April 26, 1960 L. PÉRAS 2,934,218

AUTOMATIC DEVICE FOR TRANSFERRING WORKPIECES FROM ONE MACHINE-TOOL TO ANOTHER

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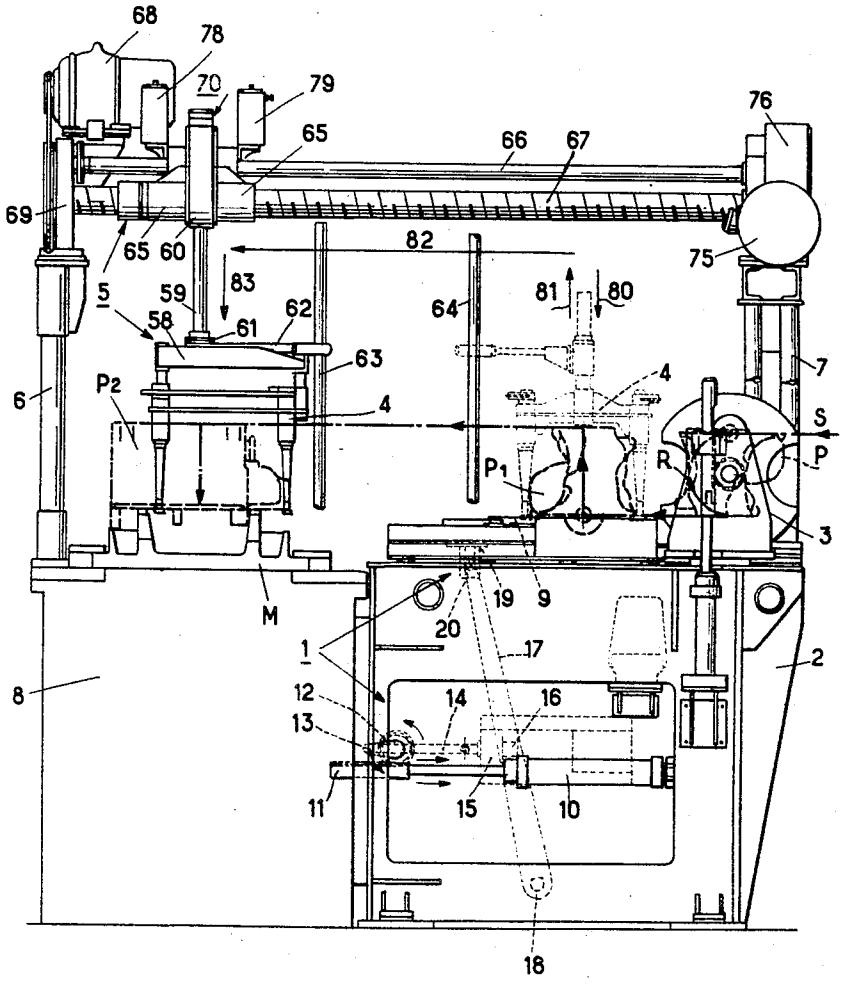
FIG. 1



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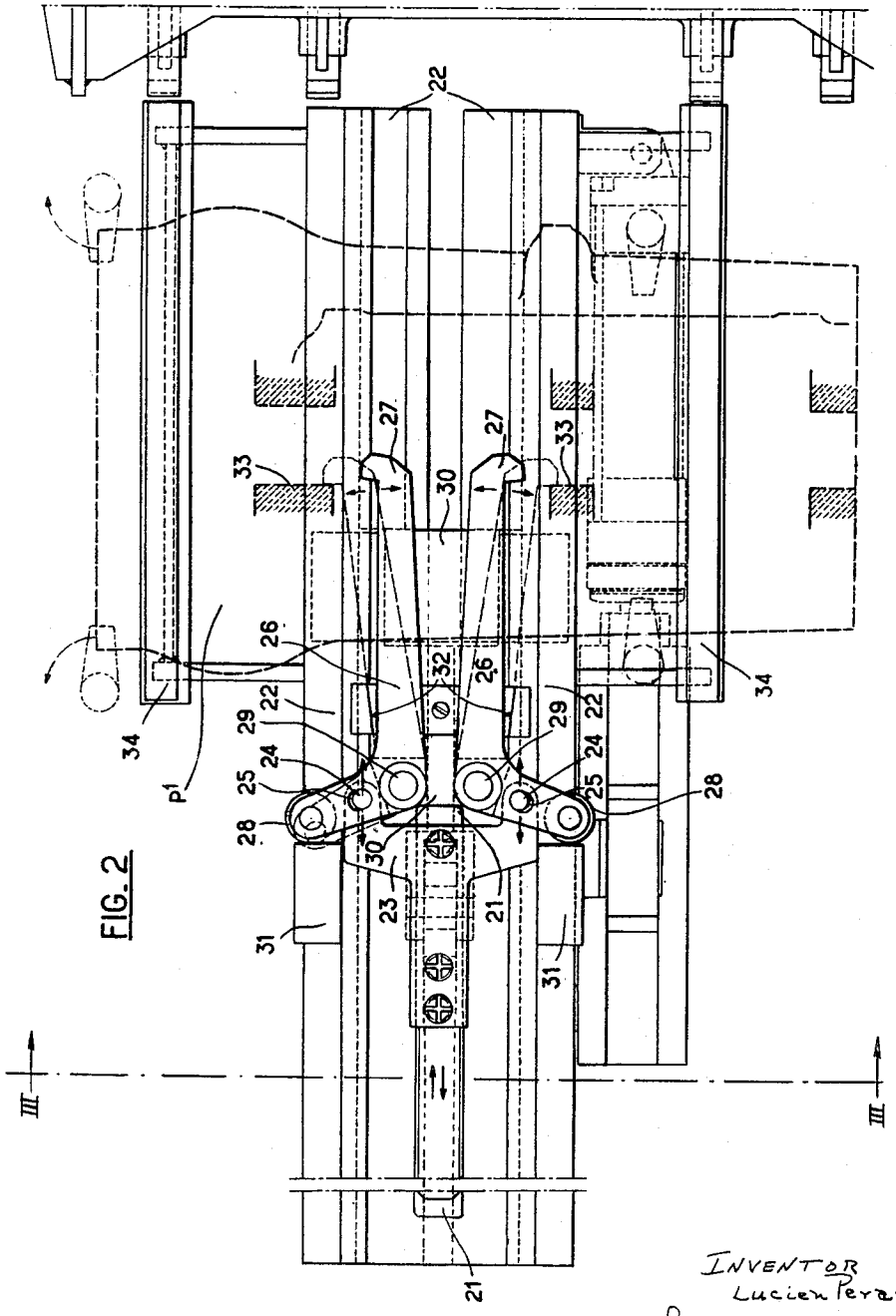

FIG. 2

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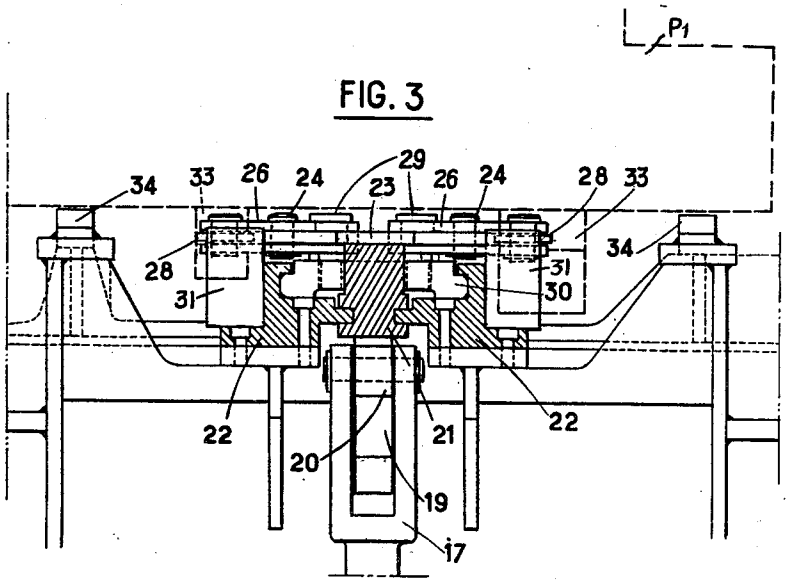
FIG. 3



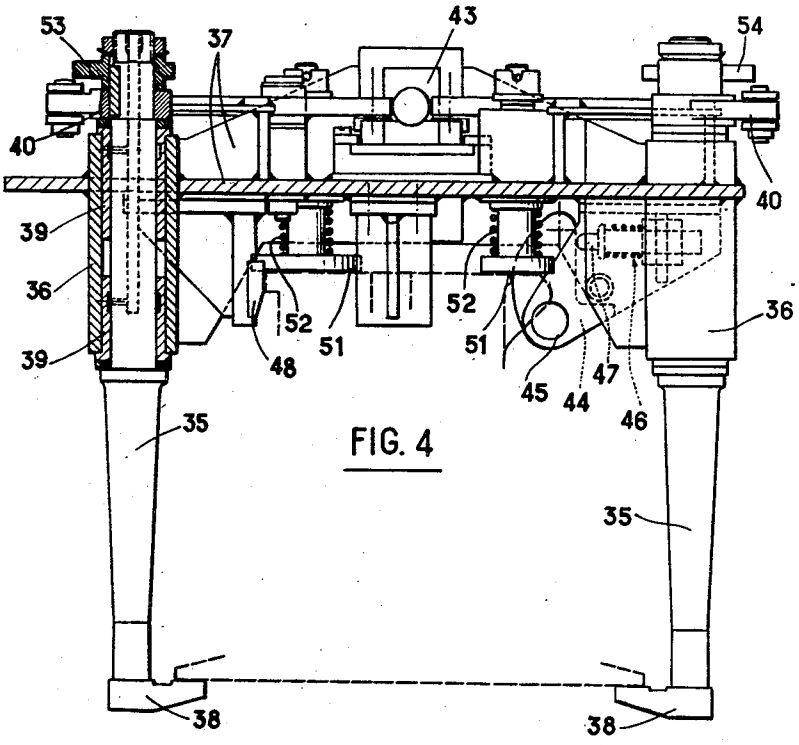


FIG. 4

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AUTOMATIC DEVICE FOR TRANSFERRING WORKPIECES FROM ONE MACHINE-TOOL TO ANOTHER

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FIG. 5

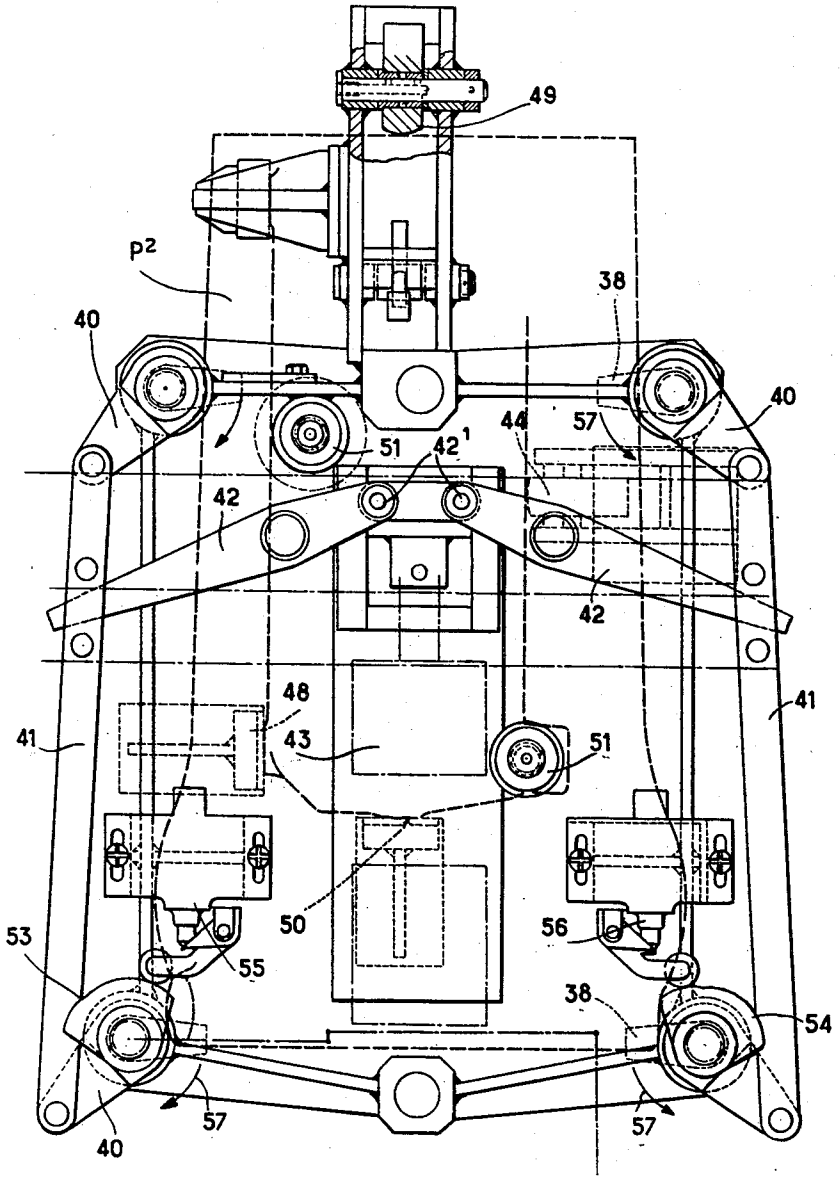

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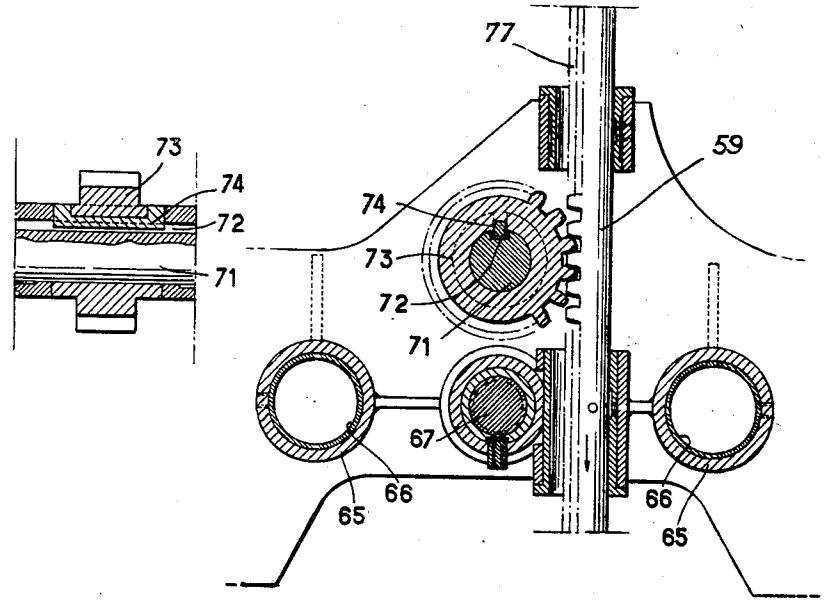
FIG. 6



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United States Patent Office 2,934,218 Patented Apr. 26, 1960

2,934,218

AUTOMATIC DEVICE FOR TRANSFERRING WORKPIECES FROM ONE MACHINE-TOOL TO ANOTHER

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Application June 18, 1957, Serial No. 666,373

Claims priority, application France July 6, 1956

7 Claims. (Cl. 214—1)

This invention relates to an automatic handling device, which is more particularly adapted to transport a workpiece from one machine-tool to another and to deposit the same accurately at the inlet of the new machine, for example on a suitable support which will hereinafter be referred to as a "machining mount," after having suitably directed the workpiece in space around a vertical axis.

Before this operation, the workpiece may in addition be directed around a horizontal axis on leaving the first machine, for example with the aid of a turret device of known type, which arrangement can lead to numerous possibilities of handling.

The device, according to the invention, considered as a whole, is composed essentially of:

A mechanical "tractor" assembly enabling the workpiece to be brought into a determined position by sliding on its horizontal plane of presentation, the said assembly comprising in particular a gripping means having an automatic action and capable of seizing the workpiece and drawing it along, to abandon it in the desired position, under the action of a driving and control mechanism, the moving parts of which perform a guided reciprocating rectilinear movement and are so disposed as to move away from one another, or towards one another, the articulated moving arms of the said gripping means, depending on whether they drive it in one direction or the other, the said rectilinear reciprocating movement being produced by a driving mechanism of suitable type, such as a jack;

A mechanical "transferring-directing" assembly, which comprises in particular a transporting means mounted to be free to rotate around a vertical support shaft and provided with pivoting support arms or stems and means of centering and holding the workpiece, the said vertical support shaft being driven with a movement of horizontal translation by a suitable drive mechanism, which is in addition equipped with a system for raising and lowering the said shaft, a horizontal directing arm rigidly solid with the transporter means and which finally produces, on contact with stops or columns disposed on its path, the desired rotation of the transporter around its vertical support shaft, so that the workpiece is thus deposited at the inlet of the new machine after having undergone a movement of translation accompanied by a rotation in relation to its previous position of presentation.

One embodiment of the invention will now be described by way of example in connection with the handling of an automobile cylinder block between transfer machines.

In the accompanying drawings:

Figure 1 is a view in elevation of the entire arrangement according to the invention;

Figure 2 is a plan view of the automatically operating gripping means;

Figure 3 is a detail cross-sectional view taken on line 3—3 of Figure 2 and showing the mechanism driving and operating the automatic gripping means;

Figure 4 is a detail view in elevation with partial section, of the arm transporter;

Figure 5 is a plan view of the arm transporter;

Figure 6 is a detail view in elevation and partial section of the mechanism for raising and lowering the arm transporter.

Referring to Figure 1, and considering the entire arrangement in its general lines, there is shown the directing device 1, which is carried by a table-shaped frame 2 and is intended to draw the casing P. The latter has previously been directed, in the example considered, at the outlet 8 of the previous machine (not shown), around a horizontal axis by means of a turret device 3 of known type, as shown by the arrow R. The purpose of this tractor device 1 is to bring the casing P into position at P^1, where it will be gripped by the arm transporter 4. In this connection, there is also shown the directing-transferring device 5 which is, supported by two portals 6 and 7 and is intended to transport the casing from its position P^1 to the position P^2 on the machining mount M, which is movable on the frame 8 of the second machine, after having directed the said casing in the desired manner around a vertical axis.

The tractor device 1 comprises in particular an automatic gripping means 9, the driving mechanism of which is housed in the frame 2. This mechanism, which is intended to impart to the gripping means 9 a reciprocating rectilinear movement, is composed of a jack 10 which, through a system comprising a rack 11, pinion 12, eccentric 13, and connecting rod 14, drives a slide 15 in such a manner that the latter is given a movement of which the acceleration and deceleration are sinusoidal functions of the space passed through. The said slide 15 is connected through another slide 16 to the central part of a lever arm 17, one end of which pivots around a fixed axis 18 while the other end is in the form of a fork and is connected to a driving member 19 of the gripping means 9 by a vertically slidable axis 20.

Referring simultaneously to Figures 2 and 3, it is seen that the driving piece 19 is solid with a mobile slide member 21 which is adapted to move horizontally in the fixed guides 22, which are fixed on the table of the frame 2 (Figure 3). In addition, an operating member 23 for the gripping means 9 is fixed to the top part of the mobile slide member 21 (Figure 2).

The said operating member 23 is of open U shape at the end facing the gripping means 9, its branches carrying at their ends two axles 24 engaged with slight clearance in the oval holes 25 in the arms 26 of the said gripping means. Each arm 26 is constituted by a piece of bent shape, of which the larger branch terminates in a gripping snout 27, the shorter branch carrying at its end a roller 28. Each of these arms is in addition articulated at its elbow, with the aid of an axle 29, on a movable slide 30 held by the guides 22. The stops 31 and 32, respectively fixed on the guides 22 and the slide 30, serve to control during operation the movement of rotation of the arms 26 of the gripping means around their axes 29. The end rotational positions of these arms are shown in solid lines and in broken lines in Figure 2, where it can be seen that in the open position of the gripping means the snouts 27 are engaged in the bores 33 of the bearings of the casing P, supported by rails 34.

The transporter 4 is illustrated in detail in Figure 4. It comprises four vertical support arms or stems 35 held in sleeves 36 solid with the frame 37, which also supports the other elements of the transporter mechanism. Each arm 35, provided at its bottom end with a support foot 38, is mounted pivotally in bearings 39 and is keyed at its top part on a crank arm 40. These crank arms 40 are connected together by a system of articulated connecting rods

41 and 42, the rods 42 being in particular articulated on the movable member of a jack 43, intended thus to actuate the four support arms 35 simultaneously.

The frame further carries various elements enabling the casing P to be put into place exactly in the transporter and hold it in this position. A cam 44, having limited rotation and movable around the axis 45, is urged by the spring 46 and the finger 47 against an upper edge of the casing, the opposite face of which is thus pushed onto the fixed stops 48 of the transporter. In the same conditions, another cam 49 which is actuated by a spring (not shown) bears, in a direction of action perpendicular to that of the cam 44, against an upper edge of the casing, the opposite face of which is pushed against the fixed support 50 of the transporter. Moreover, two push members 51 are disposed along a diagonal of the frame for the purpose of balancing their action and are urged by the springs 52 onto the upper face of the casing which they tend to push downward.

Finally, the amplitude of the pivoting movement of the vertical arms 35 is controlled with the aid of two cams 53 and 54 that are keyed on two of them. These cams actuate the contactors 55 and 56, one of which controls the stoppage, on the opening of the support feet (38) (arrow 57) and the other their stoppage on closing (position in Figure 5).

Referring to Figure 1 again, it will be seen that in the transferring-directing device 5 the transporter with arms 4 is fixed rigidly on a cross-member 58, suspended from the shaft 59 of a movable carriage 60 having a horizontal movement. The transporter 4 is made movable with respect to rotation about the vertical shaft 59 by means of a sleeve 61, which is solid with the cross-member 58 and can pivot about said shaft 59. The sleeve carries a fixed arm 62, which controls its rotation when it meets one or other of the columns 63 and 64 during the horizontal movement of translation of the carriage 60.

Said carriage 60 is supported and guided by means of two sleeves 65 which slide on two tubes 66 disposed in one and the same horizontal plane and, as will be readily understood, substantially plumb with the successive positions P^1 and P^2 of the casing.

In addition to the tubes 66, the portals 6 and 7 also support the carriage driving mechanism which comprises essentially a threaded rod 67 disposed parallel to the tubes 66 between the latter and rotated by the motor 68 and a reduction assembly 69. Said rod passes through a nut in the body of the carriage. The nut is fixed against rotation and thus controls the displacement of the carriage to the right or left.

The transferring-directing device 5 (Figure 1) contains a mechanism 70 for raising and lowering the transporter with arms 4, the essential details of said mechanism being shown in Figure 6. Said mechanism 70 comprises a tube 71 which over its entire length has a rectilinear groove 72 and passes through the body of the carriage in the axis of a pinion 73. Said pinion 73 is mounted to be free to rotate in said carriage and carries a key 74 which engages in the groove 72 of the tube 71. In this way it can move with the carriage with which it is solid in respect of sliding along the tube 71, while being solid in respect of rotation with the said tube, which is driven at the appropriate moment by means of a motor 75 and a reduction assembly 76. The pinion 73 further cooperates with a toothed rack 77 mounted to slide vertically in the body of the carriage and solid with the vertical shaft 59. The rotation of said pinion 73 in one or other direction thus determines a raising or lowering movement of the arm transporter 4. Contactors 78 and 79 are shown in Figure 1, and are fixed on the carriage and controlled by fixed cams (not shown) disposed in their path, so as to control the various movements of the carriage.

Finally, other cams and contactors (not shown) are also provided for determining, in accordance with conventional technique, the various synchronized movements of the apparatus considered as a whole, which movements will be clear from the following description of the operation of said apparatus.

The casing P, leaving the first machine according to S, passes into the turret device 3, which causes it to pivot according to R about a horizontal axis (Figure 1). When this operation has been carried out, the gripping means 9 of the tractor device 1 then advances to the right under the action of its drive mechanism, the movement of the previously described elements of said mechanism being indicated by arrows in Figure 1 as from the driving jack 10. It will be seen from Figures 2 and 3 that under the action of the thrust thus transmitted to the driving piece 19, which is guided horizontally by its slide 21, the control part 23 solid with said slide first pushes the small branches of the gripping means 9 to the right through the medium of its spindles 24, the large branches and snouts 27 of said gripping means 9 being brought into the closed position (shown in solid lines). The whole of the gripping means is, as it were, simultaneously pushed to the right with the slide 30 on which it is articulated, until the snouts 27 engage, as shown in solid lines in Figure 2, between the bores 33 of the bearings of the casing P.

As soon as the gripping means 9 has arrived in this extreme right-hand position, the jack performs its opposite stroke intended to return it to the left. In this movement, the control piece 23 first pulls the small branches of the gripping means to the left, forcing said gripping means to open, so that the snouts 27 can hook inside the bores 33 of the bearings of the casing, the opening of the large branches being limited by the stop 32 (arrows and position shown by broken lines in Figures 2).

The gripping means 9, then driven to the left, draws the casing P with it, so as to bring it into its position P^1, where it will be abandoned by the action of the fixed stops 31 disposed at a suitable point on the guides 22 and against which the rollers 28 of the small branches of the gripping means will strike, the snouts 27 of said gripping means thus drawing together while disengaging from the bores 33 of the casing.

The arm transporter 4, which is at this moment immobilised above the casing in position P^1, then descends on to said casing in the direction of the arrow 80, under the action of the raising and lowering mechanism, the motor 75 of which has been started, the shaft 59 being lowered as previously indicated.

In the downward movement of the transporter 4, the cams 44 and 49 coming into contact with the upper edges of the casing first push said casing against the stops 48 and 50, while the push members 51 bear on its upper face. When the transporter has been sufficiently engaged on the casing, the jack 43 comes into operation, causing the arms 35 to pivot by a quarter of a turn so that the support feet 38 are placed beneath the casing, which is thus firmly held in a precise position in the transporter when the latter rises in the direction of the arrow 81, again under the action of the raising and lowering mechanism.

At the end of this stroke 81 of the transferring device, the driving mechanism of the carriage 60 is started, especially the motor 68, which rotates the threaded rod 67 so that the carriage, sliding on the tubes 66, moves to the left with a movement of translation 82. In this movement, the carriage 60 first drives the transporter simply with a movement of translation similar to its own. Then, when the arm 62 meets the column 63 during this displacement, it causes the cross member 58 to rotate, and thus causes the transporter and the casing to rotate, so that they undergo a rotation of a quarter of a revolution about the vertical shaft 59 in addition to the translation 82 in the example in question.

It will readily be seen that it is possible to modify the value of this angle of rotation simply by moving the columns 63 and 64.

At the end of this stroke 82 of the carriage, the trans-

porter, having reached its extreme left-hand position, descends towards the machining mount M awaiting the casing on the second machine (arrow 83), and deposits the casing there on appropriate supports in the position P^2 with a precision permitted by the centering previously obtained in the transporter.

When the casing is supported on its mount M, the jack 43 then actuates the vertical arms 35 in the opposite direction, so as to free the support feet 38 and permit the raising and then movement of translation of the transporter to the right. During this latter movement, the arm 62, meeting the column 64, now imparts a reverse rotation to the transporter 4, which returns to its initial position above the tractor device when the carriage stops in its extreme right-hand position.

The present embodiment has naturally been given by way of example, and it will be seen that it is possible to devise numerous variants within the scope of the invention.

I claim:

1. An automatic handling device for transporting a workpiece having means defining a socket formation, from one machine to another machine, said device comprising a frame having an inlet space and an outlet space with the workpiece entering the inlet space in a movement of translation, a horiozntally disposed, rectilinear guide means, a gripping means slidably mounted thereon, a motor actuated drive means for reciprocating the gripping means, said gripping means including articulated moving arms adapted to fit in the socket formation of the workpiece in a closed position, means disposed on the guide means and cooperating with means on the arms for spreading the arms apart to engage the walls of the socket formation of the workpiece and grip the workpiece so as to move it from the inlet space, a vertical support shaft carried by the frame and disposed adjacent the outlet space in the path of the gripping means, pivoting support stems carried by the shaft and mounted for rotation thereon, means for transferring the workpiece from the gripping means onto the support stems, means for bodily moving the support shaft in a horizontal plane and including means for vertically raising and lowering the support shaft and means operating and controlling the rotational movement of the support stems about the shaft so that the workpiece is deposited at the outlet space after having undergone a movement of translation accompanied by a rotational movement in relation to its position of presentation at the inlet space.

2. A device as claimed in claim 1, wherein a mount is provided for the moving arms and is slidably mounted on the guide means, said moving arms being substantially

L-shaped and having long sections and laterally extending sections, gripping lugs extending from the free ends of the long sections, means pivotally mounting the arms to the mount adjacent the juncture of the sections, stops fixed on the guide means and cooperating with the free ends of the laterally extending sections of the arms to constitute the means for spreading the arms apart.

3. A device as claimed in claim 1, wherein a mount is provided for the moving arms and is slidably mounted on the guide means, said moving arms being substantially L-shaped and having long sections and laterally extending sections, gripping lugs extending from the free ends of the long sections, means pivotally mounting the arms to the mount adjacent the juncture of the sections, stops fixed on the guide means and cooperating with the free ends of the laterally extending sections of the arms to constitute the means for spreading the arms apart, and further stops on the guide means to cooperate with the rollers in moving the arms together into a position of disengagement with the workpiece.

4. A device as claimed in claim 1, wherein said means for transfering the workpiece includes spring urged cams arranged to engage the workpiece when it is released by the moving arms.

5. A device as claimed in claim 1, wherein said support stems are pivotally mounted in cooperating vertical positions and an articulated linkage is provided to move the support stems commonly inwardly and outwardly, said support stems having supporting feet on their lower ends to engage the workpiece.

6. A device as claimed in claim 1, wherein said means for bodily moving the support shaft in a horizontal plane includes a carriage carrying the shaft and having guide means on which it is slidably mounted and a screw rod, cooperating with a nut on the carriage, for moving the carriage.

7. A device as claimed in claim 6, wherein the means for raising and lowering the support shaft includes a pinion mounted for rotation on the carriage and axially engaged by a rotating rod having a rectilinear groove engaged by a key fixed on the pinion.

References Cited in the file of this patent

UNITED STATES PATENTS

604,973	Dinkey	May 31, 1898
710,920	Morgan	Oct. 7, 1902
2,512,333	Jaffa et al.	June 20, 1950
2,638,645	Olson	May 19, 1953
2,799,414	Streckfuss	July 16, 1957