

[54] APPARATUS FOR TRANSFERRING
FORMED ARTICLES BETWEEN PRESSES

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abandoned.

Foreign Application Priority Data

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[51] Int. Cl. B65g 25/04

[58] Field of Search 214/1 BB, 1 B;
198/218, 219

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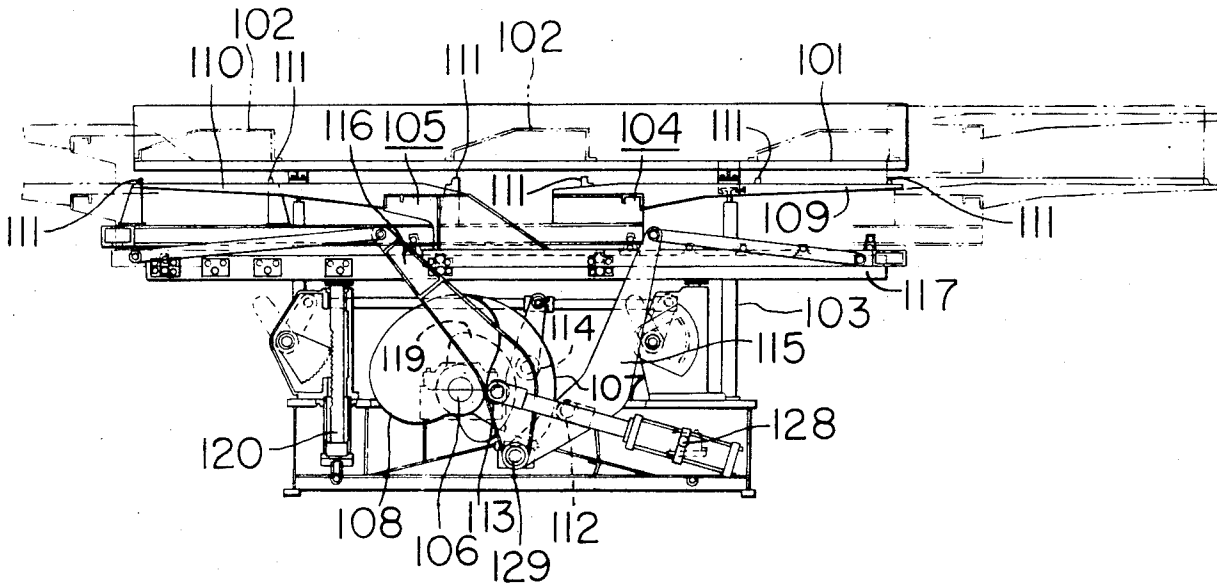
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Assistant Examiner—George F. Abraham
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[57] ABSTRACT

In a press line formed by aligning independent presses
each allotted with an operational section interrelated
therebetween, an apparatus for automatically transfer-
ring formed articles between presses.

3 Claims, 8 Drawing Figures

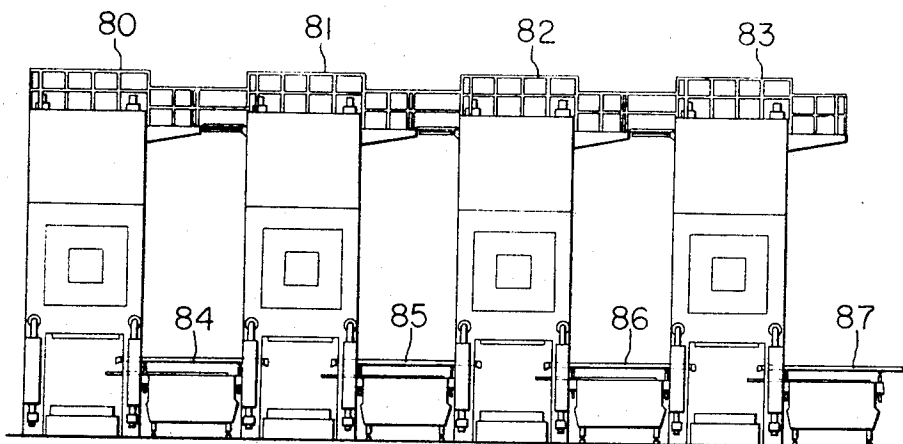


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SHEET 1 OF 4

FIG. 1



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FIG. 2

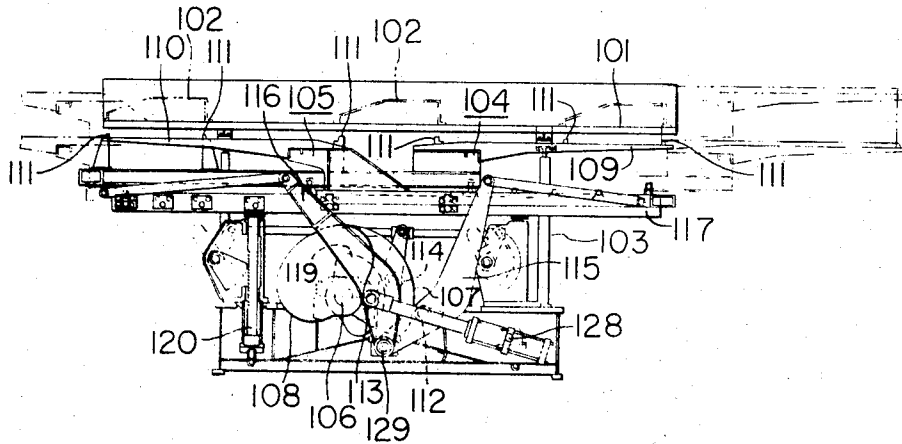


FIG. 3

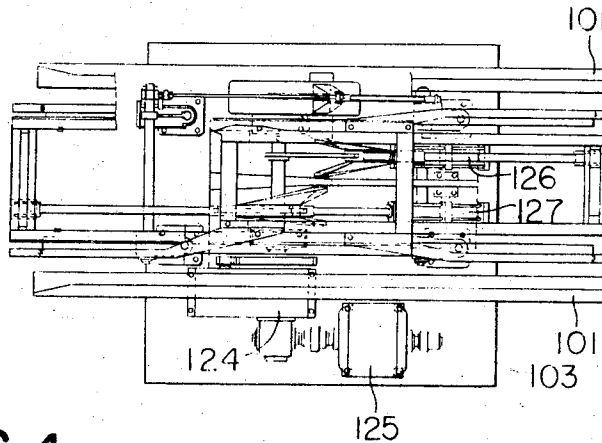
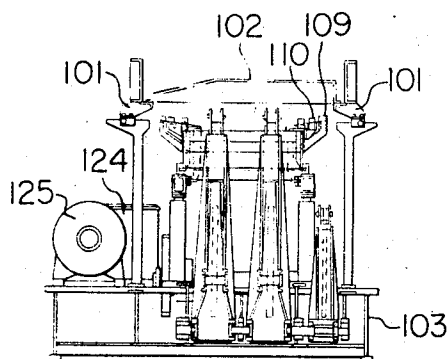


FIG. 4



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FIG. 5

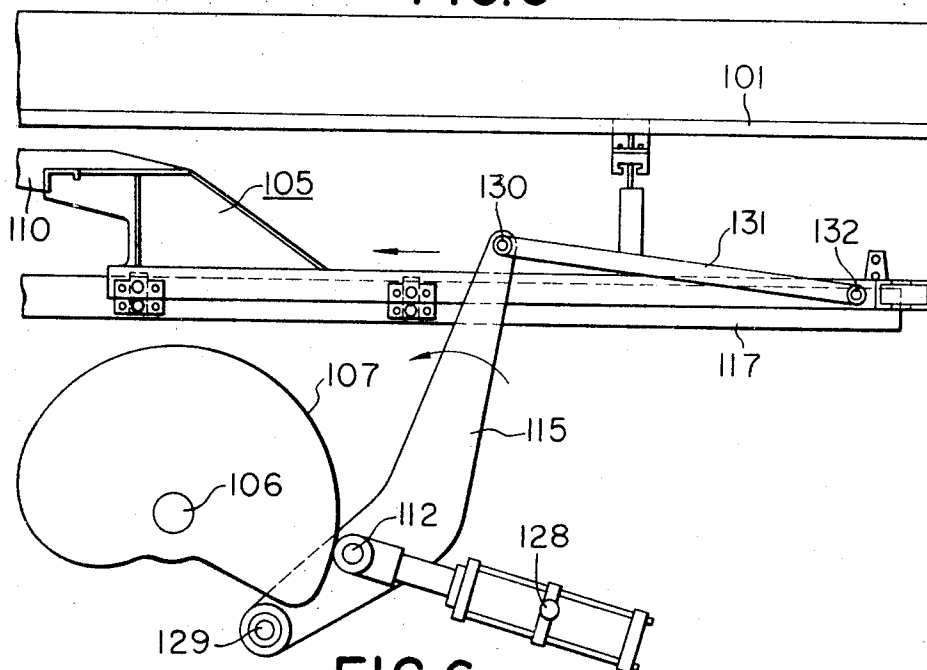
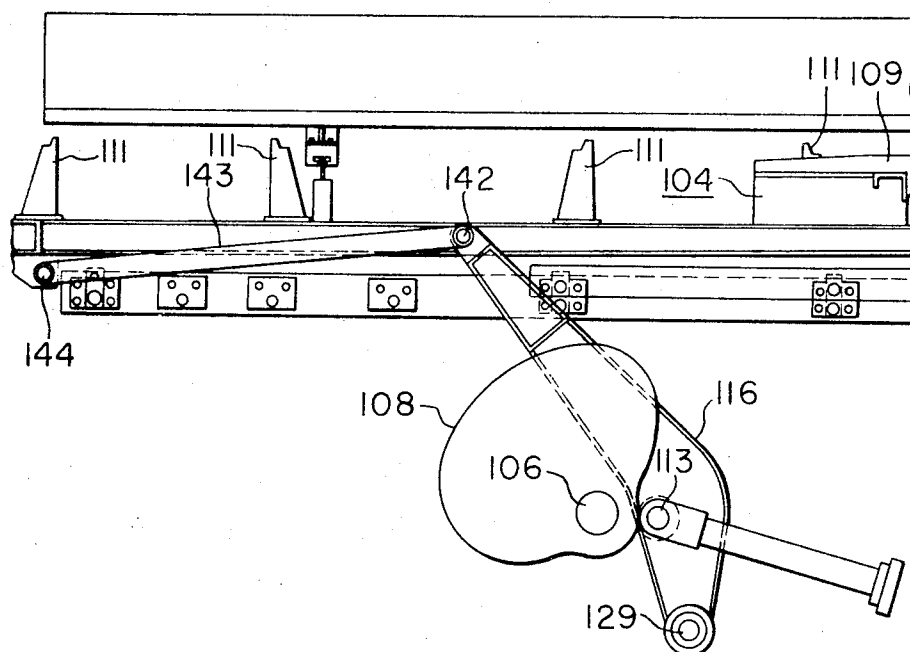


FIG. 6



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FIG. 7

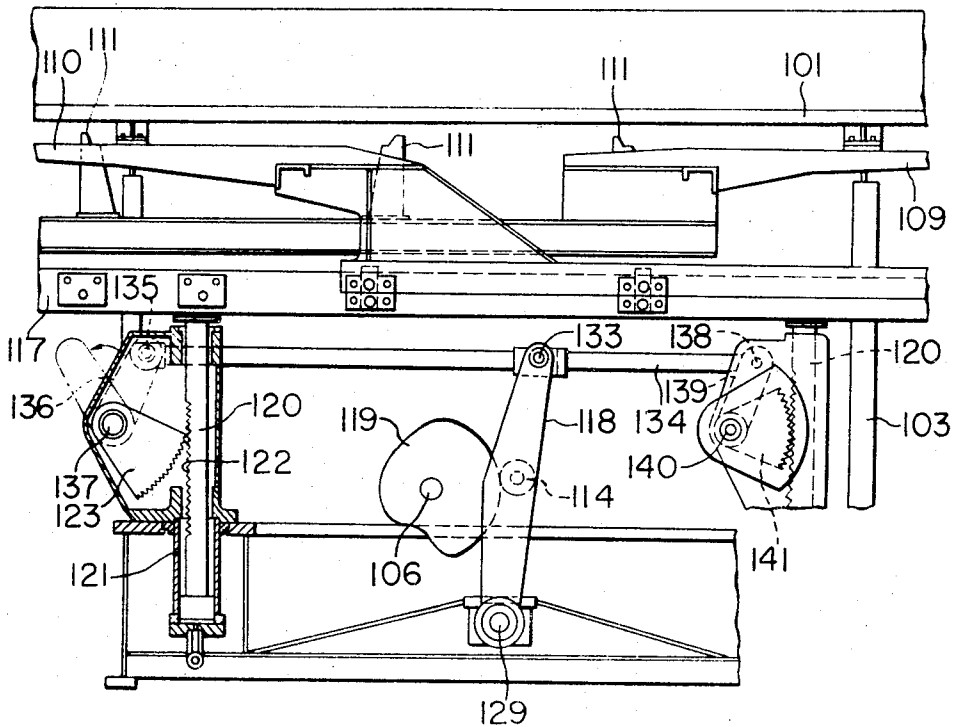
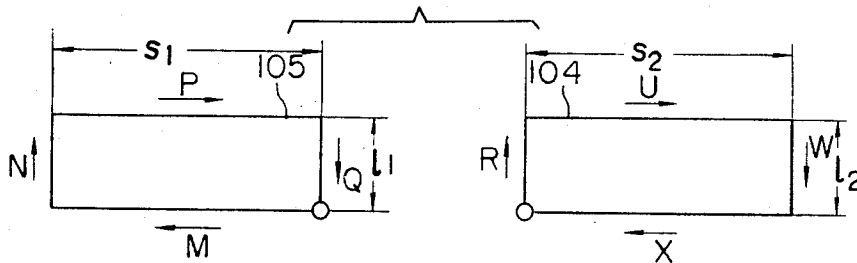


FIG. 8



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APPARATUS FOR TRANSFERRING FORMED ARTICLES BETWEEN PRESSES

This is a continuation of application Ser. No. 838,899 filed July 3, 1969 and now abandoned.

BACKGROUND OF THE INVENTION

In forming articles formed by means of a multiple-process pressworks in a press line formed by aligning presses each operating independently, it is necessary, above all, to carry but promptly a semi-finished formed article from each of the presses constituting the press line in synchronism with the operations in each of the presses, and to carry said semi-finished formed article promptly into the following or succeeding press allotted with the succeeding operation.

Heretofore, conveyer systems have been used as means for loading and unloading of formed articles between such presses. It is, therefore, not a fully automatic system which does not require manual operation, and it has no quick transfer performance. Moreover, conventional type apparatus are not appropriate, because they are apt to give deformation or strain in the formed articles to be transferred.

The object of the present invention is to quicken the transfer of formed articles between presses in a press line without giving deformation or strain in the formed articles to be transferred, and to effect a full-automatic transfer of the formed articles.

BRIEF SUMMARY OF THE INVENTION

The primary object of the present invention is to provide an and apparatus in a press line where a series of presses each allotted with independent operational section are aligned, for automatically transferring formed articles between presses.

The second object of the present invention is to provide an apparatus for loading and unloading the formed articles between the presses by a cyclic motion consisting of lifting, advancing, lowering and retreating of the transferring mechanism, by which, before forming an article by multiple-process pressing in a press line, where a number of presses each allotted with an independent operational section are aligned, taking out a formed article (semi-finished) from the die in said press, moving the formed article upwardly, then horizontally translating said formed article in a forward direction, then transferring said formed article downwardly so as to charge said formed article into the die of the following press, such operations being effected fully automatically even when the press line is operated continuously.

The third object of the present invention is to provide an apparatus which when an semi-formed article is to be transferred automatically from one stage to the next, between presses forming a press line, the article to be transferred is supported from below without grasping it and advancing it pitch-wise for a predetermined distance intermittently, so that the article is not deformed or given strains.

The fourth object of the present invention is to provide an and apparatus for transferring automatically formed articles between presses, said apparatus being adaptable conveniently in the press line consisting of said presses suitable for press working of sheet material.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of the apparatus when applied on the press line;

FIG. 2 is a side elevation showing a general view of another example of the apparatus according to present invention;

FIG. 3 is a plan view of the apparatus shown in FIG. 2;

FIG. 4 is a front elevation of the apparatus shown in FIG. 2;

FIG. 5 is a side elevation showing the horizontal transfer mechanism of the left-hand fork;

FIG. 6 is a side elevation showing the horizontal transfer mechanism of the right-hand fork;

FIG. 7 is a side elevation showing the vertical transfer mechanism of the carrier; and

FIG. 8 is a motion diagram showing the operation of loading and unloading transfer mechanism in the apparatus shown in FIG. 2.

DETAILED DESCRIPTION

An example of the apparatus which is arranged between the presses in the press line, according to the present invention, will now be described referring to FIG. 1. In FIG. 1 the numerals 80, 81, 82, 83 are presses constituting a press line, each of the presses having its function as an independent press machine. Each of the presses 80, 81, 82, 83 takes charge of an allotment in the press operation; a blank material is fed into the first press 80, and when the blank material is delivered from the fourth press 83, the desired press formed article is obtained. The numerals 84, 85, 86, 87 designate the transfer feeders, according to the present invention, provided between each of the presses 80, 81; 81, 82; 82, 83; and the press 83 and the delivery side.

Now, the apparatus according to the present invention shown in FIGS. 2 to 8 will be described.

The fixed rails 101, 101 for transfer provided between two presses serve as a guide frame in a form of a pair of rails, and are fixed on the machine frame 103 to support the side edges of formed article 102, and have a length substantially corresponding to the spacing between two presses.

The loading carrier 104 and unloading carrier 105 provided between the fixed carrying rails 101, 101 are each controlled in their motion by cams 107, 108 fixed on a cam shaft 106. The loading carrier 104 and the unloading carrier 105 each have a fork 109 directed to the following press and a fork 110 directed to the preceding press, respectively. The total length of the loading carrier 104 including the fork 109 is equal substantially to the distance between the two presses. The loading carrier 104 is provided with upwardly directed engaging members 111, 111, 111, . . . for carrying the formed article, the engaging members being spaced equally throughout the entire length of the fork 109. These engaging members 111, 111, 111, . . . project upwardly from the rails 101, 101 when the carrier 104 is in a state of being lifted, and takes a position below the rails 101, 101 when the carrier 104 is lowered.

The fork 110 of the unloading carrier 105 has a length which can operate by penetrating into the lower side of the formed article placed on the preceding press when the carrier 105 is retreated.

In the drawings, the numerals 112, 113, 114 designate the cam rollers; the numerals 115, 116 are links

which make the loading carrier 104 and the unloading carrier 105 to follow with the cams 107, 108 through cam rollers 112 and 113; 117 is a lifting frame carrying the carrier 104, 105; 118 is a link which makes the cam 119 on the cam shaft 106 to follow the vertical motion of the lifting frame through the cam roller 114; 120, 120 are legs of the lifting frame 117; 121 is an air cylinder resiliently supporting the lower end of each leg 120; 122 is a rack formed on each of the leg 120; 123, 123 are sector gears; 124 is a speed reduction gear; 125 is a motor; 126, 127 are air cylinders; 128, 128 are the centers of these air cylinders. In FIG. 8, M, N, P, Q, show the motional process of the carrier 105; R, U, W, X show the motional process of the carrier 104, l_1 is the vertical stroke of the carrier 105, and l_2 is the vertical stroke of the carrier 104. s_1 shows the advancing or retreating stroke of the carrier 105, and s_2 the advancing or retreating stroke of the carrier 104.

The operation of the apparatus according to the present invention will now be described. In a state shown in FIG. 2, the carrier is at rest, and is ready for the transfer operation. At the same time, the pressing operation of the article 102 in the preceding stage is finished, the unloading carrier 105 retreats for M stroke towards the preceding press, and during this time, the loading carrier 104 is held at rest.

Next, the carriers 105, 104 are raised simultaneously for N, R strokes, respectively, by the lifting of the lifting frame 117. The fork 110 of the carrier 105 lifts the formed article on the preceding press from the die. The engaging members 111, 111, . . . of the loading carrier 104 project simultaneously over the rails 101, 101.

Then the carriers 105, 104 advance in P, U strokes for s_1 , s_2 , respectively, while being put under the raised state.

In this state, the formed article 102, which has been taken out of the preceding press by the fork 110 and which is placed on the end near the preceding press, is advanced on the rails 101 towards the side of the following press by the engaging members 111, 111 of the carrier 105 for a length of s_1 . Due to the lowering in Q, W strokes for l_1 , l_2 respectively, which are to be effected by carriers 105, 104, the engaging members 111, 111 of the carriers 104 disengage from the formed article on the rails 101, 101, the formed article 102 alone is left on the rails 101, 101 and is supported thereby.

Next, when the unloading carrier 105 is left in its lowered position, the loading carrier 104 alone is retreated for X stroke, the carrier 104 stops just below the formed article 102 placed on the rails 101, 101, which position is appropriate for the engaging members 111, situated at the intermediate portion of the carrier, to push the formed article.

With the combination of such processes, a cyclic motion of carriers is completed. Thus, by repeating the same motions continuously as before, that is: placing the formed article 102, taken out of the preceding press, on the rails 101, 101; transfer ring said articles 102, which has been placed at the end of the rails 101, 101, towards the following press for 1 pitch (equivalent to the lengths s_1 , s_2) on the rails 101, 101; taking out again a new formed article from the preceding press and is placed on the end of the rails 101, 101.

The formed article placed on the rails 101, 101 by said repeated motion of the carriers 105, 104 is transferred intermittently and successively on the rails 101, 101 for 1 pitch. In this way the formed article 102,

which is emerged from the first press, is transferred on the rails 101, 101 towards the end portion facing the following press successively, then the formed article 102 is taken up from below by the lifting and horizontal advancing motion of the fork 109, which is continuing the cyclic motion integral with the carrier 104 and is carried into the following press, the formed article 102 is placed on a predetermined position of the following press by the successive lowering motion of the carrier 104, and the fork 109 alone is removed from the following press by the retreating motion of the carrier 104. All the succeeding operations are conducted in a perfect synchronized condition, and the formed article is taken out one by one from the preceding press by the cyclic motion of the carriers 105, 104, and the formed article is fed successively to the following press.

The following table shows the relative operation of the unloading carrier and the loading carrier with the lapse of time.

Timing	t_1	t_2	t_3	t_4	t_5	t_6
Unloading carrier	stop	M	N	P	Q	stop
Loading carrier	stop	stop	R	U	W	X

That is, when the carriers 104, 105 are in the position shown in solid line in FIG. 2 (in this state, the carriers 104, 105 are in a state of rest ready to start operation, this is the point t_1 in the table), the apparatus begins the cyclic motion. The levers 115, 116, 118 operate through rollers 112, 113, 114 abutting the cam surface of the cams 107, 108, 119 fixed on the cam shaft 106 driven by the motor 125, reducer 124. The levers 115, 116, 118 swing with the pivot 129 as center. The lever 115 is first swung in a counter-clockwise direction. Such a swinging motion can be explained referring to FIG. 5. Through a pin 130, the end portion of a lever 131 is fixed at the end of the lever 131. The other end of this lever 131 is pivoted with the right-hand end portion of the carrier 105 through a pin 132. When the lever 115 is swung in a counter-clockwise direction by the operating surface of the cam 107 through the roller 112, the carrier 105 is moved to the left. Fork 110 is also moved with such a motion of the carrier 105, and the tip end of the fork 110 penetrates into the preceding press, and the tip end is placed below the formed article which has already been formed by dies in the preceding press (this state is shown as t_2 in the table).

Then the lever 118 swings counter-clockwise by the cam surface of the cam 119 fixed on the cam shaft 106 through the roller 114. As shown in FIG. 7, the upper end of the lever 118 is pivoted at about the center of a cross bar 134 by a pin 133. The cross bar 134 is translated to the left. The left-hand end of the cross bar 134 is pivoted on the swing member 136 by means of a pin 135. The lower end of the swing member 136 is fixed on a fixed shaft of the sector gears 123, 123. The fixed shaft 137 is rotated by the left-hand transfer of the cross bar 134, and the sector gears 123, 123 are swung upwardly. The legs 120, 120 are moved vertically by the rack 122 of the leg 120 engaging the sector gears 123, 123. In the same way, the fixed shaft 140 is rotated by the left-hand movement of the cross bar 134 through the lever 139 pivoted by a pin 138 at the right-hand end of the cross bar 134. The legs 120, 120 of the frame 117 are lifted by upward swinging of the sector gears 141, 141, the base portion of which being fixed on the fixing shaft 140. Thus, the lifting frame 117 is lifted upwardly while being supported at four points. At

this moment, the formed article is simultaneously lifted by the fork 110, being taken up from below (this state corresponds to t_3 in the table).

Next, the lever 115 swings in a clockwise direction by means of the cam 107 and the roller 112, and at the same time, the lever 116 is also rotated clockwise by the cam 108 and the roller 113. The carrier 105 and the fork 110 advance to the right integrally by the swinging motion of said levers 115, 116, and simultaneously the carrier 104 and the fork 109 advance to the right integrally. The carrier 104 and the fork 109 are operated by the swinging motion of the lever 116 through the roller 113 abutting against the cam surface of the cam 108. In FIG. 6, a lever 143 is provided, of which one end is pivoted by a pin 142 and by the upper end of the lever 116 rotated clockwise with the shaft 129 as the center. The carrier 104 is advanced to the right by combination of the other end of the lever 134 and a pin 144 at the left-hand end of the carrier 104. At this moment, the formed article, which is lifted by the fork 110 and placed on rails 101, 101, is transferred to the right on the rails 101, 101 by means of the engaging members 111, 111 of the fork 109 with the horizontal translation of the carrier 104 (this state corresponds to t_4 in the table).

Then, the sector gears 123, 123, 141, 141 is rotated downwardly by the right-hand translation of the cross bar 134 caused by the abutment of the cam surface of the cam 119 and the roller 114, and the legs 120, 120 are moved downwardly, so that the lifting frame 117 also moves downwardly. In this case, the fork 109 of the carrier 104, which is integral with the lifting frame 117, is released downwardly from the formed article, which is pushed forwardly by the engaging members 111, 111 on the rails 101, 101, and the formed article alone is left mounted on the rails 101, 101 (this state is t_5 in the table).

Now, the carrier 104 is transferred to the left guided by the lifting frame 117 by the anti-clockwise rotation of the lever 116 caused by the cam 108 and the roller 113. In this case, the lever 115, to which the cam surface of the cam 107 and the roller 112 are abutting, does not rotate but keeps the position (this state corresponds to t_6 in the table). Thus the carrier 105 returns to its starting point through $M \rightarrow N \rightarrow P \rightarrow Q$, and the carrier 104 returns to its starting point through $R \rightarrow U \rightarrow W \rightarrow X$.

In this embodiment, in order to facilitate the explanation, the cyclic motion is considered to be a rectangular motion, it will easily be understood that the transition points of said rectangular motion can be made more smooth by appropriately designing the cam surfaces of the cams 107, 108 and 119.

In this way the formed article is transferred on the rails 101, 101, pitch by pitch. The formed article in the preceding press is lifted by the fork 110 of the carrier 105 through the cyclic motion of the following carriers 104, 105, and is placed on the rails 101, 101. At the same time, the formed article, which has been placed on the rails 101, 101 by the engaging members 111, 111 of the fork 109 of the carrier 104 and which has been transferred for one pitch, is transferred further for one pitch to the side of the following press.

In this manner, the formed article is transferred to the end portion near the following press on the rail 101, 101. By the following cyclic motion of the carrier 104, 105, the fork 109 lifts the formed article from below,

then transfer it in a horizontal direction, then carrying the formed article into the predetermined position of the following press, and the fork 109 alone retreats.

Thus, the formed article, which has transferred to the end portion of the following press on the rails 101, 101, is timely fed one by one to the following press.

According to the present invention, the formed article is taken out successively from the preceding press, and is transferred pitch by pitch on the rails, and is fed automatically and successively into the following press. Since the carriers 104, 105 each transfer horizontally, so that it is possible to use a long fork. Preferably, the fork is made for each of particular formed articles.

Thus, with the present embodiment of the apparatus, the formed article is fed pitch by pitch without being held between tools, but supported from below, and the article can be transferred from the preceding press to the following press, so that there is no possibility of producing deformation of the formed articles. Especially, since it is possible to use long forks without increasing the size of the apparatus, it is very economical, and the formed articles can be produced with high efficiency in the series-connected press line.

The motor used in the apparatus according to the present invention is similar to the variable speed motor used in the presses, and the loading and unloading of the formed article are controlled synchronously and automatically. The sliding motion of the press and the translating motion of the apparatus are electrically combined synchronously, so that a full automatic operation of the whole press line can be realized.

Since the apparatus according to the present invention is driven by motors, the feed can be effected even when the press is stopped at the upper dead point.

Furthermore, the apparatus of the present invention can be operated independent of the driving shaft of the press, so that there is no possibility of causing damage in the driving portion of the press. Also that the apparatus according to the present invention does not hinder the placing and displacing of dies at the exchange of the dies.

In the example of the apparatus of the present invention, it is provided with two carriers which operate separately. On one of the carrier, there is provided a fork which serves only for loading, while on the other carrier, there is provided a fork which serves only for unloading, and the motion of the carrier can be operated in synchronism with the crank shaft of the press by means of the motor which controls the cam shaft synchronously.

What is claimed is:

1. Apparatus for transferring press formed articles between spaced presses comprising laterally spaced generally horizontally extending transfer rails arranged to support the formed articles between adjacent presses, an unloading carrier disposed between said transfer rails, means associated with said unloading carrier for imparting to said unloading carrier a cyclic rectangular motion consisting of a lifting, an advancing, a lowering and a retreating motion between said transfer rails where the lifting and lowering takes place in a direction transverse to the plane of said transfer rails and the advancing and retreating action takes place in the direction of said transfer rails, a loading carrier disposed between said transfer rails and spaced in the direction of said transfer rails from said unloading carrier, means associated with said loading carrier for im-

parting to said loading carrier a cyclic motion consisting of a lifting, an advancing, a lowering and a retreating motion where the lifting and lowering motion takes place transverse to the plane of said transfer rails and the advancing and retreating motion takes place in the direction of said transfer rails, a fork secured to said unloading carrier and extending in the direction of said rails for removing an article from an adjacent press, another fork secured to said loading carrier and extending in the direction of said transfer rails for inserting an article into the next adjacent press, said another fork extending from said loading carrier in the opposite direction relative to the direction of said fork secured to and extending from said unloading carrier, and an operating mechanism operatively connected to both said means associated with said unloading carrier and said means associated with said loading carrier for synchronizing the lifting and lowering motions of said carriers so that an article is removed by said unloading carrier from the adjacent press as it performs its cyclic rectangular motion and after the article is transferred along said transfer rails it is inserted into the next adjacent press by said another fork by means of the cyclic rectangular motion of said loading carrier.

2. Apparatus for transferring press formed articles between spaced presses comprising laterally spaced generally horizontally extending transfer rails arranged to support the formed articles between adjacent presses, an unloading carrier disposed between said transfer rails, means associated with said unloading carrier for imparting to said unloading carrier a cyclic rectangular motion consisting of a lifting, an advancing, a lowering and a retreating motion between said transfer rails where the lifting and lowering takes place in a direction transverse to the plane of said transfer rails and the advancing and retreating action takes place in the direction of said transfer rails, a loading carrier disposed between said transfer rails and spaced in the direction of said transfer rails from said unloading carrier, means associated with said loading carrier for imparting to said loading carrier a cyclic motion consisting of a lifting, an advancing, a lowering and a retreating motion where the lifting and lowering motion takes place transverse to the plane of said transfer rails and the advancing and retreating motion takes place in the direction of said transfer rails, a fork secured to said unloading carrier and extending in the direction of said rails for removing an article from an adjacent press, another fork secured to said loading carrier and extending in the direction of said transfer rails for inserting an article into the next adjacent press, said another fork extending from said loading carrier in the opposite direction relative to the direction of said fork secured to and extending from said unloading carrier, an operating mechanism operatively connected to both said means associated with said unloading carrier and said means associated with said loading carrier for synchronizing

the lifting and lowering motions of said carriers, and engaging members provided on said loading carrier for transferring articles along said rails removed by said unloading carrier from the press adjacent thereto, so that an article is removed by said unloading carrier from the adjacent press as it performs its cyclic rectangular motion and after the article is transferred along said transfer rails it is inserted into the next adjacent press by said another fork by means of the cyclic rectangular motion of said loading carrier.

3. Apparatus for transferring press formed articles between spaced presses comprising laterally spaced generally horizontally extending transfer rails arranged to support the formed articles between adjacent presses, an unloading carrier disposed between said transfer rails, means associated with said unloading carrier for imparting to said unloading carrier a cyclic rectangular motion consisting of a lifting, an advancing, a lowering and a retreating motion between said transfer rails where the lifting and lowering takes place in a direction transverse to the plane of said transfer rails and the advancing and retreating action takes place in the direction of said transfer rails, a loading carrier disposed between said transfer rails and spaced in the direction of said transfer rails from said unloading carrier, means associated with said loading carrier for imparting to said loading carrier a cyclic motion consisting of a lifting, an advancing, a lowering and a retreating motion where the lifting and lowering motion takes place transverse to the plane of said transfer rails and the advancing and retreating motion takes place in the direction of said transfer rails, a fork secured to said unloading carrier and extending in the direction of said rails for removing an article from an adjacent press, another fork secured to said loading carrier and extending in the direction of said transfer rails for inserting an article into the next adjacent press, said another fork extending from said loading carrier in the opposite direction relative to the direction of said fork secured to and extending from said unloading carrier, an operating mechanism operatively connected to both said means associated with said unloading carrier and said means associated with said loading carrier for synchronizing the lifting and lowering motions of said carriers, engaging members provided on said loading carrier for transferring articles along said rails removed by said unloading carrier from the press adjacent thereto, and another operating mechanism for intermittently feeding the formed article by means of the engaging members in accordance with the cyclical rectangular motion of said loading carrier, so that an article is removed by said unloading carrier from the adjacent press as it performs its cyclic rectangular motion and after the article is transferred along said transfer rails it is inserted into the next adjacent press by said another fork by means of the cyclic rectangular motion of said loading carrier.

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