The present invention relates to a multistep, especially two-step, two-step insertion device, for instance, for shears-plateners, which are moved during a first slide stroke by a coupling member from a magazine hopper and are gripped at the end of this slide stroke by a stripper member to be maintained in a ready position, while the slide then during its second slide stroke, driven by means of teeth, feeds the platen from the ready position into a tool, whereby the reciprocating movement of the slide is derived from the upward and downward movement of a machine tappet.

If in a practice feeding movement of a feeding device is derived from the tappet movement of the machine and if further during a comparatively short stroke of the tappet the feeding device must perform a possibly long feeding stroke, the danger exists, that the advancing work pieces, for instance, work pieces to be inserted into a tool for further operation, are not only not reliably gripped at the start of the feeding movement, rather may slide at the end of the feeding movement easily beyond the insertion tool and thus are not properly inserted.

It is therefore, one object of the present invention to provide a multistep, especially a two-step insertion device, in which, on the one hand, the work pieces are reliably gripped a the start of the feeding movement, and, on the other hand, are rather safely inserted into the tool at the end of the feeding movement of these preliminary fed work pieces.

It is another object of the present invention to provide a multistep, especially two-step insertion device, wherein the device includes means for performing the advancing and returning stroke movement of the slide driven by the machine tappet along a straight line corresponding to a sinus-curve and which comprises a driving rod which carries within a cross guide at its driving side end a guide block, the driving rod moving upwardly and downwardly in the same sense as the machine tappet and the driving rod being releasably coupled with the machine tappet by means of a stroke equalization device disposed within the tappet arm.

An axle enters into the guide block at one end while its other end is rotatably mounted in a driver lever which in turn is coupled to a shaft rotatably mounted in a housing wall of a drive box for joint rotation. The shaft carries at the opposite end a transmission member rigidly secured thereto and formed as a notched segment or toothed gear. The transmission member is in mesh with a transmission drive consisting likewise of gears mounted on axles disposed in the housing wall, whereby on the same axle carrying the drive gear a crank is mounted on which a slide drive link engages which is adjustable as to its stroke and the slide is connected with a tipping lever formed as a double-armed lever for an indirect and retarded, respectively, slide movement on the end opposite to the crank. The tipping lever is mounted on an axle disposed crosswise to the longitudinal axis of the slide within a slide receiving- overriding the width of the tipping lever in the direction of its swinging movement. In order to bring about at first control of the slide tongs, the upper free end above the tipping lever formed as a control wedge engages the tong arms with corresponding wedge-shaped counter-control faces provided on the tong arms always prior to the start of the retarded advancing movement caused by the braking of the slide in the direction of gripping of the work piece and prior to the start of the return stroke for the purpose of releasing, that means the freeing of the work piece.

With the practical realization of this concept of the present invention it is made possible that the problem on which the present invention is based can be solved satisfactorily. Due to the fact that it has been brought about by the means of the present invention to obtain a forward and rearward stroke movement, which follows a sinus curve pattern, it is achieved that at the start of the forward stroke, as well as at the start of the idle return stroke once the movement equals zero, which means that at the start of the forward stroke the work piece is safely gripped by the slide tongs, while at the start of the return stroke, due to the temporary standstill of the slide, a satisfactory release of the work piece to the tool for further working can take place. Thus it cannot occur that the work piece fed to the tool does not reach the latter, rather simply slides thereover, since the freeing of the work piece takes place only at the time point, when the slide has reached its standstill caused by the means of the present invention.

Furthermore, the fact that the slide tongs are forcibly controlled contributes to the safe gripping and also to the release of the work pieces and in particular prior to each forward stroke—in the withdrawn position of the slide—the tipping lever which is connected with the slide drive link, is at first subjected to swinging movement and closes over its control wedge the slide tongs, so that the latter can grip the work piece safely. At the start of the return stroke, this tipping lever is tipped again about its bearing axle, whereby the control wedge swings out from its working position and the springs charging the tong arms can become effective in the direction of opening the tongs, so that the tongs open. Only after the tongs are opened, the actual return stroke of the slide takes place.

This effect of the forced control is brought about in connection with a friction brake, so that the slide is not permitted to move immediately upon movement of the slide drive link. The movement is effective upon the tipping lever always at first at the start only, so that the tipping lever can operate as planned. Only after the tipping lever has performed its working function—in the direction of the closing of the tongs—will the slide be moved against the friction force of the brake. Due to the fact that the friction force of the brake is adjustable, the gripping force can likewise be changed, because upon increasing the friction, the slide retardation is increased and the path for gripping the work pieces by closing the tongs is lengthened until finally the friction force is overcome and the slide is moved.

Also the structural arrangement of the stroke equalization device disposed on the slide is of importance for a safe function of the insertion device. Since, namely under circumstances the drive stroke of the tappet can be greater than that of the driving rod, which cooperates with stroke-limiting abutments, the remaining portion of the tappet stroke which cannot be taken up may or cannot be transmitted any more by the driving rod must be taken up by a spring disposed within a bearing housing arranged adjustable as to its height in the tappet arm. This overrun of the tappet stroke is also required for the necessary standstill of the slide at the start of the forward stroke and at the start of the return stroke.

For simplification of the mounting and for a better handling of this device, it is also of importance that the stroke equalization device disposed on the tappet side is
released耦合 with the driving rod disposed on the slide side, which arrangement is brought about such that the driving rod has a set-off coupling head at its end on the coupling side, while the end of the coupling rod on the coupling side is correspondingly recessed likewise in a set-off manner. By simple sliding into each other of both parts the coupling is brought about. This type of connection is also of advantage for balancing out the assembly tolerances.

The limit of the drive stroke of the driving rod is chosen suitably such that in connection with the transmission gear between the drive and the crank a rotary swinging angle of about 180° is formed and that for obtaining a forward movement following a sinus-shaped curve in a path-time diagram in both end positions of the crank, the longitudinal axis of the crank, as well as the longitudinal axis of the slide drive link are disposed in one vanishing plane parallel to the axis of the forward stroke of the slide.

Also the stroke length of the slide can be adjusted in this insertion device by adjusting the crank lever of the crank on its rotary axis crosswise to its longitudinal axis.

Furthermore, a longitudinal adjustment of the total slide device relative to the tool can be performed without any difficulty, whereby for the length of balancing, the slide drive link has at its end on the side of the coupling a longitudinal slot through which a crank pin, securable in the longitudinal slot, extends. All these setting and adjustment positions are of importance not to be underestimated as to the technique of mounting, as well as to the performance of a safe function of the device.

In order to retain now temporarily the work pieces to be transported safely at the level of the slide tongs, supporting plates are provided, which are swingable towards the slide center and which are controlled by the slide itself. If the slide is disposed in its returned position, these plates swing by the force of the spring, which biases the plates in opposite directions inwardly and support the work piece falling from the ready position into the open slide tongs as long until the tongs are closed and the advancing slide moves the plates again outwardly.

With these and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is a vertical section of an inserting device attached to a machine;

FIG. 2 is a top plan view of the slide drive, partly in section;

FIG. 3 is a top plan view of the slide device;

FIG. 4 is a fragmentary section of the driving housing, within the range of the mounting of the drive rod;

FIG. 5 is a fragmentary top plan view of the slide tongs with the control wedge of the tipping lever; and

FIG. 6 is a cross-section of the slide within the range of the friction brake.

Referring now to the drawings, and in particular to FIGS. 1 to 3, the insertion device comprises a tappet 10 which is connected with a tappet arm 11, the latter being equipped at its free end with a clamp-like holding device 12, in which a stroke equalization device 13-21 is retained, which is adjustable as to its height.

The stroke equalization device 13-21 comprises a bearing bushing 13 receiving a helical pressure spring 14, which in turn is supported at both ends by a pressure disk 15 and 16, respectively, which is axially movable within the bearing bushing 13. These pressure disks 15 and 16 are secured against axial removal from the bearing bushing 13 by a cup-screw 17 and 18, respectively, which cup-screws 17 and 18 are screwed to the outer face of the bearing bushing 13. A coupling rod 19 extends through the center of the bearing bushing 13 over its entire length and is equipped at its free upper end with a safety means 20. The entire stroke equalization mechanism is movable on this coupling rod 19. The lower free end of the coupling rod 19 has a set-off recess 21. A head 22 of a driving rod 23, whose free end is cut off, is received lockingly through its shape in the set-off recess 21 of the coupling rod 19, which driving rod 23 is joined with the tappet movement in the same direction. This driving rod 23 enters a gear box 24 and has a cross-guide 25 for reception of a guide block 26. One end of an axle 27 enters the guide block 26, the other end of which is received rotatably by a coupling lever 28, which in turn is coupled for joint movement with a shaft 29. The latter is rotatably mounted in a bearing housing wall 30 and carries at its lower end a transmission member 31 formed as a toothed gear segment or as a toothed gear, which is thus rigidly connected. This transmission member 31 engages an intermediate gear 32, which is mounted on an axle 33 retained in the housing wall 30. This intermediate gear 32 is in operative engagement with an output gear 34 which is likewise disposed on an axle 35 mounted in the housing wall 30. The transmission member 31 and the gears 32 and 34 thus form a transmission drive.

On the driving axle 35 is mounted also a crank 36 which is adjustable in crosswise direction to the longitudinal axis of the axle 35. This crank 36 is received in a cross groove 37 disposed at the end face of the axle 35. The crank lever 36 has a longitudinal slot 38 through which securing screw bolts 39 extend and which enter the axle 35. A crank pin 40 disposed on the driving end of the crank 36 enters a coupling break of a slide drive link 42, which coupling break is formed as a longitudinal slot 41 and the crank pin 40 is in the longitudinal slot 41.

This slide drive link 42 in conjunction with a tipping lever 43 and 44 constitutes the connection with the slide 45. In particular, the slide drive link 42 engages a lever arm 43 of the tipping lever 43 and 44 designed as a double-armed lever, which tipping lever 43 and 44 is mounted within the slide 45 on a pivot 46. The slide 45 is recessed in this bearing range beyond the width of the tipping lever 43 and 44 in the direction of the movement of the slide 45, so that the tipping lever 43 and 44, relative to its direction of movement, is mounted with play in this recess. The other lever arm 44 of the tipping lever 43 and 44 is formed as a control wedge and penetrates between the arms 48 and 49 of the slide tongs 13. The control wedge faces 44a of the other lever arm 44 (FIG. 5) cooperate thereby with corresponding wedge-shaped complementary faces 48a and 49a of the tong arms 48 and 49, respectively. If the control wedge 44 at the start of the forward movement is moved in the direction of the arrow (FIG. 4), the tong arms 48 and 49 are operated in the direction of closing by swaying the latter about their bearing points 50 and 51, thereby simultaneously tensioning the springs 52 and 53, which then turn during the movement of the other lever arm 44 opposite to the direction of the arrow shown in FIG. 4, open again the tong arms 48 and 49 at the start of the return stroke movement.

The slide 45 is guided between lateral guide ledges 54 and is continuously braked by means of a friction brake (FIG. 6). The latter comprises a brake block 56, which is supported on the inside on one of the lateral guide ledges 54. The brake force is adjusted by means of a screw 57.

Furthermore, a pair of supporting plates 58 amounts to an element of the structural parts of the slide 45, the plates being oppositely biased by a spring 59 and swingably mounted at the pivots 60. If the slide 45 is disposed in its withdrawn position, these plates 58 swing towards the center of the slide drive 42, the outer face of which is a falling work piece 61. If the latter is gripped by the slide drive 42 and if the slide 45 moves forwardly again, these plates 58 are turned outwardly again by means of the front edges 45a.
of the slide 45, and are thus controlled by the slide 45 itself.

Furthermore, two coupling members 62 are swingably mounted on the slide 45 and are biased by springs 63, whereby these coupling members 62 bring about that during the forward stroke of the slide 45 a work piece 61 is moved out from the magazine hopper 64. A stripper device 65 secures the removed work piece in its ready position.

The operation of the present inserting device is now described in greater detail:

Starting from the position shown in FIG. 1, during the lowering of the tappet 10 of the machine along the stroke equalization device 13-21, the driving rod 23 is moved downwardly, in the direction of the arrow shown in FIG. 4, whereby the drive stroke is limited in the lower position by the abutment 66 (FIG. 4) and in the upper position by the abutment 67 (FIG. 4), since the cross guide 25 cooperates with the abutments 66 and 67. In the downward movement of the driving rod 23, the guided guide block 26 is moved simultaneously, which in turn turns the coupling lever 28 about its axle 27. The coupling lever 28 in turn brings about the movement of the transmission member 31 by means of the shaft 29 and, on the other hand, by the transmission member 31 over the transmission gears 32 and 34. The crank 36 is, thereby, turned likewise, which crank 36 joins the slide drive link 42, so that the latter runs through its rotary swinging angle of 180° (shown in dotted lines in FIG. 1) until the opposite point 68 is reached.

At the start of the pulling movement of the slide drive link 42, the tipping lever 43 and 44 is tipped in the direction of the stroke axis of the slide 45 about its pivot 46, so that the wedge control between the control wedge 44 of the tipping lever 43 and 44 and the arms of the slide tongs 48 and 49 is lifted, with the result that the tongs open in view of the fact that the springs 52 and 53 become effective and the work piece 61 thus can fall into the tool 69. This releasing movement of the tongs takes place still during standstill of the slide 45, thus immediately prior to the return stroke, which starts only upon abutment of the slide 45 during the tipping movement of the tipping lever 43 and 44 with its lever arm 43 on the rear lower edge of the recess 47. Now the slide 45 is returned against the force of the friction brake.

If now the slide 45 has reached its rearward return position, the plates 58 can swing toward the center and can support temporarily the work piece 61 retained in ready position by the stripper device 65. During the lowering of the machine tappet 10, the return stroke of the slide 45 performs as stated above. If now the tappet stroke is greater than the driving stroke of the rod 23, the rest of the stroke of the tappet 10 goes into the spring 14 of the stroke equalization device 13-21.

If now the machine tappet 10 starts its return stroke, the slide 45 is operated in the direction of forward movement by means of the driver mechanism set forth above, until the slide 45 has reached the position shown in FIG. 1.

During the starting phase of the movement of the slide drive wedges 42, the tipping lever 43 and 44 is at first again tipped with the result that the lever arm 44 closes forcibly the tong arms 48 and 49, which grip in turn safely the work piece 61 which is at the present time on the plates 58. If now the tipping movement of the tipping lever 43 and 44 reaches the position in which the lever arm 43 abuts the front side lower edge of the recess 47, the slide 45 is advanced against the force of the friction brake. During this forward stroke another work piece 61 is moved out by the coupling members 62 through the caliper slot of the 64 until the ready position is reached in which the stripping member 65 retains the work piece 61.

Furthermore during the forward movement of the slide 45, the plates 58 swing again outwardly into the position shown in FIG. 3 of the drawings, by means of the forward slide edges 45. If finally the tappet stroke is completely terminated and if the slide 45 is in the position shown in FIG. 1, prior to the already described slide return stroke, the work piece 61 is set down.

It is now understood that the shown and described embodiment of the present invention amounts to merely an example for the realization of the present invention and is not limited thereto, rather within the frame-work of the present invention other embodiments and applications are possible. This relates in particular to the structural arrangement of the means which follow a sinus-shaped pattern of the forward and return movement, as also the two-step insertion device can be used with advantage also in deviation from shears-platen for other work pieces and in particular also there, where it is of essence to obtain with a possibly small driving strip a possibly large forward stroke and where it is also of essence that the work piece is safely gripped and is set down jolt-free in the tool.

1. A multiple, especially two-step insertion device as for shears-platen, comprising a machine tappet, a slide linearly moved by said machine tappet, means causing a reciprocating movement of said slide corresponding with a sinus curve, means for performing an upward and downward movement, respectively, of said machine tappet, said machine tappet having an arm, a driving rod movable upwardly and downwardly, respectively, simultaneously and in the same direction with said machine tappet, a stroke balancing member retained by said arm of said machine tappet and releasably coupling said driving rod with said machine tappet, said driving rod having a cross guide, a guide block carried by said driving rod in said cross guide, an axle, one end of said axle being received in said guide block, a coupling lever receiving rotatably the other end of said axle, a gear box having a housing wall, a shaft rotatably mounted in said housing wall and keyed at one end to said coupling lever, a transmission member secured to the other end of said shaft, a plurality of gears rotatably mounted in said housing wall and operatively engaging said transmission member, a crank operatively connected for joint rotation with the last of said gears, said means causing a reciprocating movement of said slide including a drive link for said slide and mounted on said crank and including means for adjustment of its stroke, a tipping lever having two lever arms connected with said slide drive link at the remote end from said crank and adapted to cause an indirect and retarded movement respectively of said slide, said slide having a recess of a width surpassing the width of said tipping lever, a bearing axle disposed in said slide recess crosswise to the longitudinal axis of said slide and supporting said tipping lever, slide tongs received in said slide, the upper end of said tipping lever having an inclined end face to form a control wedge, said slide tongs having two arms and each of said arms having an inclined face complementary to that of said tipping lever, and said tipping lever cooperating with said arms of said tongs in order to bring about a forced control of said slide tongs prior to the start of the advancing stroke of said slide retarded by a braking action for the