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Aisuta et al.

[11] **3,841,142**

[45] **Oct. 15, 1974**

[54] **METHOD AND APPARATUS FOR SETTING SELF-MOVING BOLSTER IN PRESSES**

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[21] Appl. No.: **262,106**

[52] **U.S. Cl.** **72/448,** 100/DIG. 18

[51] **Int. Cl.** **B21j 13/02**

[58] **Field of Search** ..... 72/448, 427, 344, 345, 72/346; 100/229, DIG. 18

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Primary Examiner—C. W. Lanham
Assistant Examiner—Gene P. Crosby
Attorney, Agent, or Firm—Toren and McGeady

[57] **ABSTRACT**

Self-moving bolster and the related devices used in press machines for pressing steel plates, operate to raise and lower automatically through wheels which are provided in the bolster itself. In order that said bolster can be set at a predetermined position smoothly and firmly in the press room, cooperating abutting members and positioning members are provided on said bolster and on the bed of the press, whereby the entry of said self-moving bolster into the press room of the press, positioning of the bolster therein or the removal of said self-moving bolster from the press room are all performed automatically.

4 Claims, 17 Drawing Figures

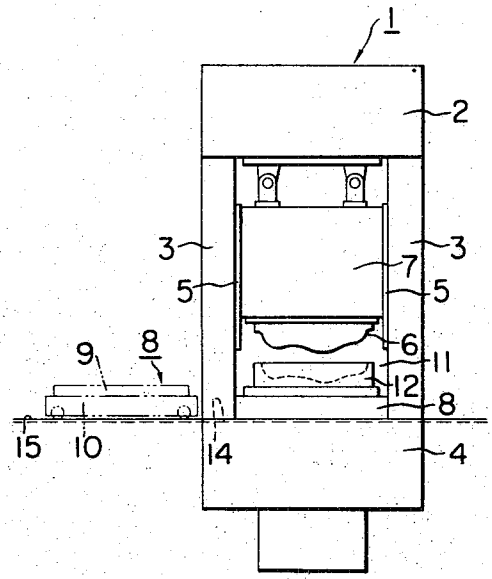


FIG. 1

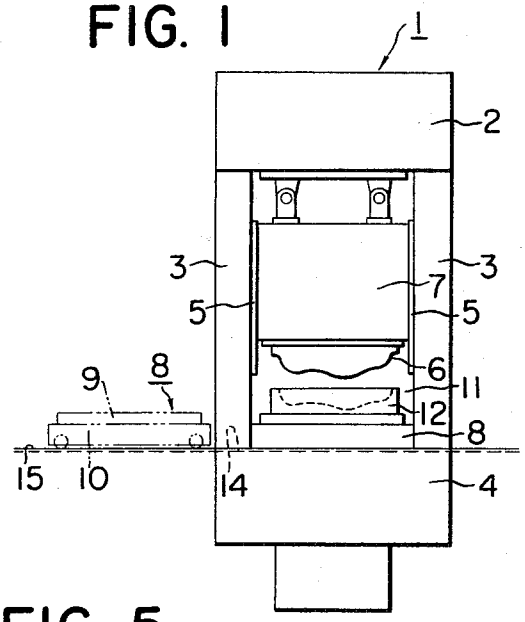


FIG. 2

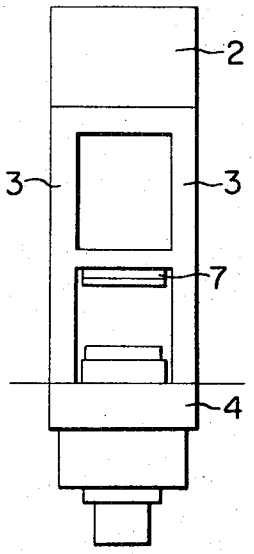


FIG. 5

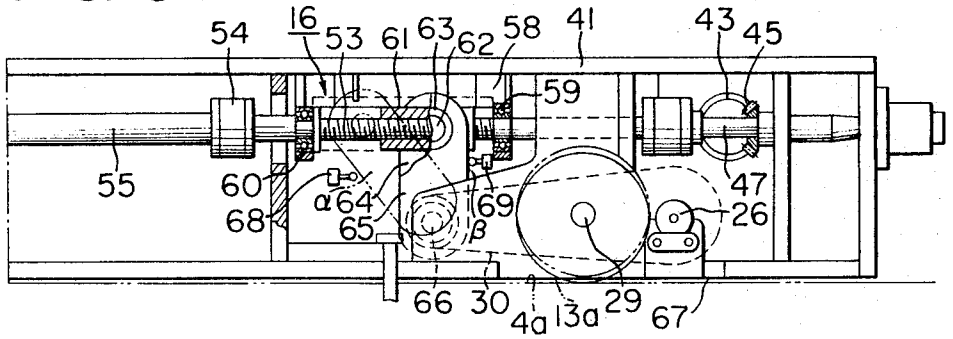


FIG. 6

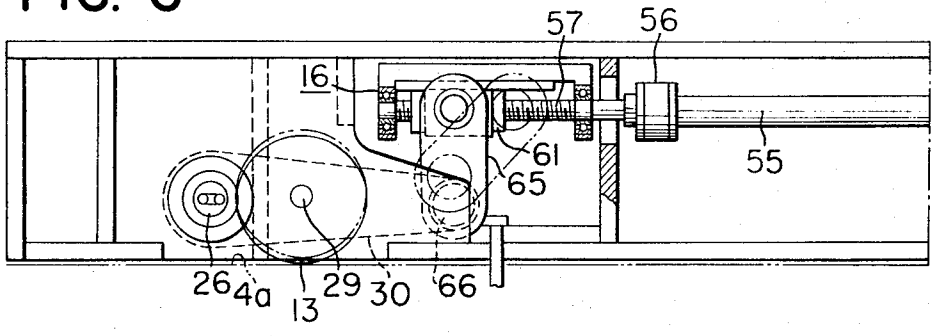


FIG. 4

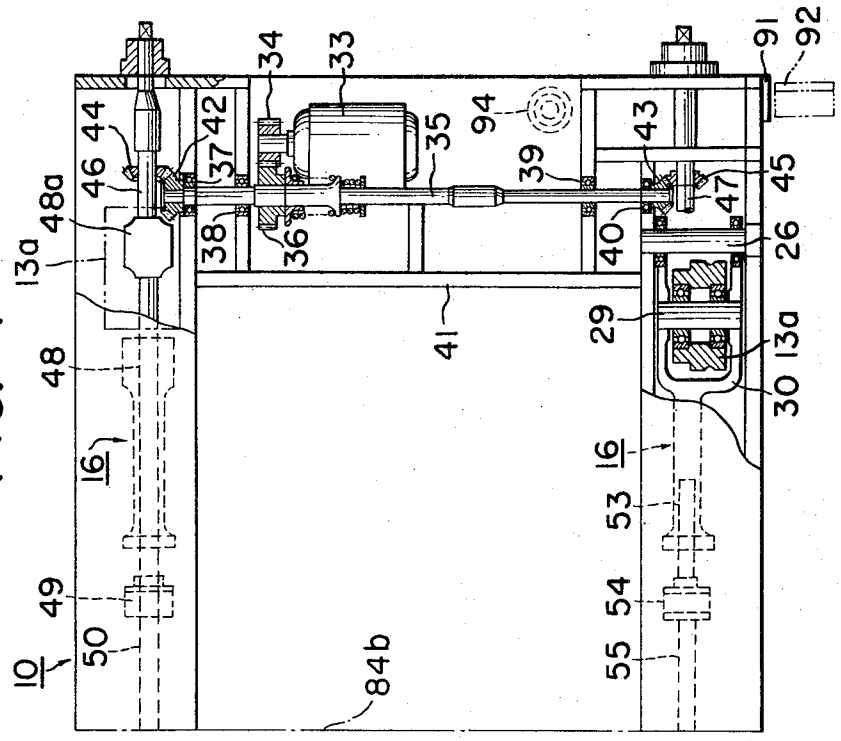

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FIG. 3

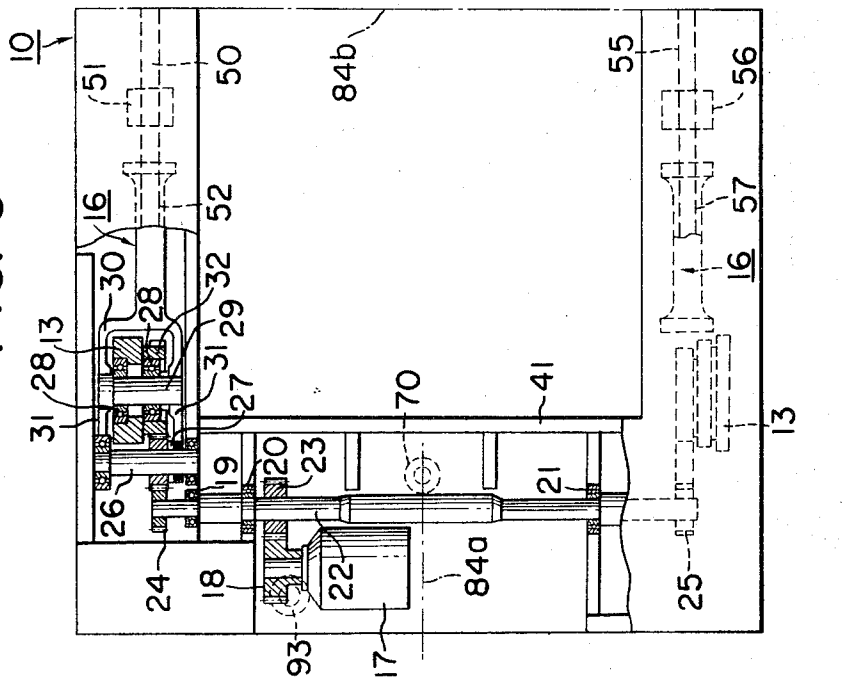

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FIG. 7

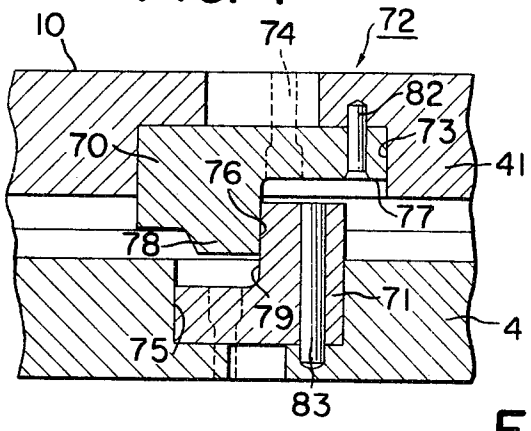


FIG. 8

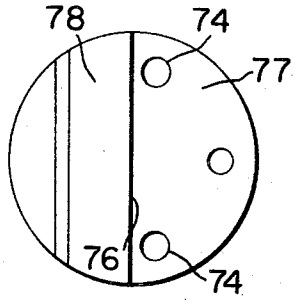


FIG. 9

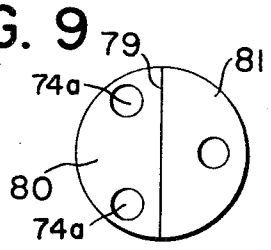


FIG. 10

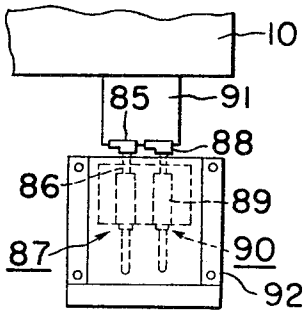


FIG. 11

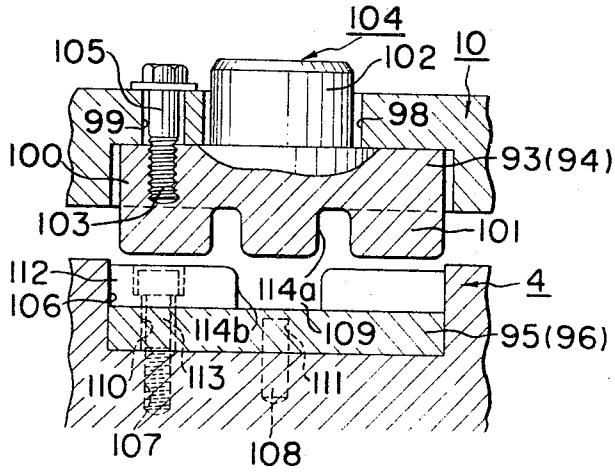


FIG. 12

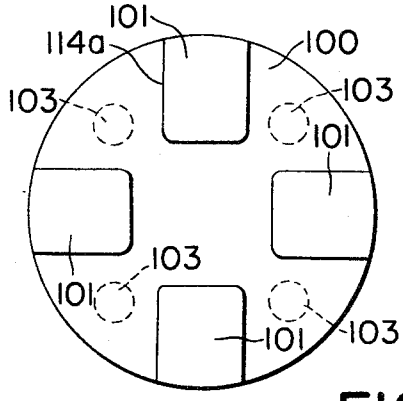


FIG. 13

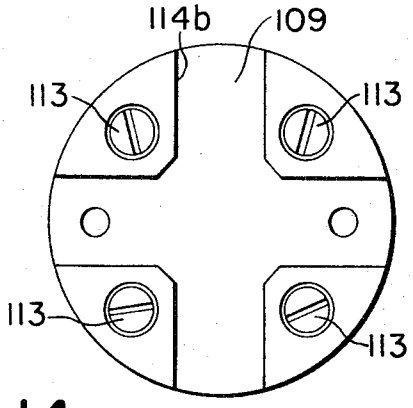


FIG. 14

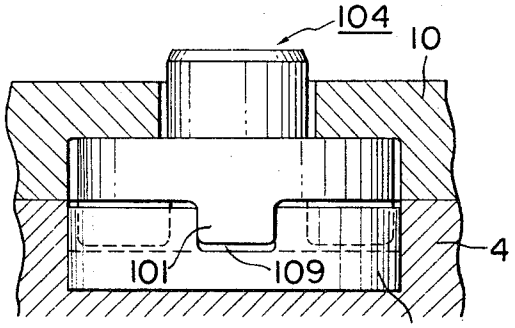


FIG. 15

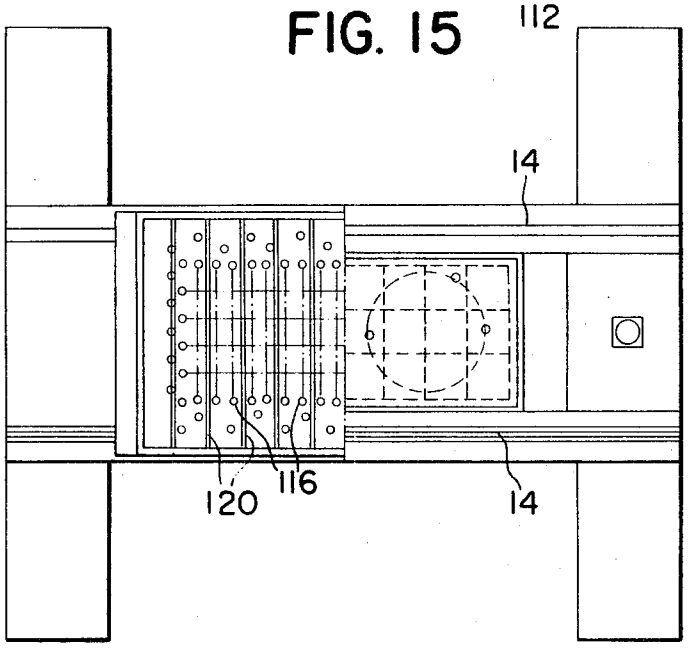


FIG. 16

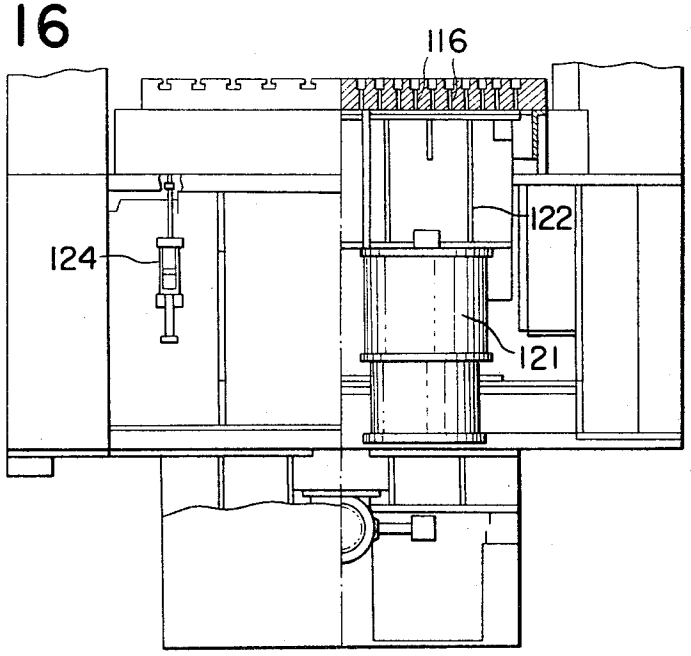
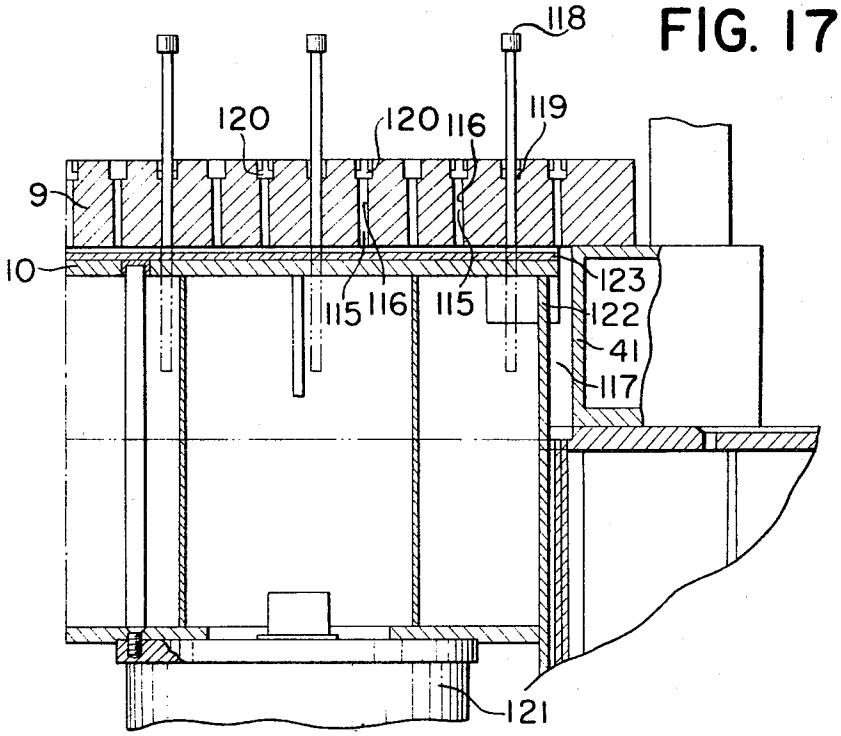

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FIG. 17


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METHOD AND APPARATUS FOR SETTING SELF-MOVING BOLSTER IN PRESSES

BACKGROUND OF THE INVENTION

In a large-sized press machine used for pressing steel plates, it is conventional to use metal dies having a large volume and a heavy weight, so that it is generally difficult and dangerous to carry out the replacement or repair of the die in the press room. Accordingly, a transferrable bolster is used instead of setting said dies (generally consisting of an upper die and a lower die) on a bolster fixed on the bed of the press in the room, whereby said die is carried into and carried out of the press room after being mounted on the transferrable bolster. Thus, when the die is to be replaced, the die is carried out of the press room while it is still mounted on the transferrable bolster, and the replacement or repair of the die is carried out outside of the press room.

Such a moving bolster is found to be very convenient especially for large-sized presses.

However, the moving bolsters which have been used have wheels, which are made to run on rails, and the bolster is made to stop by abutting a part of the bolster against a stopper provided on the bed in the press room, or by abutting the wheel against a stopper, after which the bolster is lowered by means of a lift mechanism located just below the wheels, and the bolster is set at a predetermined position by being clamped.

In such a case, it is difficult to stop the bolster at a predetermined position due to a reaction etc. when the moving bolster is caused to abut against the stopper, and it is also difficult to position the bolster accurately when the bolster is lowered for the positioning, so that some correcting operation is required after lowering.

Another means for positioning a moving bolster in a press room involves a method in which a fitting hole having a circular section is provided at the bed portion in a press room, and also a columnar projection which is fittable in said fitting hole is provided at the lower surface of the moving bolster. Thus in lowering the moving bolster, said projection is caused to fit into said fitting hole.

However, this is found inconvenient, because a considerable vibration is imparted to the moving bolster when it is positioned merely by means of a fitting hole having a circular section and a columnar projection which is fitted in said fitting hole.

Furthermore, since pressure pins to be inserted into a moving bolster are merely inserted loosely into inserting holes formed in the bolster, when the moving bolster is to be transferred, it is impossible to transfer the moving bolster, and it becomes necessary during each operation to pull out the pressure pins. Furthermore, when the bolster is to be set, it is necessary to put the pressure pins one by one at required positions, which is quite troublesome.

With the present invention, it is possible to execute automatically all the operations of self-moving bolsters by accomodating a motor for moving the self-moving bolster, stopping it at a predetermined position, positioning it at a predetermined position, and raising or lowering the bolster itself, thereby obviating the position correcting operation.

SUMMARY OF THE INVENTION

This invention relates to a method and apparatus for transporting a self-moving bolster used for a press for working steel plates press room, positioning and setting the bolster therein, and removing the bolster from the press room.

The invention provides a self-moving bolster in which said bolster is adapted to lowered by retracting wheels, which are provided in said bolster itself, when the self-moving bolster, which can be transferred on rails by the wheels, is to be set at a predetermined position in the press room.

The invention further provides an abutting member and a positioning member on said bolster, and also an abutting member and a positioning member on the bed in the press room, whereby said bolster is stopped by abutting the abutting member of said bolster against the abutting member provided in the bed, then engaging or fitting the positioning member of the bolster with the positioning member provided on the bed by lowering of said bolster itself, whereby the bolster is set automatically at a correct position in the press room.

The invention is so contrived that said bolster can be transferred with the pressure pins accommodated therein, and no hindrance to the operation is produced thereby.

Additionally, the invention provides a moving bolster and related mechanisms adapted to put the pressure pins, accommodated therein, instantly to a working condition when said moving bolster retracts its wheels and is positioned and set surely and automatically at a predetermined position in the press room in a state without vibration, etc.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a front elevation showing a general view of the present invention,

FIG. **2** is a side elevation showing a general view of the present invention,

FIG. **3** is a plan view of the essential parts at the left half of the carrier of the moving bolster according to the present invention,

FIG. **4** is a plan view of the essential parts showing the right half of said carrier,

FIG. **5** is a side elevation showing a raising and lowering mechanism at the left half portion of said moving bolster,

FIG. **6** is a side elevation showing the raising and lowering mechanism at the right half portion of said moving bolster,

FIG. **7** is a sectional view showing a stopping mechanism of said moving bolster,

FIG. **8** is a bottom view of the abutting member at the side of the moving bolster in FIG. **7**,

FIG. **9** is a plan view of the abutting member at the bed side in FIG. **7**,

FIG. **10** is a plan view showing a mechanism for generating a signal to stop said moving bolster, and a mechanism for generating a signal for operating the raising and lowering mechanism to lower the moving bolster,

FIG. **11** is a sectional view of a mechanism for positioning of said moving bolster,

FIG. **12** is a bottom view of the positioning member at the bolster side in FIG. **11**,

FIG. 13 is a plan view of the positioning member at the bed side in FIG. 11,

FIG. 14 is a sectional view showing a state wherein the positioning member at the bolster side is engaged with the positioning member at the bed side,

FIG. 15 is a plan view showing the relative position of the moving bolster according to the present invention in which the pressure pins are accommodated in the press room,

FIG. 16 is a sectional view showing the relation between the moving bolster set in the press room and a die cushion mechanism provided in the bed, and

FIG. 17 is a detailed view showing the operating mechanism of the pressure pins.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be described referring to the accompanying drawings.

The press machine **1** for press working of steel plates comprises a crown **2**, four uprights **3, 3, . . .**, a bed **4**, a slide **7** which slides up and down along guide members **5, 5, . . .** provided on the uprights **3, 3, . . .** and which is mounted with upper die **6** at the lower portion, and a moving bolster **8** adapted to fix firmly on the bed **4**.

The moving bolster **8** comprises a bolster **9** and a carrier **10** on which said bolster **9** is fixed, and a lower die **12** is fixed at the upper surface of the bolster **9** after the moving bolster **8** is positioned in a press room **11** of the press machine **1**. When it is necessary to carry out a pair of dies, made of an upper die **6** and a lower die **12** for replacement, from the press room **11**, the upper die **6** is mounted on the lower die **12** on the bolster **9**, and the upper die **6** and the lower die **12** are carried out together from the press room **11** by the moving bolster **8**. As shown in FIGS. **3** and **4**, the carrier **10** is provided with wheels **13, 13, 13***a*, **13***a* at four corners.

The wheels **13, 13, . . .** of the carrier **10** can be rolled with respect to rails **14, 14** provided on the bed **4** in the press room **11** and rails **15, 15** provided on the floor at a height equal to that of said rails **14, 14**. The carrier **10** is adapted to be lowered or raised through wheels **13, 13, 13***a*, **13***a* which are provided in the carrier **10** itself.

The running mechanism and the raising and lowering mechanism **16** of the carrier **10** will be described referring to FIGS. **3, 4, 5** and **6**.

In FIG. **3**, a running and driving motor **17** is mounted on the carrier **10**, a gear **18** fixed on a shaft of said motor **17** is engaged with a gear **23** fixed on a rotating shaft **22** extending in both lateral directions of the carrier **10** and supported rotatably by bearings **19, 20, 21**, and each of gears **24** fixed at both ends of a rotating shaft **22** which rotates integrally with the rotation of the gear **23** is engaged with a gear **27** fixed respectively on short shafts **26, 26**.

Next, both ends of an axle **29** supporting the wheels **13, 13, 13a, 13a** through bearings **28, 28** are supported by a bifurcated supporting lever **30**, and the bifurcated ends **31, 31** of said bifurcated supporting lever **30** are fitted and mounted rotatably to both ends of said short shaft **26**, and each of the gears **32** fixed on the wheels **13, 13** is engaged with said gear **27**.

Accordingly, when the motor **17** is operated, the rotating shaft **22** is rotated by the engagement of the gear **18** and the gear **23**, and the wheels **13, 13, . . .** are rotated respectively by the engagement of the gear **24** fixed on the rotating shaft **22** with the gear **27**, and the engagement of the gear with the gear **32**.

With this running mechanism, the moving bolster **8**, that is, the carrier **10** mounted with the bolster **9**, can be moved on the rails **14, 15** by wheels **13, 13, . . .**.

Next, the raising and lowering mechanism **16** of the carrier **8** is explained.

In FIG. **4**, the carrier **10** is provided with a motor **33** for operating the raising and lowering mechanism, and a gear **34** fixed on the shaft of this motor **33** is engaged with a gear **36** fixed on a rotating shaft **35** extending in both directions of the carrier **10**.

The rotating shaft **35** is rotatably supported on a frame **41** of the carrier **10** by means of bearings **37, 38, 39, 40**, and each of bevel gears **42, 43** are fixed at both ends of the rotating shaft **35**. The bevel gears **42, 43** are engaged with corresponding bevel gears **44, 45**, respectively, and the bevel gears **44, 45** are fixed on the respective rotating shafts **46, 47** extending in a longitudinal direction of the carrier **10**. The rotating shaft **46** rotates a threaded shaft **48** integrally through a coupling **48**a, and further rotates a transmission shaft **50** through a coupling **49**, the transmission shaft **50** being further so arranged that it rotates a threaded shaft **52** shown in FIG. **3** through a coupling **51**. The rotating shaft **47** is also connected integrally with a threaded shaft **53** through a coupling (not shown), and further connected with a transmission shaft **55** through a coupling **54**, and is so arranged that it rotates a threaded shaft **57** through a coupling **56**.

The detail of the raising and lowering mechanism **16** by the rotation of said threaded shafts **52, 53, 57** will be described referring to FIGS. **5** and **6**.

In FIG. **5**, the threaded shaft **53** is rotatably supported at both its ends on a supporting member **58** having a channel-shape fixed on the frame **41** of the carrier **10** through bearings **59, 60**. The threaded shaft **53** is engaged with an internally threaded transfer piece **61**. On the shaft portions **62, 62** projecting on both sides of the transfer piece **61**, there are pivoted the upper portions of the links **64, 65** through bearings **63**, and the links **64, 65** are pivoted by their lower ends on the base portion of the bifurcated supporting member **30** through a short shaft **66**, respectively.

Accordingly, when the threaded shaft **53** is rotated, the transfer piece **61** moves along the threaded shaft **53** led by the external thread of the threaded shaft **53**, and the transfer piece **61** reciprocates forwardly and backwardly with the positive and negative rotation of the threaded shaft **53**.

The wheels **13, 13, 13a, 13a** are mounted on the axle **29**, both ends of which are fixed on the bifurcated supporting members **31, 31** through the bearings **32, 32**. Since the end portions of the bifurcated member **31, 31** are pivoted on the shaft **26**, the transfer piece **61** moves along the threaded shaft **53**, and as the links **64, 65** change their positions from the inclined state (α) to the upright state (β), the bifurcated supporting member **30** rotates in a counter-clockwise direction with the shaft **26** as the fulcrum by the short shaft **66** on which the end portion of the bifurcated supporting member **30** and the links **64, 65** are pivoted. When the links **64, 65** are in the vertical position (β), the lowermost external periphery of the axle **13a** supported by the bifurcated supporting member **30** exposes itself downwardly

below the lowermost surface 67 of the supporting frame 41 of the carrier 10.

As the links 64, 65 incline with the movement of the transfer piece 61, the peripheral, lowermost portion of the wheel 13*a* transfers upwardly from the lowermost surface 67 of the supporting frame 41 of the carrier 10, and the peripheral, lowermost portion of the wheel 13*a* moves into the carrier 10.

In the drawing, the numeral 68 designates a limit switch operated by means of the link 64, for detecting movement of the wheel 13a to above the lowermost surface 67 of the carrier 10, and the numeral 69 designates a limit switch, operated by means of the link 64, for detecting movement of the wheel 13a to below the lowermost surface 67 of the carrier, when the links 64, 65 assume vertical positions.

The raising and lowering mechanism 16 at the side of the threaded shaft 57 which rotates integrally with the threaded shaft 53 through the coupling 54, transmission shaft 55, and the coupling 56, is the same mechanism as, and is symmetrical to the raising and lowering mechanism 16 at the side of the threaded shaft 53 as showm in FIG. 6, and the same symbols refer to the same members.

A stopping mechanism 72 is provided which causes the moving bolster 8 to stop at a predetermined position when it is carried into the press room 11 by means of an abutting member 70 provided on the lower surface of the carrier and an abutting member 71 provided on the upper surface of the bed 4 in the press room 11.

The stopping mechanism 72 will now be explained referring to FIGS. 3, 7 and 9.

First, as shown in FIGS. 7 to 9, the abutting member 70 is fixed by means of fixing bolts 74, 74 at an engaging portion 73 provided at the lower surface of the frame 41 of the carrier 10, and the abutting member 71 is fixed by means of fixing bolts 74*a*, 74*a* at an engaging portion 75 provided on the bed 4 in the press room 11. The abutting member 70 has a plane, circular form as shown in FIG. 8, and is provided with a diametral, vertical abutting surface 76 at the lower surface thereof, the right half portion from the vertical surface 76 being made as a plane surface 77 which is located upwardly from the lower surface of the frame 41 of the carrier. The left half portion from the vertical surface 76 is formed as a stepped portion 78 projecting downwardly from said plane surface 77.

As shown in FIG. 9, said abutting member 71 presents a plane circular form which is smaller than said abutting member 70, and is provided with a diametral, vertical abutting surface 79 on the upper surface. On the right half portion from this vertical surface 79 there is formed a stepped portion 81 projecting above the plane surface 80 of the left half portion, with the plane surface 80 being located inwardly from the upper surface of the bed 4.

As shown in FIG. 7, said abutting members 70 and 71 are so formed that they contact closely when their abutting vertical surfaces 76, 79 are abutted against one another, and at the same time the lower surface of the stepped portion 78 of the abutting member 76 at the side of the carrier 10, that is, the side of the moving bolster 8, is placed above the upper surface of the bed 4, and the upper surface of the stepped portion 81 of the abutting member 71 at the side of the bed 4 is placed below the lower surface of the frame 41 of the carrier 10.

In the drawings, the numeral 82 designates a positioning knock pin of the abutting member 70 at the side of the carrier 10, and the numeral 83 designates a positioning knock pin of the abutting member 71 at the side of the bed 4.

The abutting member 70 at the side of the carrier 10, that is, the side of the moving bolster 8 is placed at a position shown in FIG. 3, that is, a position to the left of the carrier 10, and is provided, with its center conformed with the longitudinal center line 84*a*. The abutting member 71 at the side of the bed 4 is provided at a position on the bed 4 corresponding to the abutting member 70 at the side of the carrier 10.

As shown in FIG. 10, a stop directing mechanism 87 of the driving motor 17 of the moving bolster is comprised of a dog 85 and a limit switch 86 provided near the upright 3, and an operation directing mechanism 90 for raising and lowering mechanism 16 of the carrier 10 is comprised of a dog 88 provided on the carrier 10 and a limit switch 89 provided near the upright 3.

In this case, said dogs 85, 88 are fixed on an attaching member 91 attached at the lower corner to the right end portion of the carrier 10 as shown in FIG. 4, and the limit switches 86, 89 are fixed on the attaching wall 92 provided near the upright 3 at a predetermined position on the upper surface in the press room 11 of the bed 4.

Furthermore, actuation of the limit switch 86 by the dog 85 to stop the driving motor 17 causes a signal to issue before a predetermined time at which the abutting member 70 at the carrier side abuts the corresponding abutting member 71 at the bed side, whereby the limit switch 89 is operated by the dog 88, and the signal for driving the motor for operating the raising and lowering mechanism of the carrier 10 is so adapted that the signal is issued after a predetermined time since the abutting member 70 of the carrier 10 has been brought into abutment against the abutting member of the bed 4.

Further, as shown in FIGS. 3 and 4, a positioning mechanism is comprised of two cross-shaped engaging projections 93, 94 provided at the lower surface of the carrier 10 and two positioning holes 95, 96 provided on the upper surface of the bed 4. Thus, it is structured by forming a circular recess 97 at the lower surface of the carrier 10, forming inserting holes 99, 99, . . . in said circular recess 97, and opening the lower ends of these bolt-inserting holes 99, 99, . . . into the circular recess 97. A fitting member 104 is separately provided (refer to FIGS. 11, 12) comprising cross-shaped projections 101 extending radially from the center on the lower surface of a flange portion 100, a stem portion 102 formed at the upper portion, and threaded holes 103, 103, . . . in the flange portion 100. The fitting member 104 is fitted into the circular recess 97, the stem portion 102 is inserted into the hole 98, and the bolts 105, 105, . . . inserted into the bolt inserting holes 99, 99, . . . are screwed into the threaded holes 103, 103, . . . and are set firmly so that the plane lower surface of the flange portion 100 is located slightly above the lower surface of the carrier 10, thus forming a cross-shaped engaging projection 93, which is positioned above the longitudinal central line 84*a* to the left of the carrier 10 in the drawing. The cross-shaped engaging projection 94 is entirely the same as the cross-shaped engaging

projection **93**, but the cross-shaped engaging projection **94** is arranged below the longitudinal center line **84**a to the right end, the position of the cross-shaped engaging projection **93, 94** being symmetrical with respect to the transversal central line **84**b and to the longitudinal direction **84***a*.

Referring now FIGS. **11** to **14**, a bottomed circular hole **106** is formed on the upper surface of the bed **4**, and threaded holes **107, 107**, ... are formed on the bottom portion of the bottomed circular hole **106**, with a knock pin **108** being set in position as shown.

A fitting member **112** formed with a cross-shaped groove **109** extending radially from the center on the upper surface is separately provided, formed peripherally with bolt attaching holes **110, 110**, . . . , and formed with knock pin inserting hole **111** on the lower surface. The fitting member **112** is inserted into said bottomed circular hole **106**, the bolts **113, 113**, . . . inserted into the bolt attaching holes **110, 110**, . . . are screwed into the threaded hole **107, 107**, and the knock pin **108** is inserted into the knock pin inserting hole **111** so that the fitting member **112** is firmly set in said bottomed circular hole **106**, and the upper surface of the fitting member **112** is placed slightly below the upper surface of the bed **4**. In this way, the cross-shaped positioning holes **95, 96** are formed which correspond respectively with two cross-shaped engaging projections **93, 94** provided on said carrier **10** and which are respectively made detachable with the engaging projections **93, 94**.

In this case, in order to facilitate the correction of the fitting member **104**, the hole **98** and the stem portion **102**; the bolt inserting hole **99** and the bolt **105**; the circular recess **97** and the flange portion **100**, are all fitted loosely, and the lower edges of the cross-shaped projections **93, 94** and the upper edges of the cross-shaped positioning holes **95, 96** are each chamfered, and each of the respective guide surfaces **114**a, **114**b are particularly formed into straight vertical wall surfaces so that the rectilinear portions bear the load uniformly and lighten the concentrated load disposed thereon. In this example, the form of the cross-shaped engaging projection is varied to have a slight gap between one side of the cross and the other side at the cross portions.

In order that the pressure pins **115, 115**, . . . to be inserted into the bolster **9** mounted on the carrier **10** are not required to be removed at the transfer of the carrier **10**, a construction is adapted so that the pressure pins **115, 115** are transferred without obstruction together with the carrier **10**.

Referring to FIGS. **15** to **17**, a large number of the pressure pin inserting holes **116, 116**, which pass in a checker-board fashion through the upper to the lower surfaces of the bolster **9**, are communicated with a space **117** surrounded by the frame **41** of the carrier. On the upper portion of these pressure pin inserting holes **116, 116**, . . . they are each provided with an annular stepped portion **119** for preventing falling through of the pressure pins **115, 115**, . . . , by suspending the top portion **118** of the pressure pins **115, 115**, . . . to be inserted into the inserting holes **116, 116** . . . , the distance from the upper surface of the bolster **9** to the annular step portion **119** being so set that the lowermost end of the pressure pin **115** inserted into the inserting hole **116** is located above a predetermined distance from the lower surface of the carrier **10**, and at the same time that the upper end of the top portion **118** is located below the upper surface of the bolster **9**.

In the drawing, the numeral **120** designates an inserting groove having a section of inverted-T shape for inserting a mounting bolt (not shown) for fixing the lower die **12** on the upper surface of the bolster **9**.

Accordingly, the upper surface of a wear plate **123**, which is arranged at the upper surface of a die cushion pad **122** fixed at the upper portion of a die cushion cylinder **121**, is located below the upper surface of the bed **4** when the cylinder **121** is situated at the lowermost position, and at this time there is a predetermined space distance between the upper surface of the wear plate **123** and the lowermost end of the pressure pins **115, 115**, . . . inserted respectively into the pressure pin inserting holes **116, 116**. The upper surface of the wear plate **123** abuts against the lower end surface of the pressure pins **115, 115**, . . . due to the raising of the die cushion cylinder **121**, which when raised further, exposes from the upper surface of the bolster **9**, and causes to project therefrom a knock-out bar (not shown) provided on the lower die **12** mounted on the upper surface of the bolster **9** by means of the pressure pin **115**.

In FIG. **16**, the numeral **124** designates a clamping mechanism for tightening the bolster **9** on the bed **4**.

The moving bolster and the related devices according to the present invention are constituted as described above.

Firstly, there will be explained a situation in which the moving bolster **8** situated at a position shown by an imaginary line in FIG. **1** is to be set on the bed **4** in the press room **11** of the press **1**.

The metal dies are replaced outside the press room **11** of the press **1**, and the upper die **6** and the lower die **12** are mounted together on the bolster **9** of the carrier **10**. Pushing a switch (not shown) to operate the driving motor **17** housed in the moving bolster **8**, causes rotation of the wheels **13, 13**, . . . thereby causing movement of the moving bolster on the rails **15, 15**, effecting its transfer onto the rails **14, 14**. When the dog **85** fixed on the carrier **10** abuts the limit switch **86**, the driving motor **17** is stopped, and the moving bolster **8** coasts thereafter and decreases rapidly in its speed. Then the abutting member **70** is provided on the carrier **10** abuts against the corresponding abutting member **71** on the bed **4**, and the moving bolster **8** is stopped. Next, when the dog **88** comes into contact with the limit switch **89**, the operating signal to the raising and lowering mechanism **16** is issued. Until the operating signal is issued, the wheels **13, 13, 13***a*, **13***a* of the carrier **10** expose their peripheral lowermost portions from the lower surface of the frame **41** of the carrier, and maintain the rollable condition on the rails **14, 14**. At this time, the links **64, 65** shown in FIGS. **5** and **6** are in a vertical state, and the links **64, 65** are standing firm and upright to hold the wheels **13, 13, 13***a*, **13***a* in a rollable state between the short shaft **66** and the short shaft **26** through the short shaft **66** and the bifurcated supporting member **30**.

When an operating signal is given to the raising and lowering mechanism **16** of the moving bolster, the driving motor **33** of the raising and lowering mechanism **16** is operated, the threaded shafts **48, 52, 53, 57** are rotated to move the transfer piece **61**, and thereby the links **64, 65** are inclined integrally from the vertical state, and the bifurcated supporting member **30** rotates

slightly in the clockwise direction through the short shaft **66**, with the short shaft **26** as the fulcrum. Thus the peripheral lowermost portions of each of the wheels **13, 13, 13***a*, **13***a* are transferred gradually inwardly from the lower surface of the frame **41** of the carrier **10**, thus resulting in the lowering of the frame **41** itself of the carrier **10**.

In this manner, the carrier **10** is substantially stopped at a predetermined position in the press room **11** by the abutting member **70** preliminarily provided in the carrier **10** and by the abutting member **71** provided in the bed **4** before the commencement of the lowering of the frame **41**, but it is not positioned accurately and completely.

Therefore, in order to attain a correct positioning, the cross-shaped engaging projections **93, 94** on the lower surface of the carrier **10** and the cross-shaped positioning holes **95, 96** set corresponding respectively to said cross-shaped engaging projections **93, 94** provided on the bed **4** are gradually engaged each with other, whereby the position of the moving bolster **8** is corrected, Finally the links **64, 65** are inclined, and the lower surface of the carrier **10** comes into close contact with the upper surface of the bed **4** so that the peripheral lowermost portions of the wheels **13, 13, 13a 13a** sink from the lower surface of the frame **41** of the carrier **10**, and at the same time the engaging projections **93, 94** located at the symmetrical position fit completely into re-adjusting holes **95, 96** respectively, whereby the carrier **10**, that is, the moving bolster **8** is positioned on the bed **4** in the press room **11** automatically and accurately in forward and backward directions as well as to the right and left directions.

In this way, when the lower surface of the frame **41** of the carrier **10** abutted perfectly on the upper surface of the bed **4**, the limit switch **68** is operated by the inclination of the links **64, 65**, causing the motor **33** to stop operating the raising and lowering mechanism, and soon the moving bolster **8** is firmly fixed on bed **4** by a bolster clamping mechanism **124**.

After mounting the upper die **6** on the slide **7** and finishing the positioning of the upper die **6** and the lower die **12**, the press **1** is operated, and by raising a die cushion pad **122** with the operation of a die cushion cylinder **121**, the pressure pins **115, 115, ...** inserted in the inserting holes **116, 116, . . .** of the bolster **9** are raised from the wear plate **123**, and the formed product is ejected after raising the slide **7** when the formation of the steel plate is over due to the lowering of the slide **7** through a knock-out bar (not shown) of the lower die **12**.

Next, when it is desired to transfer the moving bolster **8** outside the press room **11** for the purpose of replacement of the metal dies etc., is pushed a switch (not shown) to issue an order for operation of the raising and lowering mechanism **16**, the motor **33** operates to rotate the threaded shafts **48, 52, 53, 57**, the transfer piece **61** is transferred in a direction opposite to the lowering of the carrier **10** so that the links **64, 65** will take a vertical position from the inclined position, and when the links **64, 65** assume the vertical state, each of the peripheral lowermost portion of the wheels **13, 13, 13***a*, **13***a* becomes exposed from the lower surface of the frame **41** of the carrier **10**, and relative thereto, the frame **41** of the carrier **10** is raised. When the links **64, 65** take a vertical position, the limit switch **69** operates and stops the motor **33**, and the carrier **10** is put in a movable or running state.

Next, when a switch (not shown) is closed to operate the driving motor **17**, and the wheels **13, 13, 13***a*, **13***a* are rolled on the rails **14, 14**, the moving bolster **8** is transferred outside the press room **11**. Then when the end surface of the moving bolster **8** abuts on a stopper (not shown) placed outside the press room **11**, the moving bolster **8** is stopped, and there the replacement of dies can be carried out.

When the moving bolster **8** is transferred, the die cushion pad **122** of the die cushion device is placed below the bed **4**, and the pressure pins **115, 115, . . .** are held suspended from the bolster **9**, with the lowermost end thereof located above the lower surface of the frame **41** of the carrier **10**, so that the transfer is not hindered at all.

The abutting member **70** at the bolster side of the stopping mechanism of the moving mechanism and the abutting member **71** at the side of the bed **4** are so adapted that no hindrance is produced for close contact between the lower surface of the moving bolster and the upper surface of the bed even when the moving bolster is lowered and comes into contact with the bed.

With the moving bolster according to the present invention, the carrier is raised or lowered through wheels, and particularly when the carrier is lowered, the deviation in the right or left direction and distortion are prevented while the position is corrected gradually by the cross-shaped engaging projection provided at the bolster side and the cross-shaped position correcting hole provided at the bed side. Thus it is possible to place the moving bolster automatically on the bed and to set the position correctly both in the directions right and left as well as forward and backward, that it is so efficient, and also it is possible to maintain automatically the transferrable state through the wheels, and the moving bolster can be transferred conveniently without removing the pressure pins which are maintained in place.

What is claimed is:

1. A method for setting a self-moving bolster in a press comprising the steps of advancing said self-moving bolster on rails into a press room of said press; stopping said bolster by abutting an abutting member provided on the lower surface of a carrier for said bolster against an abutting member provided on the upper surface of a bed in said press room; said abutting member of said bolster being provided with a vertical abutting surface and also being provided with a center which conforms with a longitudinal center line of said carrier; with said abutting member of said bed being provided with a vertical abutting surface engageable with said vertical abutting surface of the abutting member of said bolster; actuating a raising and lowering mechanism provided for said bolster in order to lower said bolster by retracting wheels provided on said bolster; and engaging two positioning members, each having a cross-shaped engaging projection and being provided on the lower surface of said bolster with two position holes, each having a cross-shaped groove and being provided on the upper surface of the bed in said press room, one of said positioning members being arranged on one side of the longitudinal center line at one end of said carrier, and the other of said positioning members being arranged on the other side of the longi-

tudinal center line at the other end of said carrier, one of said positioning holes being arranged at a position to engage with one of said positioning members, and the other of said positioning holes being arranged at a position to engage with the other of said positioning members, whereby the bottom portion of said bolster is brought into close contact with the bed in said press room.

2. Apparatus for setting a self-moving bolster by transporting said bolster into and out of a press room provided in a press including a bed, said apparatus comprising a driving mechanism for moving said bolster, wheels provided on said bolster, a carrier for said bolster, a raising and lowering mechanism for raising and lowering the wheels of said bolster, an abutting member located on said bolster and having a vertical abutting surface and also having a center which is conformed with a longitudinal center line of said carrier for said bolster, an abutting member provided on said bed having a vertical abutting surface engageable with said vertical abutting surface of said abutting member of said bolster, two positioning members, each having a cross-shaped engaging projection and being provided on the lower surface of said bolster, one of said positioning members being arranged on one side of the longitudinal center line and at one end of the carrier of said bolster and the other of said positioning members being arranged on the other side of the longitudinal center line and at the other end of said carrier, two positioning holes provided on the upper surface of said bed in said press room, each having a cross-shaped groove, one of said positioning holes being arranged at a position to engage with one of said positioning members, and the other of said positioning holes being arranged at a position to engage with the other of said positioning members, said cross-shaped engaging projection being configured to fit closely within said cross-shaped groove.

3. Apparatus according to claim 2 wherein said raising and lowering mechanism for raising and lowering the wheels of said bolster comprises a motor for operating said raising and lowering mechanism, a threaded shaft connected to be rotated by said motor, a transfer piece engaging said threaded shaft, a pivoted link mechanism connected with said transfer piece to be pivotally actuated thereby, and a bifurcated supporting member pivotally mounted at one end thereof upon a fixed fulcrum on said bolster, said bifurcated supporting member rotatably supporting said wheels and being pivotally engaged with said linking mechanism at an opposite end thereof.

4. A moving bolster apparatus adaptable for moving a bolster to and from a press room provided in a press, including a bed, said apparatus comprising a bolster, a carrier for mounting said bolster, said bolster including pressure pin inserting holes, each having an annular stepped portion at the upper end thereof, pressure pins configured to be inserted into said inserting holes, said pressure pins having a height which is shorter than the height of said bolster, and an enlarged upper portion adaptable to engage said annular stepped portion of said inserting holes to enable said pressure pins to be suspended within said inserting holes, whereby when said bolster is transferred relative to said press room, said pressure pins are supported by said bolster itself in a manner whereby the lower ends of said pressure pins may be positioned above the surface of said bed in said press room, and whereby when said moving bolster is set in a predetermined position on said bed in said press room, said pressure pins are caused to project from the upper surface of said bolster by operation of a die cushion apparatus provided in said moving bolster apparatus.

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