the indexing gear 42.

Referring now to the inset illustrated on Fig. 4, it will be seen that the electrical contact structure 60 includes two contacts 64, 66. The first contact 64 is preferably attachable to a stationary component of the distributing mechanism 10, such as the boom carriage 15 by means of a switch housing 62. The switch housing 62 is secured by means of a bolt 61, a fastener 67 and a plate 63. The second contact 66 is configured to be movable along with a moving component of the distributing mechanism 10, such as the connecting rod 26. The control wire 57 is connected to the contacts 64, 66 in such a way that, upon physical contact between those two elements, the control

circuit is closed, which initiates one cycle of the drive motor and its pinion gear 54. It is to be understood that the contact structure 60 of the present invention is not limited to the structure shown. Other configurations could be devised without deviating from the scope of the invention. It should also be noted that, in order to achieve desired alignment of the connecting rod 26 relative to the movable contact 66 that front and rear cable risers (not shown) may be connected to the extension member 27 and the trip lever 28, respectively. The cable risers would be flat plate-like members having diagonally opposed openings for receiving fasteners through them and through the members 27, 28 to which the connecting rod 26 is otherwise connected to. This provides an element of fine-tuning of the contact action without other substantial modification to the contact structure 60.

In application, a pin P moves onto and is lowered into the pin magazine 8 by the trip arms 22, the trip arms 22 cause the arm lever extension 27 to move forwardly which also causes the trip lever 28 to move forwardly. During this action, the elevation of the connecting rod 26 is actually raised slightly. It is this movement which is used in the contact structure 60 of the present invention to allow the electrical contacts 64, 66 to move towards one another and make physical contact with one another, thereby closing an electrical circuit of which the contacts 64, 66 are a part. The electric circuitry for the device 50, 60 of the present invention is solid state and is run off of existing plug-ins 52, 53 on the pin-setting machine. This allows the movable contact 66 to engage the stationary contact 66, thus generating an electrical signal to the drive structure 50. Following a short time delay, the drive structure 50 moves the indexing gear 42 a pre-determined amount such that the indexing cams 44 are allowed to function as intended to sequentially move the boom 12 to deliver the pins P into the magazine 4.

Significant to the special utility of the device 50, 60 of the present invention is the fact that it uses solid state circuitry to signal the distributing mechanism 10 to start and stop indexing of the boom 12. Power to run the device 50 is easily accessed and all electrical connections are plug-in type, easy-on terminals 52, 53. As mentioned earlier, the entire mechanical clutch 46 of the original equipment is replaced, thus removing concerns about humidity, heat, grease, worn clutch plates, and seized pinning gears. In the experience of these inventors, once the device 50, 60 is installed and properly adjusted, no maintenance or cleaning is necessary. An additional benefit is the strain on the distributing mechanism 10 is reduced due to the removal of the constant pressure

that is otherwise applied to the clutch 46. Another advantage is that the user no longer needs to parallel the distributing mechanism 10. There are no more problems with worn tubes, sloppy rollers, and stop plates. The device 50 takes away the need for the trip rod 29, thus eliminating multiple indexing and providing pin movement from one location to the next that is faster than with the clutch-driven mechanism 10. This quicker pace eliminates pile-ups of pins P by preventing pins P from getting too close to one another during indexing.

Based upon the foregoing, it will be seen that there has been provided a new and useful bowling pin distribution indexing device that allows for the indexing of a distributing mechanism as intended; which also allows for the replacement and elimination of certain mechanical components within the distributing mechanism that are prone to wear and which require constant maintenance; that runs off of the primary electrical power supply provided with the pin-setting machines of current manufacture; that uses a minimal number of parts and elements to accomplish the intended structure; that requires a minimal number of steps to use the structure for its intended purpose; and that is easily adaptable for use with pin-setting machines of current and existing manufacture.

The principles of this invention having been fully explained in connection with the foregoing, we hereby claim as our invention:

1. A distribution indexing device (50, 60) for use with a bowling pin distributing mechanism (10), the mechanism (10) being provided for conveying and delivering bowling pins (P) from a receiving area to a magazine (4) and comprising an elongate conveyor (12) that is movable back and forth laterally above the magazine (4) by a first cam (44) and is movable longitudinally above the magazine (4) by a second cam (44), the first and second cams (44) each being located to one side of an indexing gear (42), which comprises

a drive structure (50) that is secured to the distributing mechanism (10), the drive structure (50) being electrically actuated and having a pinion drive gear (54) that is engagable with the indexing gear (42), and

a contact structure (60) that is secured to the distributing mechanism (10), to open and close an electrical circuit for actuating the drive structure (50) and to move the indexing gear (42) according to a pre-programmed scheme.

2. The distribution indexing device (50, 60) of claim 1 wherein the distributing mechanism (10) further includes a distal end (14) and a pair of rotatable arms (22) located at the distal end (14) and means for opening and closing the contact structure (60) upon rotation of the arms (22).

3. The distribution indexing device (50, 60) of claim 2 wherein the distributing mechanism (10) further includes a movable connecting rod (26) and the contact structure (60) opening and closing means includes a first contact member (64) that is attached to the distributing mechanism (10) and a second contact member (66) that is movable by means of the movable connecting rod (26).

4. A distribution indexing device (50, 60) for use with a bowling pin distributing mechanism (10), the mechanism (10) being used to convey and deliver bowling pins (P) from a receiving area to a magazine (4) and comprising an elongate cantilevered conveyor (12) and an indexing gear (42), the indexing gear (42) carrying a first cam (44) and a second cam (44) on opposite sides of the indexing gear (42) wherein the first and second cams (44) cause movement of the conveyor (12) back and forth and inwardly and outwardly above the magazine (4) in accordance with a pre-determined delivery pattern, which comprises

a drive structure (50) that is secured to the distributing mechanism (10), the drive structure (50) being electrically actuated and having a pinion drive gear (54) that is engagable with the indexing gear (42), and

a contact structure (60) that is secured to the distributing mechanism (10), to open and close an electrical circuit for actuating the drive structure (50) and to move the indexing gear (42) according to the pre-determined delivery pattern.

5. The distribution indexing device (50, 60) of claim 4 wherein the distributing mechanism (10) further includes a distal end (14) and a pair of arms (22) located at the distal end (14), the arms (22) being configured to receive a bowling pin (P) between them and further being configured to rotate downwardly under the weight of the pin (P), and including means for closing the contact structure (60) upon downward rotation of the arms (22) and means for opening the contact structure (60) upon return of the arms (22) to their non-load position.

6. The distribution indexing device (50, 60) of claim 5 wherein the distributing mechanism (10) further includes a movable connecting rod (26) and the contact structure opening and closing means includes a first contact member (64) that is attached to the distributing mechanism (10) and a second contact member (66) that is movable by means of the movable connecting rod (26).

7. The distribution indexing device (50, 60) of claim 6 wherein the electric circuit is solid state and includes a time-delay prior to actuation of the pinion gear drive (54).

8. In a bowling pin-spotting machine having a pin elevator (6) for conveying pins (P) from the pit of a bowling lane to a distributing mechanism (10) for distributing pins (P) received from the elevator (6) to a conveyor (12) and means for effecting the controlled movement of the conveyor (12) back and forth and inwardly and outwardly above a pin magazine (4) for the controlled delivery of pins (P) to the magazine (4), the control means including a first cam (44) disposed to one side of an indexing gear (42) and a second cam (44) disposed to the other side of the indexing gear (42), a distribution indexing device (50, 60) which comprises

a drive structure (50) that is secured to the distributing mechanism (10), the drive structure (50) being electrically actuated and having a pinion drive gear (54) that is engagable with the indexing gear (42),

an electrical circuit for actuating the drive structure (50), and

a contact structure (60) that is secured to the distributing mechanism (10) to open and close the electrical circuit for actuating the drive structure (60) and to move the indexing gear (42) according to a pre-programmed scheme.

9. The distribution indexing device (50, 60) of claim 8 wherein the distributing mechanism (10) further includes a distal end (14) and a pair of rotatable arms (22) located at the distal end (14) and means for opening and closing the contact structure (60) upon rotation of the arms (22).

10. The distribution indexing device (50, 60) of claim 9 wherein the distributing mechanism (10) further includes a movable connecting rod (26) and the contact structure opening and closing means includes a first contact member (64) that is attached to the distributing mechanism (10) and a second contact member (66) that is movable by means of the movable connecting rod (26).

11. The distribution indexing device (50, 60) of claim 10 wherein the electric circuit is solid state and includes a time-delay prior to actuation of the pinion gear drive (54).

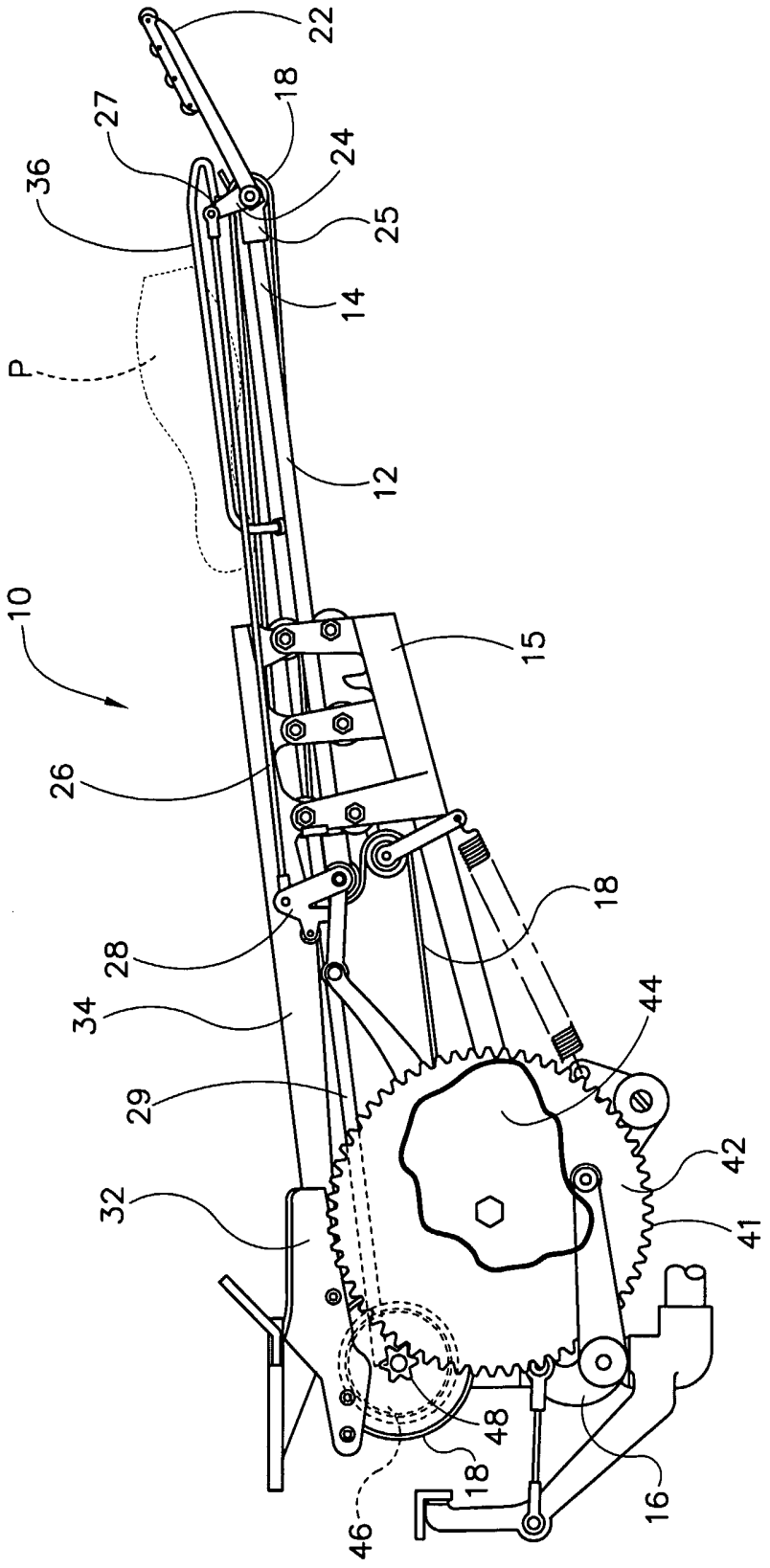


FIG. 1
PRIOR ART

FIG. 2

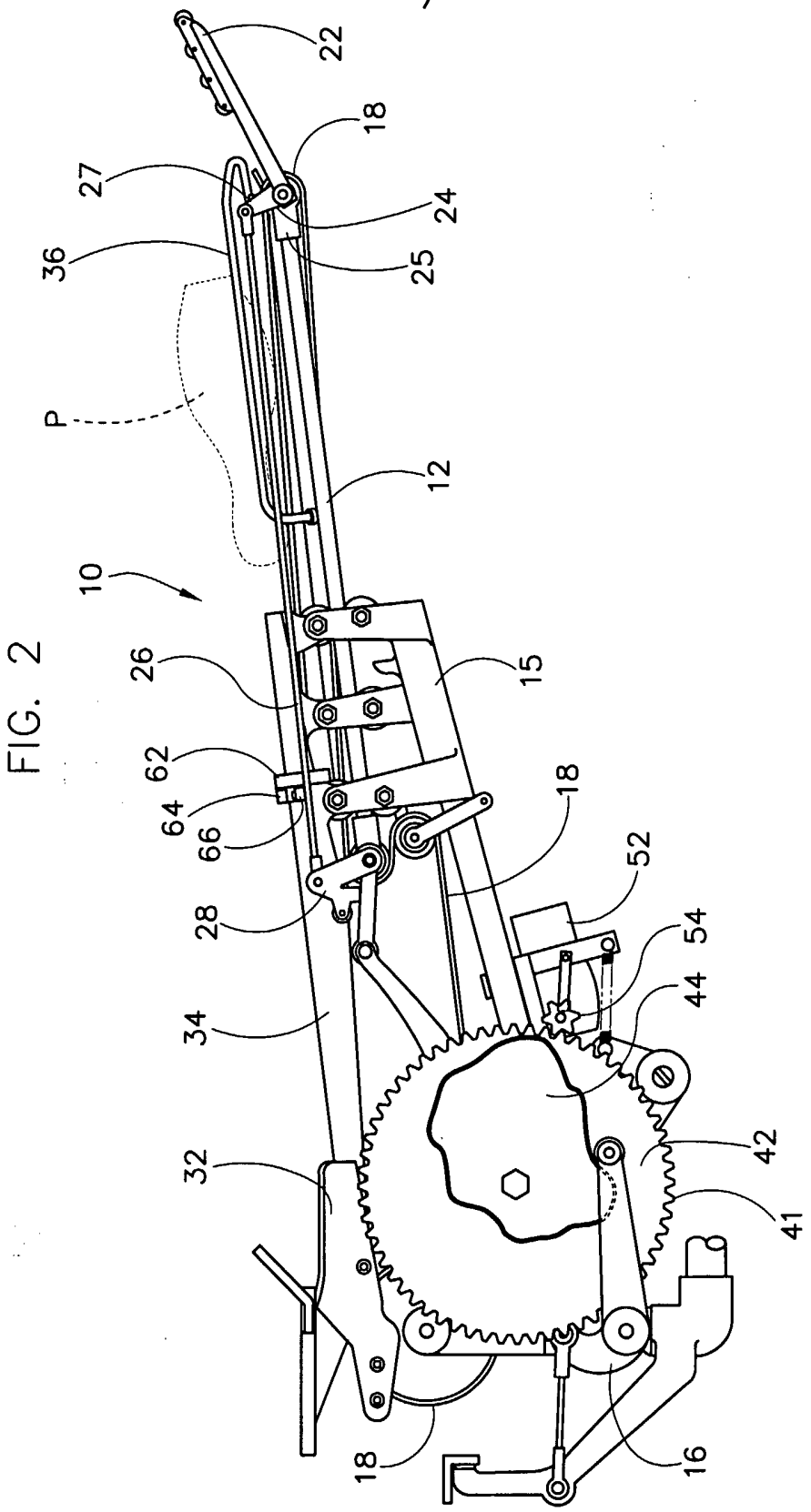


FIG. 3

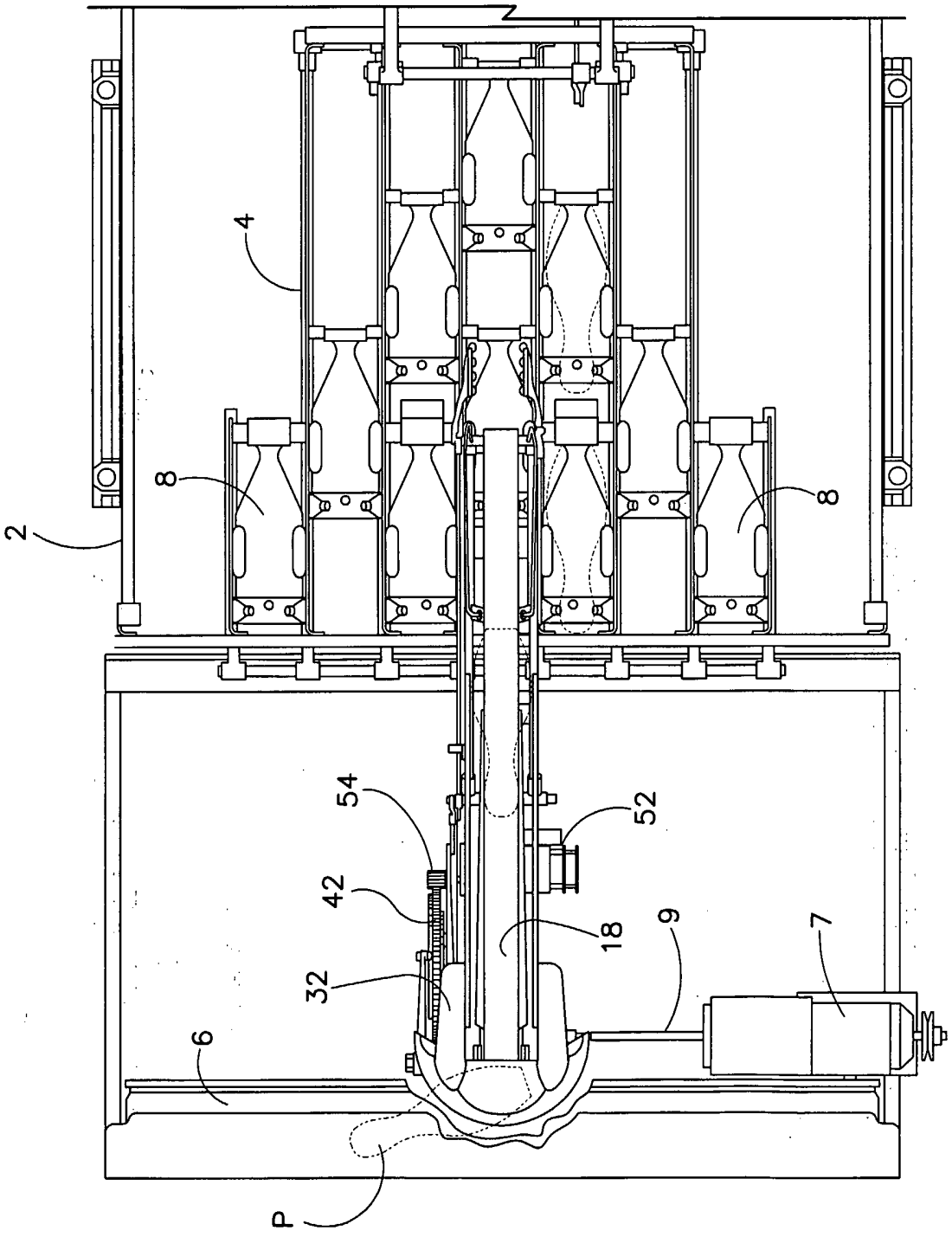


FIG. 4

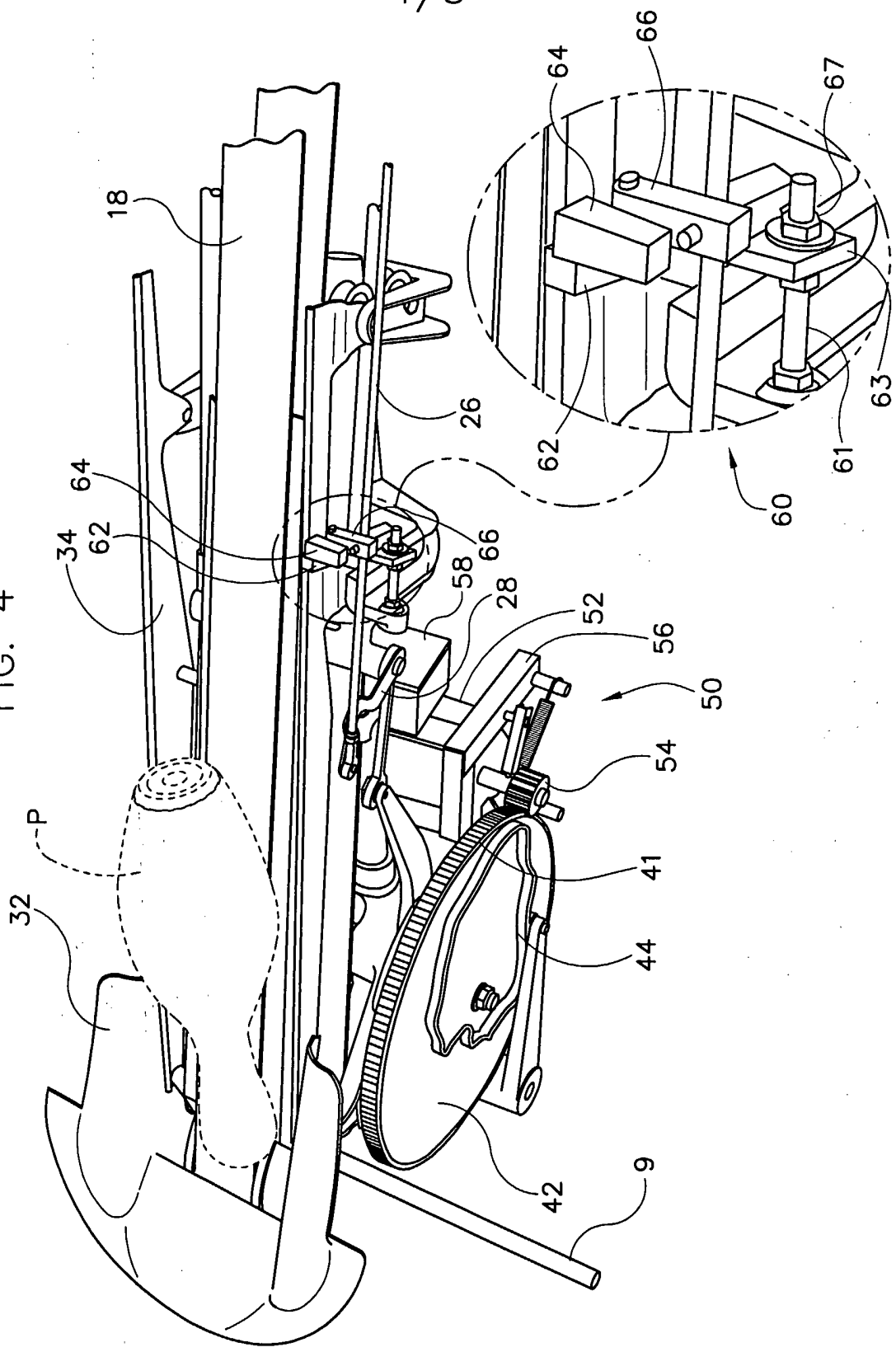


FIG. 5

