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Fritz Huhn, South Pasadena, Calif., assignor to Vigon, Inc., Industry, Calif., a corporation of California
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This application is a continuation in part of my copending application, Serial No. 569,665 filed March 5, 1956.

This invention relates to a mechanism for feeding articles at a feeding station into a receptacle for the article which is advanced to the feeding station and then removed from the feeding station.

It is particularly adapted for the feeding of elongated articles of more than one diameter into such receptacle.

It has been particularly designed for the feeding of bolts and screws and other headed fasteners.

In my previous application, Serial No. 569,665, now Patent No. 2,857,788, I have described a mechanism for drilling holes in the heads of screws.

In this machine the screws held in a magazine are fed in a row to a filling station. At this station an escapement mechanism feeds the screws one at a time to the shuttle mechanism which transfers the screws into a notch positioned in a dial. The dial is rotated into the filling position. It is held in such position while a shuttle inserts the screw into its receiving notch and a gripping mechanism holds the screw in the notch. The screw is then rotated to advance a second notch to receive a screw and as the dial rotates, drilling and other operations are caused to be performed with respect to the screw at its various stations.

The invention of this application relates to an improved escapement and shuttle mechanism. For this reason, the drilling machine, more fully described in my said copending application, will be described only sufficiently to describe the construction and operation of my new escapement and shuttle mechanism and its functions in relating to the rest of the drilling machine. For further details of the drilling machine, reference is hereby made to my copending application which is hereby incorporated in this specification as if fully set forth in this application.

It is an object of my invention to devise an escapement and shuttle mechanism which is capable of fast operation and which will be positive in action.

It is a further object of my invention to devise an escapement and shuttle mechanism which is adjustable to permit its use with screws and bolts of various diameters and head diameters and heights.

These and other objects of my invention will be more fully described in connection with the drawings of which:

FIG. 1 is a vertical section with parts in elevation and parts omitted for clarity of showing of the drilling machine employed in my invention;

FIG. 2 is an end view of FIG. 1 on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary section taken along line 3—3 of FIG. 1;

FIG. 4 is a section taken on line 4—4 of FIG. 3;

FIG. 5 is a fragmentary section on line 5—5 of FIG. 3;

FIG. 6 is a fragmentary section taken on line 6—6 of FIG. 1;

FIG. 7 is a fragmentary section taken on line 7—7 of FIG. 6;

FIG. 8 is similar to FIG. 7;

FIG. 9 is similar to FIG. 7;

FIG. 10 is a view in section and partly in elevation taken on line 10—10 of FIG. 6;

FIG. 11 is a section taken on line 11—11 of FIG. 12;

FIG. 12 is a section, with parts in elevation, taken through the supporting plates for the shuttle and escapement mechanism positioned by the plates 53 and 52 on FIG. 1;

FIG. 13 is an end view of FIG. 12 taken on line 13—13 of FIG. 12;

FIG. 14 is a section taken on line 14—14 of FIG. 12;

FIG. 15 is a perspective view of one end of the sleeve shown in FIG. 14;

FIG. 16 is an end view of FIG. 14 taken on line 16—16 of FIG. 14;

FIG. 17 is a section taken on line 17—17 of FIG. 13;

FIG. 18 is a view partly in section taken along line 18—18 of FIG. 13;

FIG. 19 is a view, partly schematic, showing the shuttle and escapement position corresponding to FIG. 18;

FIG. 20 is similar to FIG. 18 showing a further position of levers shown in FIG. 18;

FIG. 21 is a schematic showing of the shuttle position corresponding to FIG. 20;

FIG. 22 is another position of the levers shown in FIG. 18;

FIG. 23 is a schematic showing of the shuttle position corresponding to FIG. 20;

FIG. 24 is the same position as shown in FIG. 20;

FIG. 25 is a schematic showing of the shuttle position corresponding to FIG. 24;

FIG. 26 is a fragmentary section taken on line 26—26 of FIG. 28 with parts omitted for clarity of showing;

FIG. 27 is a section taken on line 27—27 of FIG. 26;

FIG. 28 is a view taken on line 28—28 of FIG. 27.

As more fully described in my copending application, the screws to be drilled, designated by the numeral 1 are placed in a hopper 2 (see FIGS. 1, 2 and 3). The hopper 2 has a downwardly inclined bottom 3 (see FIG. 5) permitting the screws to pass by gravity toward an open portion 4 of the hopper into the drum 5.

The drum 5 is mounted for rotation on a shaft 6 positioned in a bearing sleeve 7 on plate 8. The rotatable drum 5 is open at its side 9 adjacent the opening 4 on the inner side of the hopper 2. About the inner periphery of drum 5 are positioned a series of spaced vanes 10 connected at one end to the drum.

As the drum rotates, the screws are tumbled and a portion of the screws fall into an inclined and downwardly sloping pan 11 connected at its lower end to a guide 12.

The screws pass down the inclined pan 11 to the upper end of the inclined guide 12 formed by two vertical parallel plates or rails 13a and 13b, spaced sufficiently apart by means of spacer bracket 124 (FIG. 27), to receive the shank of each screw 1. Those screws which fail to drop from the lower end of pan 11 with their shanks down in position between the plates 13a and 13b of guide 12, fall back down into the bottom of the hopper or the drum 5. A baffle 15 connected at its upper end to a hinge 16 mounted on plate 17, prevents ejection of any screws out of the hopper by the action of the rotating drum 5. A second baffle 18 is fastened to a plate of guide 12, to aid in guiding the screws into guide 12.

The screws descend by gravity down the guideway 12 to be introduced into notches provided in a dial mechanism which grips the screws and as the dial is rotated the screw is moved from station to station where the head of the screw is drilled with a bore perpendicular to the screw driver slot in the head of the screw.

The dial mechanism, and the drilling mechanism illustrated in this specification is fully described in my copending application. It will be referred to here only as it relates to and elucidates the function of the improve-
ment of my invention forming the subject matter of this application.

The particular feature is a novel mechanism whereby one screw at a time is advanced to the position, termed the filling position, at which position means are provided to transport the screw into the receiving notch in the dial. The device for feeding the screws one at a time to the escapement mechanism and the transport mechanism is termed the shuttle.

Means are also provided to adjust the guide, the escapement and the shuttle to guide and insert screws of various sizes into the notches in the dial.

These will be more fully described below.

Referring particularly to FIG. 1, the dial, indicated generally by the numeral 19, is in the form of a disc having an outer peripheral flange 20 in which are cut 10 spaced notches 21, at equal intervals about the peripheral flange 20, each notch being located 36° away from the adjacent notch. In each of notches 21, referring also to FIGS. 6 to 10, is located chuck 22. It will be noted that the screw 1 which is to be drilled, when inserted into the chuck 22, is supported therein by contact of the lower surface of the head of the screw with the upper surface 23 of the chuck and with a lug 24, the shank of the screw extending downwardly into the chuck recess 25. Further, it will be noted that the chuck 22 can accommodate screws of different lengths since the shank of the screw, as indicated in FIG. 10, can hang below the lower end of the chuck recess 25 and within the inner periphery 26 of flange 20 adjacent the inner face 27 of the dial. Directly below and spaced from the bottom of each of the notches 21 in the dial is a slot 28 passing completely through the disc from one face thereof to the other.

A series of slots 29 (FIG. 6) having about the same depth as the notches 21, are cut into the outer periphery of the dial, each of slots 29 extending from the opposite face 30 of the dial and communicating with a notch 21 in the flange 20. Positioned for pivotal movement in each of the slots 29 in the dial 19 is a gripper member 31 which is pivoted on a screw 32 passing radially into the dial and extending through the slot 28 below each of the notches 21. The gripper 31 is in the shape of a fork having gripping arm 33, the outer end of which is shaped to form a hook 34.

It is noted that the gripper arm 33 is disposed in slot 29 below the outer periphery of the dial as seen particularly in FIG. 6. The hook 34 of each gripper 31 passes through the cut-away portion 35 of the adjacent chuck 22 and beneath the lug 24 therein for gripping the shank of a screw positioned in the chuck as described above. The screw 32 has a reduced portion 198 and the gripper 31 is locked onto the screw 32 to prevent longitudinal movement of the gripper along the screw, by means of a snap ring 37, which can be snapped around said reduced portion of the screw, into the slot 38 in the bifurcated lug of the gripper 31. Vertical adjustment of the gripper 31 on the pivot screw 32 is provided to raise or lower the gripping hook 34 of the gripper in slot 29, thus providing adjustment of the hook 34, for engagement with screws of varying sizes disposed in the chucks 22.

The outer end 39 of each of the grippers 31 (FIG. 7) is provided with a recess 40 which receives the ball end 41 of a plunger 42. The plunger is telescoped into the tube 43 which is mounted on a ball and socket 44 on post 45 fixed to the rear face 30 of the dial 19 near the outer periphery thereof. The spring 46 urges the gripper 31 clockwise as seen on FIG. 7 to grip the shank of a screw 1 positioned in the chuck 22, as seen in FIG. 9.

A rod 47 actuates each of the gripper members 31 (see FIGS. I, 7 to 9). The rod 47 extends through bearing plates 48, 49 and 50 (FIG. 1), and is held in position at its outer end in an insulated slot formed in an end member 50 of the machine. Plate 48 is provided with a curved bearing surface for receiving rod 47 and permitting rocking motion of the rod. Rod 47 has a flat portion which is received in an inclined slot in plate 48 which slot is substantially parallel to the first mentioned slot in plate 50. These slots permit rocking motion of the ends of rod 47 on the curved bearing surface.

Just before the screw is urged by the shuttle plate into position in the chuck 22 at the screw feeding or loading station of the dial 19 (as will be more fully described below), the rod adjacent the gripper 31 is moved or rocked in a direction shown by arrow 51 in FIG. 7, by movement of the opposite end of rod 47. The movement is controlled by timing and actuating mechanism, more fully described in my copending application, to contact the arm of the gripper 31, forcing the same to pivot in a counter-clockwise direction about pivot screw 32 and against the action of spring 46, to the position shown in FIG. 7, with the hook 34 of the gripper retracted sufficiently out of the chuck recess 25 to permit the screw to be introduced into the chuck 22 by the shuttle mechanism as described below.

The cam shaft 54 is mounted in plates 49, 48, 53 and 52 and carries, among other cams, the cam 55 which operates the lever 56 which actuates the rod 47. The cam 57 is mounted on the cam shaft 54 externally of the plate 52 on the plate extension 58 (see FIGS. 1, 2 and 3).

The cam follower 59 is mounted at the end of a lever 60 which is hinged on pin 61 positioned in the block 62. The block 63 is adjustable mounted in the bracket 63, mounted on plate 52, between the screw 64 positioned in the plate 52 and the screw 65 positioned in the head of the bracket 63.

The lower end of the lever 60 terminates in a fork 66 which carries a rod 67 (FIGS. 12-14) as will be more fully described below.

The sleeve 68 forms with the flange 69, has its opposite end formed with a reduced cross section at 70. The sleeve fits into bores 71a and 71b in plates 52 and 53. The bore 71a is larger in diameter than the complementary diameter of 68 and the bore 71b is of diameter larger than the complementary diameter at 70. Diagonally positioned flats are provided on surfaces of 70 and the chamfered plate 72 also provided with complementary flats is mounted on the reduced portion and the plate 72 and flange 69 are clamped against the faces of plates 52 and 53 by means of the through bolts.

As will be seen from FIG. 14, the portion 70 of reduced diameter protrudes beyond the clamping plate 72 to a portion adjacent the dial 19. The protruding portion is notched at a diametrical plane 73 and at a chordal plane 74 perpendicular to the plane 73. Adjacent the end 75 of the sleeve 65 is a transverse notch 76 (see FIG. 15) which is formed in both surfaces of the sleeve in the chordal plane 74. A bore 77 is positioned axially aligned on a diameter perpendicular to the chordal plane 74. The exterior surface of the sleeve adjacent the bore 77 is flattened as is shown at 78 (see FIGS. 14 and 15). Longitudinally spaced from the bore 77 is a second bore 79. A bushing 80 notched and bored to conform with the sleeve is fitted into the end of the sleeve.

The rod 67 is formed with three diameters. The smallest diameter 81 extends exteriorly of the bushing and plate 52 and carries the shuttle actuating plate 84 held against the step 85 by the retaining nut 86 (see FIG. 14). The section 82 of the rod 67 is journaled in the bearing in the bearing 87 mounted on the flange 69. The fork 66 is held between the retainer 87 and the shuttle actuating plate 84. The portion 83 of larger diameter is journaled in the bushing 80. A spring 90 is positioned between the washer 89 abutting the step 88 and the bearing retainer 87.

The outer end of the rod 67 terminates inside the sleeve 68 and bushing 80 and is formed with an end notch 91 carrying a transverse slot 92 and a diametric bore 93 and an axially aligned counter bore 94. The shuttle plate 95 fits into the notch 91 with the boss 96 fitting into the transverse slot 92. The screw 96a is positioned
in the bore 93 and 94 to hold the shuttle plate securely in the slot 91. The screw retainer plate 97 is positioned in transverse slot 76, on screw 98 passing through the bore 77. The mounting of the plate 97 and shuttle plate 95 is easily accomplished by retracting the rod 67 until the bore 94 is aligned with bore 79, whereupon the shuttle plate having been placed in position the screw 96a is inserted through the plate 95 and the plate 97 is placed in position and the screw 98 inserted, and the plate 97 is thus positioned to permit the shuttle plate to slide over the plate 97.

The adjusting rod 99 having a cylindrical surface journal in the plates 52 and 53 carries eccentrically positioned cylindrical ends 100 and 101 positioned respectively in slots 100' in the flange 69 and slots 101' in the clamping plate 72 (see FIG. 16).

The escapement actuating rod 102 is slideably positioned in bores in plates 52 and 53. The end 103 protruding beyond plate 52 and through a notch in 69 carries a pin 104 and a stop nut 105 (see FIGS. 12 and 17). The opposite end 106 is notched at 107 and holds the hook 108 by means of the screw 109 passing through slot 115 in the hook 108. The spring 110 is positioned about rod 102 between the plate 52 and a spring retainer 111 positioned on 102. The spring retainer 111 is mounted on rod 102 by a screw 112 bored to receive the rod 114 which passes through bores in plates 53 and 52. The spring retainer is held in position on the rod 114 by the set screw 113.

The shuttle actuating rod 67 and the escapement actuating rod 102 are operated via the clutch plate 84 mounted on the shuttle actuating rod. The plate 84 is bored with a bore 116. Hingedly mounted on plate 84 at hinge 117 is the escapement actuating lever 118 which in turn is formed with a slotted end 118'. The pin 119 passes through the slot 118'. The lever 118 is bored at 119' and the screw 120 and nut 121.

The screw passes through the bore 116 and is directed towards the stop pin 119 positioned in the bearing retainer 87 (see FIGS. 12 and 18).

The functioning of the escapement and shuttle mechanism will be further described by reference to the position diagrams FIGS. 18 and 19 which show the shuttle 95, escapement hook 118 and the dial notch 21 in the position to receive a screw (see FIGS. 6 and 7). FIG. 20 and FIG. 21 show the second stage of advance of the shuttle. FIG. 22 and FIG. 23 show the shuttle in the advanced position for insertion of the screw into the notch. FIGS. 24 and 25 show the shuttle partly retracted, the position of the lever 84 and 118 being in the position shown in FIG. 20, and the shuttle in the position of FIG. 21 but showing the ready position of the next screw for insertion as shown on FIG. 19 which follows to start the next cycle.

Referring to FIGS. 12, 18 and 19, the cam 57 has rocked the lever 60 so that the fork 66 has moved the shuttle actuating plate 84 to the right into the position shown in FIG. 18 thus compressing the spring 30 (FIG. 14) and moving the shuttle plate 95 over the screw retainer plate 97 and under the end of the guide plate 13a. In this position the spring 110 has retracted the rod 102 with the stop nut 105 against the plate 52.

The hook 108 is thus advanced over the face of the guide plate 13a and underneath the head of the screw thus holding the screw of screws in the guide 12. A screw has previously been fed by the previous cycle, as will be described below, and deposited onto the screw retainer plate 97 and thus aligned with the notch 21.

The continued rotation of the cam now rocks the lever 60 so that the fork 66 locks the actuating rod 67 to the left (see FIG. 22) and the spring 90 causes the rod 67 to be moved to the left thus advancing the shuttle plate 95 underneath the end of the guide plate 135 and closing the space between the guide plates 13a and 13b. This action advances the screw 1 under the end of the guide plate 135 in preparation for insertion of the screw into the notch 21.

It will be noted that in moving to this position the lever 118 has pivoted on pin 104 and 117 to the vertical position where the screw 120 in contact with the end of the stop pin 119, but, due to the fact that lever 118 is free floating, it transmits no force to rod 102 and no movement of the rod 102 has occurred until screw 120 abuts pin 119 (see FIG. 20) about which it then pivots, as described below. The screw 120 accounts for the rest position of the escapement hook during the translation of the shuttle plate from the position shown in FIG. 19 to the position shown in FIG. 21. The continued movement of the shuttle actuating rod 67 under the urging of spring 89 moves the rod 67 to the left. The screw 133 on the shuttle actuating plate 84 comes against the flange 69, as will be more fully described below. This arrests the leftward motion of the rod 67 (see FIG. 22).

It will be observed that in the passage from the position shown on FIG. 20 to the position shown in FIG. 22, the screw 120 abuts the end of the pin 119, thus causing the lever 118 to fulcrum on 117 and withdrawing the escapement actuating rod 102 to the right compressing the spring 110 (FIG. 17). This motion thus has caused rod 67 to advance shuttle plate 95 to the extreme left position (FIG. 23) causing the introduction of the screw 1 into the notch 21. At this point the escapement hook 108 has been withdrawn to the right, by rod 102. This permits the line of screws to advance until they are stopped by the shuttle plate 95.

The cam 57 continuing its rotation, the lever 69 is again rocked so that its fork 66 repeats its travel 84, the right pushing the shuttle actuating plate to the right, to the position as shown in FIG. 24, lever 118 rocking on the screw 120, the rod 102 having been retracted to the left under the force of the compressed spring 110. The resultant position of the escapement hook 108 and the shuttle plate 95 is shown in FIG. 25. The escapement hook has moved under the next to the last screw and the shuttle plate has taken the position shown in FIG. 21. The continued rotation of the cam and the movement of the fork 66 to the right (FIG. 12) causes the further outward movement of the rod 67, to the position shown in FIG. 18, the lever 118 fulcrums and is described in connection with FIG. 18. When the shuttle plate has been retracted to the position of FIG. 19, the last screw falls into the position as described in connection with FIG. 19 for the repetition of the cycle.

During the period of movement of the shuttle plate from the position of FIG. 22 the rod 47 is rocked to the right (viewing FIG. 8), thus causing the spring 46 to extend the plunger 42 to rock the gripper 31 so that the hook 34 grips the screw 1, and then the rod 47 is retracted by the cam 55 and lever 56 (see FIG. 1). The dial is thereafter rotated 36° during the period between movement of the shuttle plate from the position shown in FIG. 23 back to the position shown in FIG. 19. The rotation of the dial thus advances the notch with the screw gripped therein to the first drilling station and moves an empty notch into the screw receiving position.

The dial 19 (see FIG. 1) is mounted for step-wise rotation by index plate 122 to which the dial 19 is connected for rotation with the index plate.

The dial actuating mechanism includes an index plate 122 having ten equally spaced holes therein. A mating plate 123 containing ten equally spaced pins is aligned with the holes in the index plate and positioned forindiscriminate mating engagement with said holes. Plate 123 is free to move axially and rotatably.

The mating plate is moved into engagement with the index plate, rotated 36° to rotate the dial plate and then withdrawn by suitable cam and lever arrangements more fully described in my copending application, Serial No. 569,665.

Suitable drive mechanism, cams and other timing and
Actuating mechanism are provided as is more fully described in my aforesaid copending application Serial No. 569,665.

A very useful feature of the escapement and shuttle mechanism of my present invention are the features of adjustability which permit the feeding of screws of various head and Shank diameters and head heights into the dial notches. It will be observed that the dial notch and gripper will permit the entry of various diameter screws by provision of suitable screw receiving chucks positioned in the notches. (See FIGS. 6 and 7 and my copending application for further description of this feature.)

In order to process screws of various sizes, the guide plates 13a and 13b (FIGS. 3 and 19) are made adjustable to accommodate various sizes of screws. The position of the hook 108 and the travel of the escapement actuating rod 102 is made adjustable to fit various head diameters so that the hook can take the positions as shown in FIGS. 19, 21, 25, and 25 to engage the head of the screw 1 and in the position of FIG. 23 to clear the head of the screw directly above.

The level of the top of the shuttle plate 95 and the screw retainer plate 97 are made adjustable so that for various sizes of screws, the functions and position of the shuttle plate as previously described in connection with FIGS. 19, 21, 25, and 25 may be made possible. For this purpose the initial and final positions of the stroke of the shuttle plate 95, as well as its relative position with respect to the end of the guide plates 13a and 13b and with respect to the plate 97 is adjusted. The adjustments previously stated are obtained in the preferred embodiment described in this application as is more fully stated below.

The guide plates 13a and 13b are mounted on the U-shaped bracket 124 (see FIG. 27). The bracket 124 is mounted on the step 125 in the pocket 126 cut into plate 53 (see FIGS. 26, 27, and 28). The slots 127 are cut into the plate 53 and studs 128 are passed through the slots 127. The studs 130 pass through slots 129 positioned in the mounting lug 131 attached to guide plate 13a and pass at right angles to the studs 128.

By moving the plate 13a right or left (see FIGS. 27 and 28), through adjustment of studs 130, the relative position of the guide plate 13a may be adjusted with respect to the guide plate 13b to permit the feeding of various diameter screws down the guide 12.

The relative position of the ends of the guide plates 13a and 13b with respect to the shuttle plate 95 may also be adjusted by means of the slots 127 and studs 128.

The insertion of the shuttle plate 95 into the socket 91 and the screw retainer plate 97 (see FIG. 14) has been described previously. The plate 95 is chosen of the proper thickness and width and the plate 97 is of the proper dimensions to fit into the receiving grooves and pockets as described above. They are of the dimensions to conform to the screw diameter, head diameter and height so that the screws may take the positions shown in FIGS. 19, 21, and 23. The head of the screw in moving through the various positions passes over the coplanar surfaces formed by the sides of the ends of the guide plates 13a and 13b and the ends of the shuttle when it is in the position shown in FIG. 23 and over the side of the shuttle plate 95 and over the end of the screw retainer plate 97, and the shank of the screw moves between the ends of the guide plates 13a and 13b and screw retainer plate as the screw moves through its various positions as shown in FIGS. 21, 23, and 25.

A further adjustment of the relative position of the ends of the guide plates 13a and 13b with respect to the shuttle plate 95 is provided by the eccentrics 100 and 101 on the shaft 99. By loosening screws 73' (FIG. 16) and turning rod 99, the eccentrics moving in slots 100' in the flange 69 and 101' in the clamping plate, cause the shuttle plate assembly mounted in sleeve 68 to rock in the over-size bores 71a and 71b (see FIG. 14). This adjustment moves the shuttle plate and the screw retainer plate to or away from the ends of the guide plates 13a and 13b. This adjusts the spacing between the ends of the guide plates 13a and 13b and the face of the screw retainer plate to the dimension proper to receive and pass the screw (see FIG. 21) and to permit the shuttle plate to slide between the end of the guide plates and the top surface of the screw retainer plate 97 (see FIG. 21).

The adjustments previously described does not affect the position of the escapement hook 108. The rod 102 to which the hook is attached passes through a notch in the flange 69 (see FIG. 13) and thus is not affected by the rocking of the sleeve 68.

To adjust the position of the hook 108 so that it will engage the head of the screw when moved to the position of FIGS. 19, 21 and 25, the hook is adjusted on the screw 109 passing through the slot 115 in hook 109 into and out of the rod 102, numeral 131 being a guiding shoulder for the hook, formed by notch 107.

The stroke of the shuttle and the escapement hook and the terminal positions at both ends of these strokes are adjusted as will be described below.

The shuttle actuating plate 84 carries an extension 132 in which is mounted an adjustment screw 133 which limits the travel of the shuttle actuating plate 84 by contact of screw 133 with flange 69, as will be seen from FIGS. 12 and 22 and thus the amount of advance of the shuttle to the charging position as will be seen from FIG. 23. The forwardmost retracted position of the shuttle plate 95 (see FIGS. 18 and 19) is controlled by the stroke of the fork 66 and the position of the fulcrum 61.

The stroke of the fork is determined by the lever ratio of 60 and by the design of the cam 57 as will be understood by those skilled in this art. The position of the fulcrum pin 61 is adjusted by adjusting screws 64 and 65 which move the block 62 in the bracket 63 and thus the position of the fulcrum pin.

The stroke of the escapement actuating rod and the position of the terminal of its stroke is determined by the position of the stop nut 105 from the plate 52 which determines the terminus of its travel towards the guide 12 (see FIGS. 12, 18 and 19). The terminus of its travel away from the guide 12 (see FIGS. 22 and 23) is determined by adjusting screw 120 which determines the angular deflection of the lever 118 in traveling from the position of FIG. 20 to the position of FIG. 22. Thus the connection formed of pin 104 and slot 118 acts as a free floating loose pivotal connection during the travel of the lever 118 until the end of the screw 120 abuts on pin 119. Thereafter the connection between the plate 84 and the rod 102 is a positive connection, the lever 118 hinging on hinge 117, pivoting at the end of screw 120 and the resultant angular motion of the lever 118 is transformed into a rectilinear motion of the rod 102 by means of the slot 118 and pin 104 without binding. The position of the hook with respect to the guide plate 13a is made adjustable by means of the adjusting nut 195 mounted on the threaded portion of 102. This adjustment complements the adjustment of the hook in notch 107 to position the hook for engagement of the screw size to conform to the adjustment of the guideway as described above.

It will be observed that the angular position of the lever 118 at which the connection is transformed from a free floating connection to a positive connection is determined by adjustment of the length of the screw 120 which protrudes through the shuttle actuating plate 84. This therefore adjusts the period of travel of the rod 67 during which the rod 102 is at rest. This determines the stroke of the rod 102 away from the guide 12 which connects the lever 118 to the sleeve 68.

While I have described a preferred embodiment of my
invention for purposes of illustration thereof, it is to be understood that various modifications and adaptations thereof may be made within the spirit of the invention as set forth in the appended claims.

I claim:

1. An escapement and shuttle mechanism suitable for feeding screws, which comprises a guideway adapted to receive and guide screws to a filling station, a screw retainer plate positioned at said filling station and spaced from the end of said guideway, a shuttle plate positioned for reciprocating movement between said screw retainer plate and the end of said guideway, an escapement member positioned at said guideway and spaced from the end of said guideway, a shuttle plate actuating rod connected to said shuttle plate, an escapement actuating rod connected to said escapement member, means for reciprocating said shuttle plate actuating rod, means for reciprocating said escapement actuating rod, said last mentioned means including a free floating lever connection between said shuttle plate actuating rod and said escapement actuating rod, means for transforming said free floating lever connection into a positive motion connection between said rods, said last mentioned means including an abutment means causing pivotal motion of said free floating lever connection on said abutment means after advance of said shuttle plate past the end of said guideway, said pivotal motion of said free floating lever connection on said abutment means taking place during continued advance of said shuttle plate, and in a direction to retract said escapement member away from said guideway.

2. In the mechanism of claim 1, said free floating lever connection comprising a lever hingedly mounted on said shuttle plate actuating rod, a loose pivotal connection between said last named lever and said escapement actuating rod, said last named lever pivoting angularly on said shuttle plate actuating rod on reciprocation thereof.

3. In the mechanism of claim 1, said means for transforming said free floating lever connection into a positive motion connection between said rods including an adjustable screw mounted on said lever, said abutment comprising a fixed pin mounted adjacent to said screw, said screw contacting said pin on a predetermined amount of angular pivotal movement of said lever after advance of said shuttle plate past the end of said guideway, producing a positive motion connection between said rods on continued movement of said lever, to retract said escapement member away from said guideway.

4. In the mechanism of claim 1, means for adjusting the position of the ends of the reciprocatory travel of said shuttle plate actuating rod and means for adjusting the position of the ends of the reciprocatory travel of said escapement actuating rod.

5. In the mechanism of claim 1, said guideway comprising a pair of spaced guide plates, a bracket mounting said guide plates, a mounting lug on one of said guide plates, slots in said lug, adjustable studs passing through said slots and engaging said lug and said bracket, said slots being oversized with respect to said studs and permitting movement of said lug on adjustment of said studs for changing the relative position of said one of said guide plates with respect to the other guide plate, and means for adjusting the spacing of said screw retainer plate from the ends of said guide plates.

6. In the mechanism of claim 1, said reciprocating means for said shuttle plate actuating rod comprising a sleeve, a motion transmitting connection between said sleeve and shuttle plate actuating rod and reciprocally mounted in said sleeve, a spring mounted in said sleeve, a motion transmitting connection between said shuttle plate actuating rod and said spring, means for supporting said sleeve, a cam, a cam follower for said cam, a lever connected to said cam follower at one end of said lever, motion transmitting means between the other end of said lever and said shuttle actuating rod, a pivot for said last named lever intermediate the ends of said lever.

7. In the mechanism of claim 1, said guideway comprising a pair of spaced guide plates, means for adjusting the spacing between said guide plates and means for adjusting the spacing of said screw retainer plate from the ends of said guide plates.

8. In the mechanism of claim 7, means for supporting said pivot and means for adjusting the position of said pivot on said supporting means.

9. In the mechanism of claim 7, said guideway comprising a pair of spaced guide plates, means for adjusting the spacing between said guide plates and means for adjusting the spacing of said screw retainer plate from the ends of said guide plates.

10. In the mechanism of claim 7, means for positioning said screw retainer plate in said sleeve at one end thereof of adjacent said guideway and spaced from the end of said guideway, means for removably positioning said shuttle plate at the end of said shuttle plate actuating rod between said screw retainer plate and the end of said guideway.

11. An escapement and shuttle mechanism suitable for feeding screws which comprises a guideway adapted to receive and guide screws to a filling station, a sleeve, means for supporting said sleeve, with one end of said sleeve adjacent said filling station, means for positioning a screw retaining plate at said one end of said sleeve and spaced from the end of said guideway, a rod reciprocally mounted in said sleeve, a shuttle plate removably mounted at one end of said rod adjacent said first mentioned end of said sleeve between the end of said guideway and said screw retainer plate, an escapement member positioned at said guideway and adapted to arrest the motion of screws in said guideway, an escapement actuating rod connected to said escapement member, means for reciprocably mounting said escapement actuating rod, means to reciprocate said shuttle plate actuating rod, a free floating lever connection between said rods and means for transforming said free floating lever connection into a positive motion connection, said last mentioned means comprising a stop member and a fixed shutter, said stop member being mounted on said free floating lever, said stop member being normally spaced from said abutment but engageable therewith on oscillation of said free floating lever toward said abutment, said stop member engaging said abutment after advance of said shuttle plate past the end of said guideway, said shuttle plate actuated said shuttle actuating rod past the end of said guideway, said free floating lever pivoting on said abutment during continued advance of said shuttle plate, and in a direction to retract said escapement member away from said guideway.

12. In the mechanism of claim 11, means for adjusting the ends of the reciprocatory travel of said shuttle plate actuating rod and means for adjusting the position of the ends of the reciprocatory travel of said escapement actuating rod.

13. In the mechanism of claim 11, said means for reciprocating said shuttle plate actuating rod comprising a spring mounted in said sleeve and a motion transmitting connection between said spring and shuttle plate actuating rod, a cam, a cam follower for said cam, a lever connected to said cam follower at one end of said lever, a shuttle actuating plate mounted on said shuttle plate actuating rod, a motion transmitting means between the other end of said lever and said shuttle actuating plate, a pivot for said last named lever intermediate the ends of said lever, said free floating lever being hingedly mounted on said shuttle actuating plate, a loose pivotal connection between said last named lever and said escapement actuating rod, said last named lever pivoting angularly on said shuttle actuating plate on reciprocation thereof, a stop connected to said shuttle actuating plate, a fixed plate, said stop contacting said fixed plate to arrest the angular motion of said free floating lever at a predetermined point in the travel of said shuttle plate actuating rod, said free floating lever pivoting on said abutment during continued advance of said shuttle plate, said
free floating lever retracting said escapement actuating rod and said escapement member during pivotal motion of said last mentioned lever on said abutment.

14. In the mechanism of claim 13, wherein said loose pivotal connection is a pin and slot connection, said stop member mounted on said free floating lever is an adjustable screw and said abutment is a fixed pin, the end of said screw contacting and pivoting on the end of said pin after said advance of said shuttle plate past the end of said guideway.

15. An escapement and shuttle mechanism suitable for feeding screws which comprises a guideway adapted to receive and guide screws to a filling station, a sleeve, means for supporting said sleeve, with one end of said sleeve adjacent said filling station, means for positioning a screw retaining plate at said one end of said sleeve and spaced from the end of said guideway, a rod reciprocably mounted in said sleeve, a shuttle plate removably mounted at one end of said rod adjacent said first mentioned end of said sleeve between the end of said guideway and said screw retaining plate, an adjustable escapement hook positioned at said guideway and adapted to arrest the motion of screws in said guideway, an escapement actuating rod connected to said adjustable escapement hook, means for reciprocably mounting said escapement actuating rod, a spring mounted in said sleeve and a motion transmitting connection between said spring and shuttle plate actuating rod, a second spring, a motion transmitting connection between said second spring and said escapement actuating rod, a cam, a cam follower for said cam, a lever connected to said cam follower at one end of said lever, an actuating plate mounted at the other end of said shuttle plate actuating rod, the other end of said lever being in motion transmitting engagement with said actuating plate, a pivot for said last named lever intermediate the ends of said lever, a second lever hingedly mounted on said actuating rod, a loose pivotal connection between said last named lever and said escapement actuating rod, said last named lever pivoting angularly on said shuttle plate actuating rod and said actuating plate on reciprocation of said plate and last named rod, a stop mounted on said actuating plate, a fixed member, said stop adapted to abut said fixed member to arrest the motion of said shuttle plate actuating rod, an adjustable stop screw on said second lever intermediate the ends thereof, a fixed pin, said stop screw being normally spaced from said pin but engageable therewith on angular motion of said second lever toward said pin, said second stop screw engaging said pin after advance of said shuttle plate past the end of said guideway, said second lever pivoting on said pin during advance of said shuttle plate, said second lever retracting said escapement actuating rod and said escapement hook during angular motion of said second lever on said pin.

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