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**A PRESS MACHINE AND A METHOD OF TRANSFERRING
A PLURALITY OF MINIATURE COMPONENTS**

BACKGROUND OF THE INVENTION

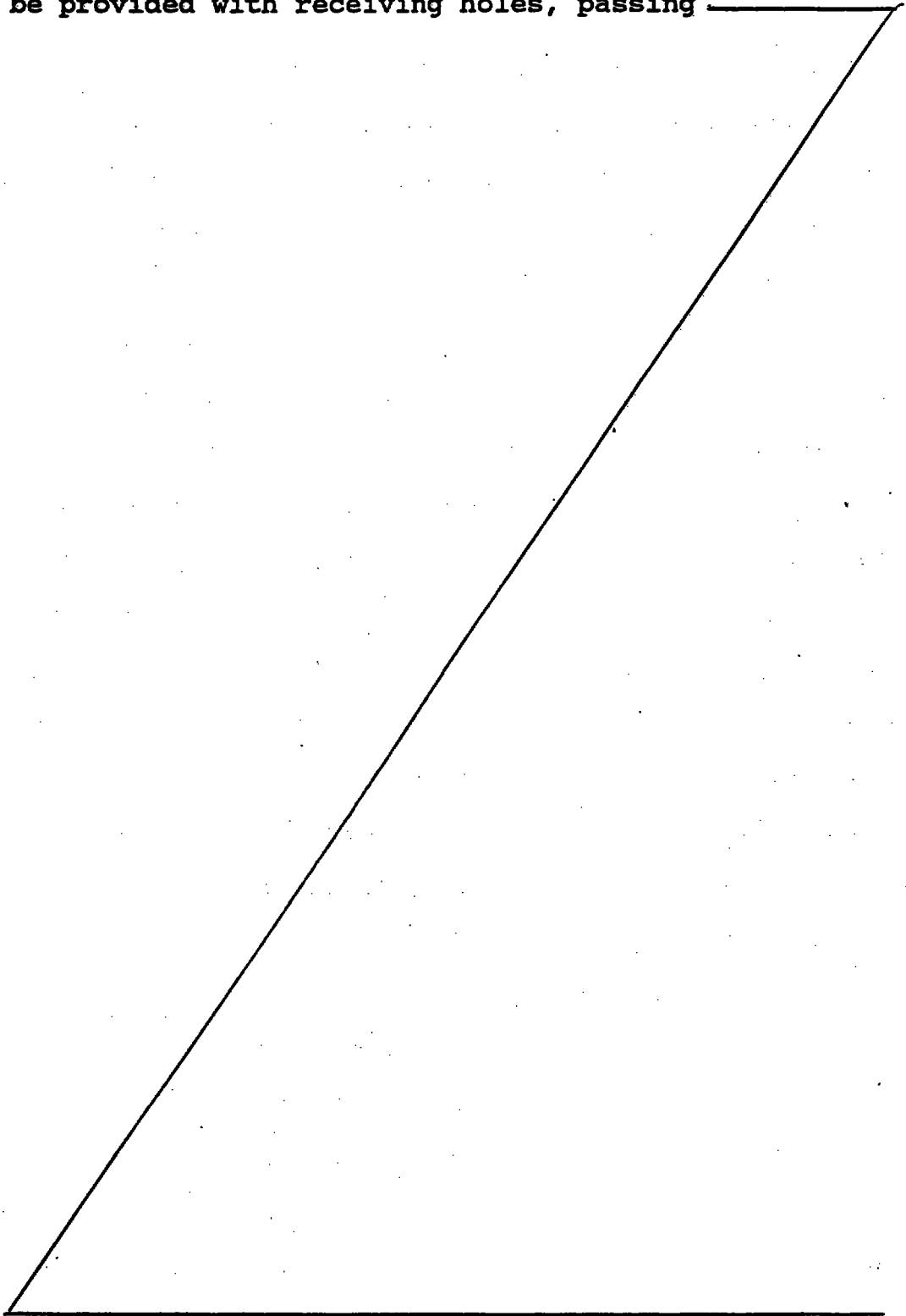
Field of the Invention

5 The present invention relates to a press machine
and a method for transferring a plurality of miniature
components held in receiving holes of a first plate to
a second plate. More particularly, though not
exclusively, the present invention relates to a method
10 of pressing chip type electronic components for
carrying out at least one of an operation for
inserting chip type electronic components such as chip
capacitors or chip resistors into receiving holes of
a holding plate, an operation for transferring chip
15 type electronic components from a holding plate
holding such chip type electronic components to
another one, and an operation for pressing out chip
type electronic components from receiving holes of a
holding plate.

20 **Description of the Background Art**

In general, a holding plate elastically holding
a number of chip type electronic components is
employed for simultaneously applying electrodes onto
end portions of the chip type electronic components,
25 as described in U.S. Patent No. 4,395,184. This
holding plate comprises a hard substrate, a thin flat
plate portion formed at a central portion of the hard
substrate to be provided with a number of through

holes, and a rubber-like elastic member which is embedded in a concave defined in the flat portion to be provided with receiving holes, passing



through the elastic member, in portions corresponding to the through holes. This holding plate is adapted to form external electrodes on both ends of chip type electronic components by a method disclosed in U.S. Patent No.

5 4,664,943, for example.

First, a guide plate, which is provided with a plurality of through holes in correspondence to the receiving holes of the holding plate, is placed on the surface of the holding plate. Then chip type electronic components are inserted one by one into the through holes of the guide plate by an introducer. Then, the chip type electronic components received in the through holes are downwardly pressed by a number of press pins to be received in the receiving holes, so that the holding plate elastically holds the chip type electronic components to expose upper end portions thereof on its surface. The holding plate thus holding the chip type electronic components is then turned over and the downwardly exposed portions of the chip type electronic components are pressed against an electrode coating plate which is coated with electrode paste of silver or the like, so that electrodes are applied to the exposed end portions of the chip type electronic components. Then the electrodes applied to the chip type electronic components are dried, and thereafter a second holding plate is arranged under

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the first holding plate holding the chip type electronic components through a frame type spacer of a prescribed thickness. Then the chip type electronic components are transferred from the first holding plate to the second one
5 by press pins which are similar to the above, so that other end portions, provided with no electrodes, of the chip type electronic components are exposed. Thereafter electrode paste is applied to the other end portions of the chip type electronic components by an operation
10 similar to the above, and then dried, so that electrodes are formed on both end portions of the chip type electronic components. Finally the holding plate holding the chip type electronic components, which are provided with the electrodes on both end portions, is placed on a
15 recovery case, and the chip type electronic components are downwardly pressed out from the receiving holes by the press pins, to be collected in the recovery case.

In order to insert the chip type electronic components from the guide plate into the holding plate, or
20 press out the chip type electronic components from the holding plate to the recovery case, transfer the same from a holding plate to another one, employed is a press machine having a number of press pins. U.S. Patent No. 4,395,184 discloses an example of such a press machine.
25 This press machine comprises an upper plate which is

vertically moved by a handle and a number of press pins which are downwardly projected from the upper plate. A mechanism for positioning a guide plate, a holding plate and a discharge plate in an overlapping state is provided under the upper plate.

In order to improve high-volume production capability, a single holding plate is generally provided with thousands of receiving holes. However, such a holding plate is inferior in rigidity along the perpendicular direction since the same is provided with a thin flat plate portion having a number of through holes in its center and a rubber-type elastic member embedded in the thin flat plate portion for partially covering the through holes. When chip type electronic components are simultaneously inserted or transferred into the thousands of receiving holes provided in such a holding plate, an extremely heavy load is applied to the holding plate, to cause deformation or cracking. Thus, the life of the holding plate is reduced.

When thousands of chip type electronic components are simultaneously pressed in a single operation, further, extremely high reactive force is applied to a pin head holding the press pins. Thus, a strong thrust is required for pressing the pin head, leading to increase of the machine size, while the machine is rattled with increase

of pressing times, leading to reduction in accuracy.

In order to change the size of the holding plate, further, it is necessary to also change the pin head, which is selected in correspondence to the size of the holding plate. In other words, it is necessary to prepare a plurality of pin heads in correspondence to the types of holding plates, while an operation for exchanging the pin heads is complicated.

SUMMARY OF THE INVENTION

Accordingly, the present invention aims to overcome at least some of the abovementioned problems associated with the prior art.

Additionally, it is desirable to provide a press machine for and a method of pressing chip type electronic components, which can reduce a load applied to a holding plate as well as reactive force applied to a pin head in a pressing operation, and furthermore to provide a press machine for and a method of pressing chip type electronic components, which can apply a single pin head to a plurality of sizes of holding plates in common.

According to one aspect of the present invention there is provided a press machine for transferring a plurality of miniature components held in receiving holes of a first plate to a second plate, the press machine comprising a pin head having a portion provided with a plurality of press pins, said portion

being smaller than a portion of said first plate provided with said receiving holes.

According to another aspect of the present invention there is provided a method of transferring a plurality of miniature components held in a first number of receiving holes of a first plate to a second plate, the method comprising passing a second number of press pins through different ones of said receiving holes a plurality of times until all the components have been transferred, said first number being greater than said second number.

The present invention extends to inserting and removing chip type electronic components to and from a holding plate as well as transferring the components from one holding plate to another. Therefore, according to yet another aspect of the present invention, there is provided a press machine for chip type electronic components for carrying out at least one of an operation for inserting chip type electronic components into receiving holes of a holding plate, an operation for transferring chip type electronic components from a holding plate to another one and an operation for pressing out chip type electronic components from receiving holes of a holding plate, said press machine comprising: a table for horizontally supporting a holding plate in a set position; a pin head mounting member; means for

horizontally moving said table from the set position to a plurality of working positions; means for vertically moving said pin head mounting member; a pin head, having a portion provided with a plurality of
5 press pins corresponding to receiving holes of said holding plate, said portion being smaller than a portion of said holding plate provided with said receiving holes.

Similarly, according to a further aspect of the
10 present invention there is provided a method of pressing chip type electronic components using a press machine comprising a horizontally supported holding plate provided with a number of receiving holes at constant arrangement pitches and a horizontally
15 supported pin head having a number of press pins at the same arrangement pitches as said receiving holes for carrying out at least one of an operation for inserting chip type electronic components into receiving holes of the holding plate, an operation for
20 transferring chip type electronic components from the holding plate to another holding plate, and an operation for pressing out chip type electronic components from receiving holes of the holding plate, said method comprising: preparing said press machine
25 with said pin head having a portion provided with said press pins, said portion being smaller than a portion of said holding plate provided with said receiving

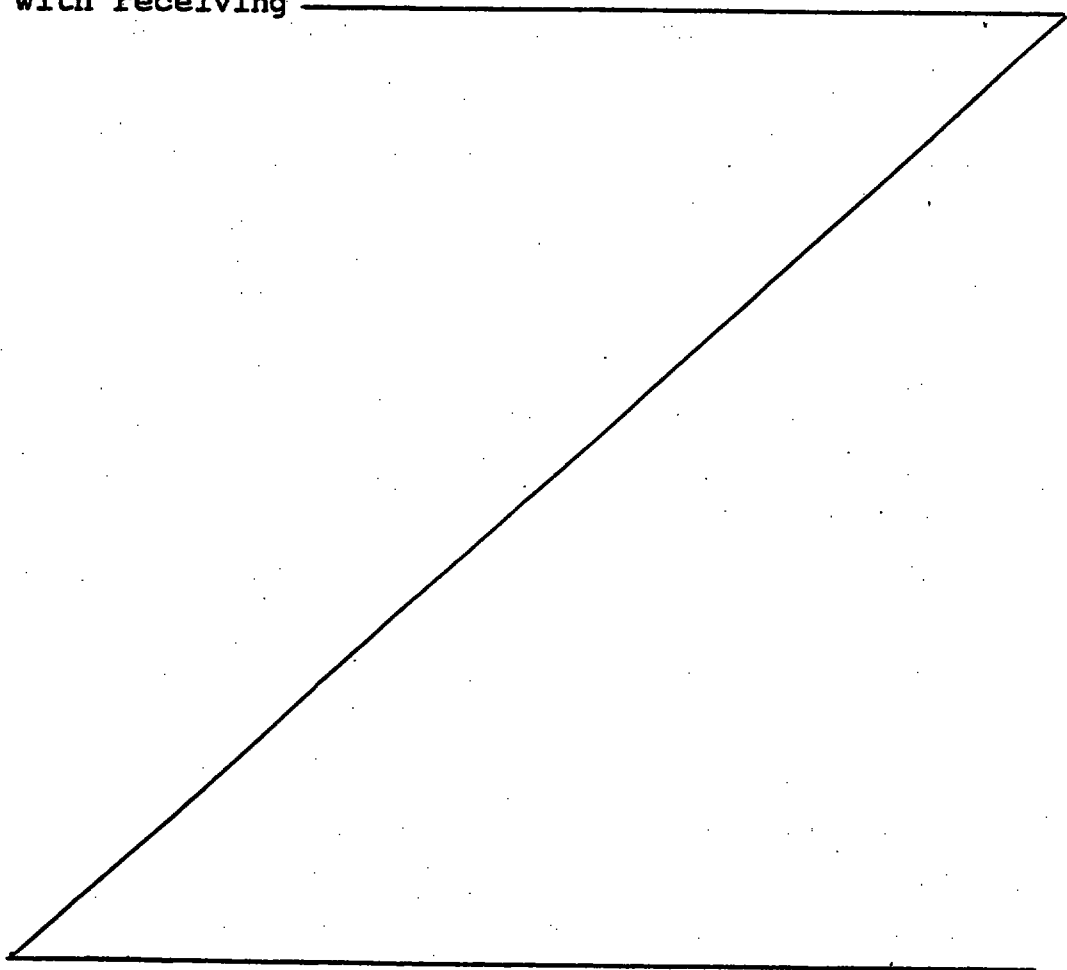
holes; and relatively moving said holding plate and
said pin head in the horizontal direction by a
plurality of prescribed distances and relatively
moving said holding plate and said pin head in the
5 vertical direction for each of said relative
horizontal movements, thereby engaging said pin head
with a single said holding plate a plurality of time
at different respective locations on said single
holding plate.

10 Alternatively stated, according to a yet further
aspect of the present invention there is provided a
method of transferring a plurality of miniature
components held in receiving holes of a first plate to
a second plate, the method comprising: securely
15 locating said first plate in a first working position;
vertically moving a pin head comprising a plurality of
press pins in a first direction so that said press
pins pass through some of said receiving holes of said
first plate and engage some of said components,
20 thereby transferring them from said first plate to
said second plate; vertically moving said pin head in
a second direction opposite to said first direction so
that said press pins are withdrawn from said receiving
holes in said first plate, and moving said first plate
25 horizontally at least once to at least one second
working position and repeating the vertical movements
of the pin head to transfer others of said components

from other receiving holes of said first plate to said second plate.

5 An exemplary operation for downwardly inserting chip type electronic components into receiving holes of a holding plate is now described.

10 First, a guide plate storing chip type electronic components in its through holes is placed on the upper surface of a holding plate, and these plates are integrally set on a support. Thereafter the holding plate and the guide plate are horizontally moved so that an end of a portion of the holding plate provided with receiving



holes is located under a pin head. The pin head is downwardly moved to press a first group of the chip type electronic components with press pins, thereby inserting the same into a first group of the receiving holes of the holding plate. Then the pin head is upwardly moved and thereafter the holding plate and the guide plate are horizontally moved by a constant distance so that a region of the holding plate, which is adjacent to the end provided with the first group of the receiving holes receiving the first group of the chip type electronic components, is located under the pin head. Thereafter the pin head is again downwardly moved to insert a second group of the chip type electronic components into a second group of the receiving holes of the holding plate. Such an operation is so repeated as to insert the chip type electronic components into all receiving holes of the holding plate.

The portion of the holding plate provided with the receiving holes is not restricted to a square form but may be in any arbitrary form such as a circular or elliptical form. When the portion provided with the receiving holes is in a square form and the portion of the pin head provided with the press pins is in a rectangular form having a width identical to that of the portion provided with the receiving holes and a depth smaller than that of

the portion provided with the receiving holes, it is possible to press the chip type electronic components in relation to all receiving holes by simply relatively moving the holding plate or the pin head relatively along the depth. Thus, the horizontal movement can be unidirectionally limited to simplify a mechanism for such movement, while the receiving holes and the press pins can be preferably improved in positional accuracy.

10 When the portions provided with the receiving holes and the press pins are in square and rectangular forms having the same widths, the press pins may press the holding plate twice if the depth of the portion provided with the press pins is half that of the
15 portion provided with the receiving holes, while the press pins may press the holding plate three times when the depth of the former is $1/3$ that of the latter. If receiving holes can be pressed twice by different press pins, the depth of the portion
20 provided with the receiving holes may not be integral times that of the portion provided with the press pins.

 As to the horizontal movement and the opposite movement of the holding plate and the pin head, either
25 one or both of the holding plate and the pin head may be moved.

 The pin head has a portion provided with press pins, which portion

is smaller than that of the holding plate provided with receiving holes, is adapted to carry out pressing operations in a divided manner, whereby only a small load is applied to the holding plate every pressing operation, to reduce deformation and cracking of the holding plate.

Further, it is also possible to reduce reactive force which is applied to the pin head, whereby a mechanism for driving the press pins can be reduced in size and a portion for supporting the holding plate and a mechanism for driving the same may not be much increased in rigidity.

In addition, the pin head can be applied to various sizes of holding plates in common so far as the holding plates have receiving holes at constant arrangement pitches.

The above and further features of the present invention are set forth with particularity in the claims, and should become clearer from consideration of the following detailed description of exemplary embodiments of the invention given with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front elevational view schematically showing a press machine according to a first embodiment of the present invention;

Fig. 2 is a sectional view showing an essential part

of the press machine during an operation for inserting chip type electronic components in detail;

Fig. 3 is a plan view showing respective working positions of a table moving mechanism included in the press machine;

Fig. 4 is a sectional view showing an essential part of the press machine in an intermediate stage of the operation for inserting chip type electronic components in detail;

Fig. 5 is an enlarged sectional view of the press machine during an operation for transferring chip type electronic components;

Fig. 6 is an enlarged sectional view of the press machine in an intermediate stage of the operation for transferring chip type electronic components;

Fig. 7 is an enlarged sectional view of the press machine during an operation for discharging chip type electronic components;

Fig. 8 is a front elevational view showing a press machine according to a second embodiment of the present invention;

Fig. 9 is a sectional view showing an essential part of the press machine shown in Fig. 8 during an operation for inserting chip type electronic components in detail; and

Fig. 10 is a sectional view showing the press machine of Fig. 8 in an intermediate stage of the operation for inserting chip type electronic components.

DETAILED DESCRIPTION OF THE EMBODIMENTS

5 Fig. 1 shows a first embodiment of a press machine embodying the present invention, which is applied to an operation for inserting chip type electronic components C into receiving holes a₁ of a holding plate A, an operation for transferring chip type electronic components from a holding plate holding the same to another one, or the like. The holding plate A is similar in structure to that disclosed in Japanese Patent Publication No. 3-44404 (1991).

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 The inventive press machine is formed by a press body 1 which is set in a horizontal position, a movable table 2 which is supported on the body 1 through a guide rail 3 to be movable in the horizontal direction (direction perpendicular to the plate of Fig. 1) and a uni-axial unit 4, a press head portion 5 which is vertically movably supported with respect to the body 1, and a vertical cylinder 6, serving as a press machine driving portion, for vertically driving the press head portion 5.

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 The press body 1 vertically slidably supports a pair of vertical shafts 7, so that the press head portion 5 is mounted to extend across the upper end portions of the

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guide plate B'. Then the support frame 38 comes into contact with the table 34, and the protrusion 32a is separated from the holding plate A, as shown in Fig. 9.

After such a first pressing operation is completed in the first working position, the table 34 is moved to a second working position, to carry out a second pressing operation. Thereafter the table 34 is returned to the set position, so that the guide plate B' and the holding plate A' are removed from the table 34. The holding plate A' is then carried to an electrode applicator.

According to the second embodiment, the upper ends of the receiving holes b_1 of the guide plate B' are inwardly tapered to serve as recesses for facilitating removal of the holding plate A' holding the chip type electronic components C from the guide plate B'. Therefore, the guide plate B' may not be provided with the cavities b_1 dissimilarly to the first embodiment, and the chip type electronic components C are hardly inclined when the same are inserted in the receiving holes a_1 . Thus, the chip type electronic components C can be efficiently inserted into the receiving holes a_1 .

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.

CLAIMS:

1. A method of pressing chip type electronic components using a press machine comprising a horizontally supported holding plate provided with a number of receiving holes at constant arrangement pitches and a horizontally supported pin head having a number of press pins at the same arrangement pitches as said receiving holes for carrying out at least one of an operation for inserting chip type electronic components into receiving holes of the holding plate, an operation for transferring chip type electronic components from the holding plate to another holding plate, and an operation for pressing out chip type electronic components from receiving holes of the holding plate, said method comprising:

preparing said press machine with said pin head having a portion provided with said press pins, said portion being smaller than a portion of said holding plate provided with said receiving holes; and

relatively moving said holding plate and said pin head in the horizontal direction by a plurality of prescribed distances and relatively moving said holding plate and said pin head in the vertical direction for each of said relative horizontal movements, thereby engaging said pin head with a single said holding plate a plurality of times at different respective locations on said single holding



plate.

2. A method of pressing chip type electronic components in accordance with claim 1, wherein said portion provided with said receiving holes is in the form of a square and said portion provided with said press pins is in the form of a rectangle having a width being identical to that of said portion provided with said receiving holes and a depth being smaller than that of said portion provided with said receiving holes.

3. A press machine for chip type electronic components for carrying out at least one of an operation for inserting chip type electronic components into receiving holes of a holding plate, an operation for transferring chip type electronic components from a holding plate to another one and an operation for pressing out chip type electronic components from receiving holes of a holding plate, said press machine comprising:

a table for horizontally supporting a holding plate in a set position.

a pin head mounting member;

means for horizontally moving said table from the set position to a plurality of working positions;

means for vertically moving said pin



head mounting member;

a pin head, having a portion provided with a plurality of press pins corresponding to receiving holes of said holding plate, said portion being smaller than a portion of said holding plate provided with said receiving holes.

4. A press machine for chip type electronic components in accordance with claim 3, wherein said pin head comprises a backing plate which is detachably mounted on said pin head mounting member and a pin plate, having holes for receiving said press pins, which is mounted with a prescribed space from said backing plate, and said press pins are provided with flange portions and received in said holes of said pin plate so that said flange portions engage with said pin plate, to be supported by said pin plate.

5. A press machine for chip type electronic components in accordance with claim 4, wherein said pin head further comprises a stripper plate which is provided to be oppositely approachable to/separable from said pin plate, said stripper plate having holes for slidably receiving said press pins.

6. A method of transferring a plurality of



miniature components held in receiving holes of a first plate to a second plate, the method comprising:

securely locating said first plate in a first working position;

vertically moving a pin head comprising a plurality of press pins in a first direction so that said press pins pass through some of said receiving holes of said first plate and engage some of said components, thereby transferring them from said first plate to said second plate;

vertically moving said pin head in a second direction opposite to said first direction so that said press pins are withdrawn from said receiving holes in said first plate, and

moving said first plate horizontally at least once to at least one second working position and repeating the vertical movements of the pin head to transfer others of said components from other receiving holes of said first plate to said second plate.

7. A method in accordance with claim 6, wherein said components are transferred to a second plate which comprises a plurality of receiving holes for receiving said components.



8. A press machine for transferring a plurality of miniature components held in receiving holes of a first plate to a second plate, the press machine comprising a pin head having a portion provided with a plurality of press pins, said portion being smaller than a portion of said first plate provided with said receiving holes.

9. A method of transferring a plurality of miniature components held in a first number of receiving holes of a first plate to a second plate, the method comprising passing a second number of press pins through different ones of said receiving holes a plurality of times until all the components have been transferred, said first number being greater than said second number.

10. A method or machine substantially as described herein with reference to the accompanying drawings.

