July 14, 1953 T. E. MEAD 2,645,485

POWER-ACTUATED APPARATUS FOR SETTING PINS

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Fig. 1

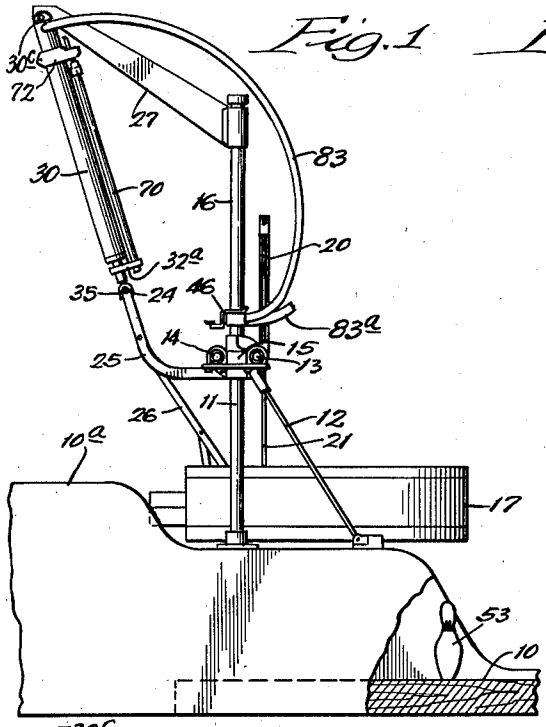


Fig. 2

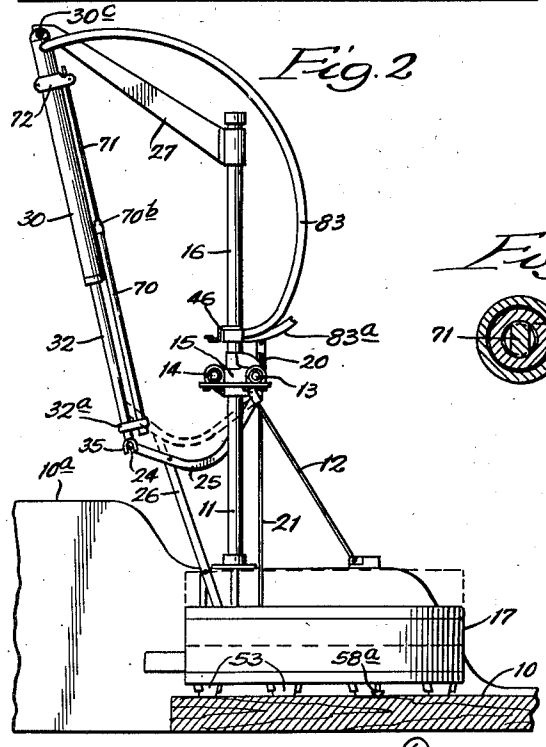


Fig. 3

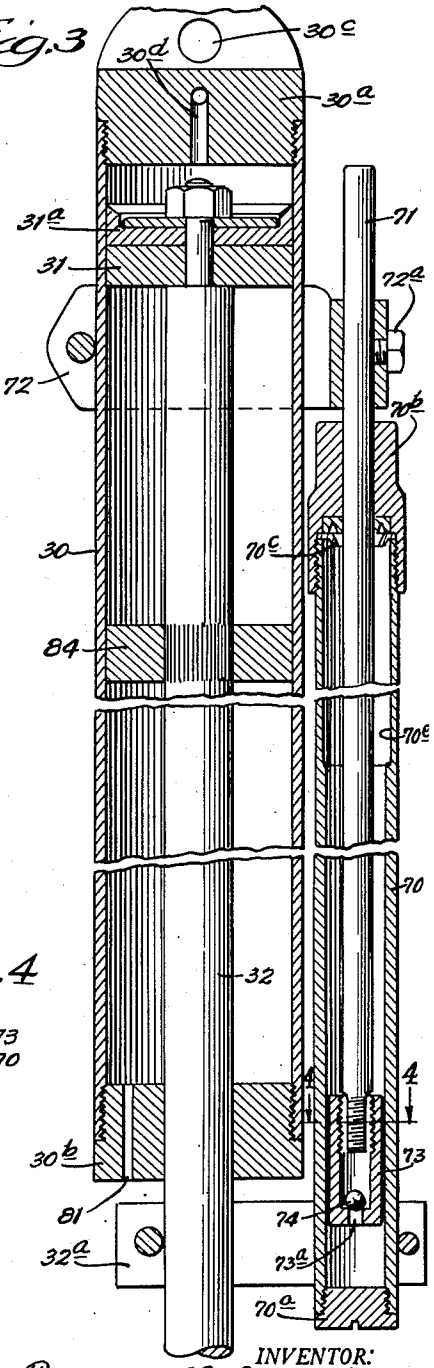


Fig. 4

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Fig. 6

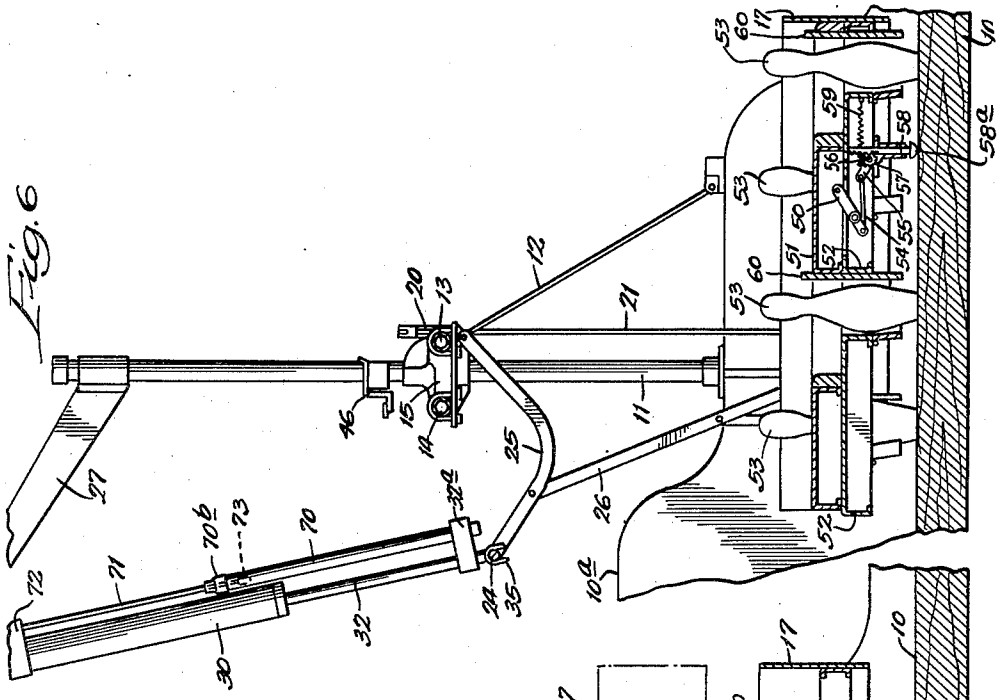
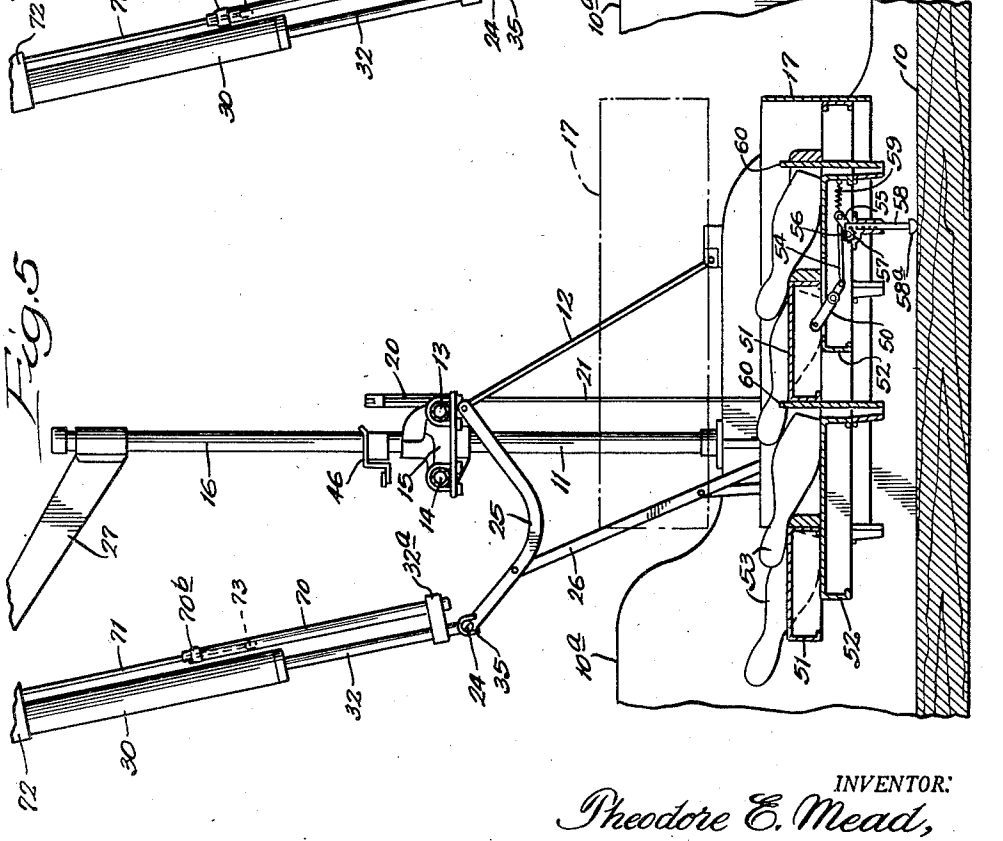


Fig. 5



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POWER-ACTUATED APPARATUS FOR SETTING PINS

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3 Claims. (Cl. 273—42)

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This invention relates to power-actuated pin-setting apparatus for bowling alleys; in particular, it concerns apparatus which will automatically spot bowling pins in position with substantially the same action as has in the past been employed manually by expert pin boys.

This application is a continuation in part of my co-pending application, Serial No. 25,856, for "Power-Actuated Pin-Setting Apparatus," filed May 8, 1948, now Patent No. 2,621,930, issued December 16, 1952; all subject matter contained in said co-pending application which is applicable to the disclosure of the present application is made a part hereof by reference.

It is a particular object of this invention to provide automatic apparatus for use with a conventional pin-setting machine which will substantially duplicate, in the operation of such machine, the action normally imparted thereto manually by a skilled operator.

Another object of my invention is to provide, in combination with a pneumatic power device for actuating a pin-setting machine, further and additional means which regulate the timed application of force to the pin-setting apparatus to duplicate the manual operation of a skilled pin boy.

Still another object of my invention is to provide automatic actuating apparatus particularly adapted for use with a pin-setting machine of the well-known type wherein the pins are normally carried on cradles in a semi-horizontal position and tipped into erect position just before they are brought in contact with the alley.

Other objects and advantages of my invention will appear as the specification proceeds.

I have illustrated a typical embodiment of my invention in the accompanying drawings, of which Figure 1 is a view in side elevation of a bowling alley having a pin-setting machine equipped with my novel automatic actuating apparatus; Fig. 2, a side view, partly in section and partly in elevation, of the apparatus of Fig. 1; Fig. 3, a sectional view of the principal components of the automatic actuation apparatus embodied in my invention; Fig. 4, a view in cross section of a portion of the apparatus of Fig. 3, the section being taken along the line 4—4 of Fig. 3; Fig. 5, a side view, partly in section, of the apparatus of Fig. 1, showing in detail the structure of the pin-setting machine; and Fig. 6, a view similar to Fig. 5 but showing the apparatus at a later stage of its operative cycle.

While the structure of the pin-setting apparatus proper is of great importance in an understanding of my invention, since it explains the purpose underlying certain of the features of my invention, it is not believed necessary to enter herein into an extended description of such pin-setting apparatus for the reason that it is widely known and conventional. Accordingly, I shall herein describe the pin-setting apparatus proper only to the extent believed necessary to provide a full understanding of my invention and its purposes and functions.

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In the drawings, a bowling alley 10 is shown; it is provided with the conventional side walls 10a on each of which is mounted an upright support 11, such supports serving as supporting members for the pin-setting machine and my automatic actuating apparatus. At the upper ends of supports 11, plates 15 serve as end supports for a pair of transverse tubes 13 and 14 which extend across the alley between the two upright supports 11.

Extending upward from transverse bars 13 and 14 and symmetrically spaced thereon with respect to the midline of the alley 10 are a pair of upright tubes 16. To the upper ends of tubes 16 a pair of backwardly-and-upwardly-extending brackets 27 are rigidly affixed. At their rearward ends brackets 27 are bolted or otherwise affixed together so as to form a generally V-shaped support bracket for the automatic actuating apparatus hereinafter described.

A support bracket 12 extends from each of the plates 15 to a suitable mounting fixture on the upper edge of side wall 10a, thus reinforcing the pin-setting machine and the automatic actuating apparatus. The pin holder and spotting apparatus 17 is supported on a pair of vertical arms 21 which are pivoted at their upper ends to a pair of scissors-like levers 20 which are pivoted to a suitable bearing (not shown) supported at the midpoint of transverse members 13 and 14. A lever 25 is pivoted to each of the plates 15 and is oriented to extend generally backward thereof; the levers 25 are joined at their free ends by a transverse bar 24 which, in the conventional pin-setting machine, serves as a handle for manual actuation. A pair of levers 23 are pivoted respectively to the levers 25 near the free ends thereof and are pivoted at their lower ends to the pin-setting frame 17. They thus serve to support and steady that frame and provide a lever linkage to cause it to be lowered toward the alley when the handle 24 is depressed.

Coil springs (not shown) carried within the transverse tubes 13 and 14 exert a force on the scissors-like levers 20 tending to maintain pin-

setting frame 17 in a raised position over the alley and, except when sufficient downward force is being exerted on handle 24, the aforesaid springs cause the frame 17 to rise from the alley and occupy its normal position thereabove. The structure just described is conventional and it or its equivalent is found in all pin-setting machines in general use.

The construction of pin-setting frame 17 may be of any desired form; a number of different forms of such frames have been developed. They have in common the property that provision is made for receiving bowling pins in the frame in a substantially horizontal or reclining position. When the pin setter is ready to spot the pins on the alley, the pin-setting frame can be made to raise the pins to a vertical position and to place them on the appropriate spots on the alley. In the drawings, I have illustrated a typical frame structure; the main outer frame 17 is provided with two sets of horizontal cradle members which are denoted 51 and 52. Cradle members 52 are fixed in position relative to frame 17, but cradle members 51 are free to move with respect to members 52 in the manner hereinafter described. The rear face of each of the members 51, other than those at the extreme back of the frame, is provided with a transverse vertical extension 60 which serves as part of the means for aligning the pins in their proper positions. The two sets of cradle members are joined together by a plurality of links 50; links 50 are bell-crank levers; they are pivoted to the frame 17 at a suitable point intermediate their ends, while their upper ends are pivoted to the movable cradle members 51. The lower end of each of the bell-crank levers 50 is pivoted to a link 54 which joins lever 50 to the free end of a lever 55, the other end of which is keyed to shaft 56. Shaft 56 is mounted in suitable bearings on the fixed frame 17. Shaft 56 also carries a pinion 57 keyed thereto. Pinion 57 co-operates with a rack 58 which is slidably mounted on the under side of frame 17 and terminates at its lower end in a padded or resilient foot 58*a*. Lever 55 is held normally by spring 59 in a position of maximum displacement to the right as viewed in Fig. 5.

From an examination of Fig. 5 it will be seen that when the pin-setting frame 17 is in any position substantially above the alley the cradle members 51 and 52 provide support for the bowling pins 53 in a reclining, almost horizontal position. At such times, the cradle members 51 and the vertical end plates 60 are held in their most retracted position by the bell-crank levers 50 and the springs 59. The bowling pins 53 can thus rest on the upper surface of members 52 with their bases against members 60 and their necks resting on the respective leading edges of cradle members 51.

It will be understood that in a typical pin-setting frame of the type shown in Figs. 5 and 6, there will be perhaps three or four of the rack and pinion structures 57, 58 and the mechanical linkage associated therewith. These will be symmetrically distributed over the frame structure 17 and will all work together as a unit, since the various feet 58*a* will strike the alley simultaneously. The single rack and pinion structure detailed in Figs. 5 and 6 is thus illustrative of the several such structures which would be found in an actual pin-setting frame.

When the frame is lowered to bring the feet 58*a* into contact with the alley surface, the rack 58 is moved upward relative to the frame 17 and pinion 57 is accordingly rotated through a substantial arc, resulting in the shift of lever 55 to the position shown in Fig. 6. This causes the advance of cradle members 51 and vertical members 60, pushing the pins 53 forward and at the same time opening up for them a vertical channel into which they slide, landing upright and on the appropriate spots on the alley, as shown in Fig. 6.

As will be seen from the drawings and the foregoing description, the successful operation of the pin-setting frame requires that the frame be lowered with a "snap" or vigorous movement through the last few inches of its downward path. While the details of construction of pin-setting frames vary from one installation to another, all of them in general use operate on principles similar to that herein described and all of them, for proper pin-setting action, must be brought into pin-setting position with a sudden vigorous movement. This is rendered necessary by the fact that the inertia imparted to the pins by the final "snap" action of the frame is largely responsible for accomplishing clean and accurate shift of position of the pins into the vertical channels which guide them to their final positions. Failure to lower the pin frame with such a snap action at the end of the stroke frequently results in jamming of one or more pins in the frame or in the falling of a pin after the frame has been raised owing to the pins not being cleanly seated on the alley within the guiding channel.

Expert pin boys develop a technique in the manual operation of pin-setting machines in which they lower the frame at a substantially uniform rate of speed until approximately the point in the stroke whereat the feet 58*a* engage the alley. From that point to the end of the downward movement of the frame, the expert pin boy greatly accelerates the rate of downward movement, thus imparting the desired snap to the frame. In studying the operation of pin-setting machines, I have discovered the importance of the final "snap" action in the lowering of a pin frame, and have developed power-actuated apparatus for pin-setting machines which accurately reproduces the action imparted to a pin-setting frame by an expert pin boy. The principal components of such power-actuated apparatus are a pneumatic power cylinder 30 and a hydraulic cylinder 70, shown in all of the figures and illustrated in detail in Figs. 3 and 4.

The power cylinder 30 is provided with upper and lower closure members 30*a* and 30*b* respectively, threaded to fit securely into the ends of the cylinder. The upper closure member 30*a* is modified to provide a bifurcated mounting member 30*c*, each fork of which carries a central aperture. Mounting member 30*c* is secured by a suitable pin to the junction of the bracket members 27. Closure member 30*a* also carries a port 30*d* which terminates in a suitable coupling member to which is affixed a pneumatic air hose 83. Hose 83 extends from the coupling at the upper end of cylinder 30 to a manually-actuable valve 46 which is mounted on one of the upright rods 16. A second hose 83*a* may extend from valve 46 to any suitable source of compressed air.

Valve 46 is provided also with an atmosphere vent and may be any pneumatic valve capable of connecting hose 83 to the pressure line 83*a* or to atmosphere at will. A suitable valve is described and shown in detail in my co-pending application, Serial No. 25,856, of which this is a continuation in part.

The bottom closure 30*b* of cylinder 30 is centrally drilled to permit passage of piston rod 32. In addition, an air vent 81 is provided in member 30*b*.

A piston 31 is affixed to the upper end of piston rod 32; the piston may be of conventional structure including the usual leather or synthetic rubber cup 31*a* which serves as packing and to prevent passage of air around the piston. A centering disc 34 is carried by piston rod 32 at a point substantially below the upper end of the piston rod; this disc is machined to fit fairly snugly in cylinder 30. It functions to prevent binding of the piston rod against closure member 30*b* during operation of the apparatus.

A collar 72 is clamped around the outside of cylinder 30 near its upper end and is employed to hold securely the upper end of a piston rod 71 which co-operates with a hydraulic cylinder 70. Rod 71 is clamped by set screw 72*a* into a cylindrical aperture provided therefor in collar 72; rod 71 is oriented parallel to the axis of cylinder 30. At its lower end piston rod 71 carries a hollow piston 73, threaded at its upper end to co-operate with threads on the lower portion of rod 71. As may be seen by examination of Figs. 3 and 4, the rod 71 is provided at its lower extremity with two flattened regions which produce a passageway into the hollow interior of piston 73 even after it has been screwed snugly into engagement with the rod 71. The bottom of piston 73 has a central aperture providing communication between the hollow interior of member 73 and the interior of cylinder 70 therebelow, and a steel ball 74 rests in aperture 73*a* to form a ball-check valve.

The bottom of cylinder 70 is closed by a threaded plug member 70*a*, while the upper portion of cylinder 70 is closed by a threaded closure member 70*b*. Member 70*b* is provided with a central aperture to permit passage of piston rod 71, and packing material is carried between the lower side of closure member 70*b* and an annular flange 70*c* on the upper end of cylinder 70. As will be seen from reference to Fig. 3, the closure member 70*b* and the flange 70*c* combine with the packing to form a stuffing box at the top of cylinder 70. In being prepared for use, cylinder 70 is filled with oil and then sealed shut by tightly screwing closure member 70*a* into engagement with cylinder 70.

A collar or coupling member 32*a* joins the lower end of piston rod 32 rigidly to the lower end of the cylinder 70, so that reciprocation of piston 31 is necessarily accompanied by reciprocation of cylinder 70 over the fixed piston rod 71.

The length of cylinder 70 is adjusted so as to provide a permissible piston stroke within cylinder 70 slightly in excess of the total stroke of piston 31 necessary to carry the handle 24 from its normal upward position to its maximum downward position. The inner surface of cylinder 70 is machined throughout the greater portion of its length to exceed by a slight amount in cross-sectional area the sectional area of the piston 73, so that a flow of oil around piston 73 within cylinder 70 is possible, although it can proceed at only a relatively slow rate at normal pressures. The upper portion of the cylinder 70 has its inner surface bored out, however, to a substantially larger diameter than the remainder of the cylinder, so that oil can pass freely and rapidly between piston 73 and the wall of cylinder 70 when the piston is in this enlarged diameter zone, marked 70*e* on Fig. 3.

In preparing the apparatus for use in actuation of a pin-setting machine, the position of piston rod 71 may be adjusted, by temporarily loosening set screw 72*a*, to the point where the piston 73 escapes from the restricted passage in cylinder 70 and into the enlarged diameter zone 70*e* at the instant the feet 58*a* come into contact with the alley surface during the downward stroke of the handle 24. When this optimum position has been located, set screw 72*a* may be tightened again and the piston rod 71 left permanently in that position.

In the operation of my invention, the lower end of the piston rod 32 is securely affixed by a coupling member 35 to the midpoint of handle 24. The springs carried in tubes 13 and 14 normally maintain the pin-setting frame 17 at its upper or retracted position, and the cylinders 30 and 70 offer no substantial opposition to such retraction of frame 17, since piston 31 will be lubricated to slide smoothly within cylinder 30 and the ball-check valve 74, 73*a* permits free and rapid movement of the cylinder 70 in the upward direction, since the ball 74 is unseated from aperture 73*a* by the force of the oil and the oil flows freely through the hollow piston 73 into the zone of cylinder 70 above the piston.

When the operator desires to set the pins he makes the appropriate manual adjustment of valve 46 to connect the pressure line 83*a* to the hose 83. This results in the imposition of a super-atmospheric fluid pressure on the upper side of piston 31 and the piston and piston rod immediately begin a downward movement. This movement proceeds at a steady, uniform pace until the feet 58*a* come into engagement with the alley surface. At that instant, the piston 73 passes into the enlarged diameter zone 70*e* of cylinder 70 and the accumulated fluid pressure in cylinder 30, being suddenly freed of the resistance offered by piston 73, very rapidly accelerates the downward motion of frame 17 and seats it on the alley with a "snap." This results in clean and accurate spotting of the pins, since the inertia imparted to the pins by the acceleration insures that they will move into the proper vertical position in the vertical channels between plates 60 and members 52.

Thus it will be seen that my invention substantially duplicates the action given a pin-setting machine by a skilled manual operator. The particular virtue of my invention lies in the sudden acceleration given the pin-setting frame during the last few inches of its motion, after a slower, steady movement theretofore. This change from normal speed at the end of the stroke is essential; I have found that equivalent results are not obtained by moving the frame rapidly from the start. When rapid movement of the frame throughout its downward stroke is adopted, the pressure in the cylinder 30 decreases as the frame drops and as the volume of air in cylinder 30 above piston 31 increases. The inevitable result is that the frame is decelerating as it nears the alley surface, and the motion imparted to the feet 58*a* and thence to cradle members 51 is not the sudden, snappy motion necessary to satisfactorily seat the pins but is a lighter, gradual motion likely to leave the pins jammed in the frame or not properly seated so as to remain standing on their spots when the frame is retracted. By the use of my invention, however, the frame is accelerated

sharply when feet 58a engage the alley surface, and highly satisfactory pin-setting operation is achieved.

While I have in this specification described for purposes of illustration a single embodiment of my invention, it will be understood that many variations in details may be made by persons skilled in the art without departing from the spirit of my invention. Accordingly, I desire that the illustrated embodiment be considered exemplary only and that the scope of the invention be determined by reference to the appended claims.

I claim:

1. In pin-setting apparatus, a pin-setting carriage mounted for vertical movement, mechanism arranged with said carriage for exerting a constant force thereagainst to move said carriage downwardly toward pin-setting position, and means arranged with said mechanism operative to resist downward movement of said carriage during the greater portion of its movement into pin-setting position while being inoperative to resist the downward movement thereof during the final portion of such movement toward pin-setting position comprising a hydraulic cylinder equipped with a piston slidably movable relative thereto, said piston and cylinder being related in a relatively tight slidable engagement through a greater portion of the length of said cylinder while the remaining portion of said cylinder is enlarged to provide a passage for the flow of fluid between said cylinder and piston to render it inoperative to resist movement of said carriage.

2. In pin-setting apparatus, a pin-setting carriage mounted for vertical movement and equipped with a handle extending laterally therefrom, a fluid pressure cylinder equipped with a piston connected to said handle for moving said carriage downwardly, means for supplying a fluid at constant pressure to said cylinder to actuate said piston, and a hydraulic cylinder equipped with a piston and arranged with said fluid pressure cylinder and piston to retard the rate of movement of said carriage through the initial and greater portion of its movement into a downward, pin-setting position while being inoperative to retard the movement of said carriage through the final portion of its downward movement, said hydraulic piston and cylinder being in a relatively tight slidable engagement throughout the major portion of the piston stroke and said hydraulic cylinder being enlarged in diameter through a portion of its length to permit the free passage of fluid between the piston and cylinder wall when the piston travels through the remaining portion of its stroke.

3. In pin-setting apparatus, a frame providing spaced vertical guides, a pin-setting carriage mounted upon said guides for vertical movement, arms fixed to the upper end portions of said guides and extending inwardly toward each other, a pressure cylinder pivotally connected to said arms and provided with a piston, a piston rod connected to said piston at its upper end and at its lower end connected to said carriage, means for admitting fluid under constant pressure into said pressure cylinder to move said piston, a hydraulic cylinder rigidly connected to said piston rod and being equipped with a piston, a rod connected at one end to said last-mentioned piston and at its other end rigidly connected to said pressure cylinder, said hydraulic cylinder being substantially filled with a liquid and slidably receiving its piston in a relatively tight relationship through a portion of its length whereby the rate of movement of the piston in said hydraulic cylinder is retarded by the action of said liquid through a portion of the length of said hydraulic cylinder, said hydraulic cylinder being enlarged adjacent one end whereby the liquid may pass freely between the cylinder wall and piston and said fluid is ineffective to retard the rate of movement thereof through this portion of the piston stroke.

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