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(54) **Two parallel staggered rows die forming system for approximately circular shape parts, in order to limit sheet scraps in productions by coil fed transfer presses**

(57) A two parallel staggered rows die forming system for approximately circular shape parts, in order to limit sheet scraps in productions by coil fed transfer presses. The complete system consists of:
- unwinding reel (5) of the sheet metal coil (2), straight-

ener press;
- feeder (7) of the sheet metal strip (2) to the first mould;
- Transfer press equipped with a line of dies;
- Transfer system (9) of the piece from one die to another;
- Clamping systems (26, 27) of the piece (3).

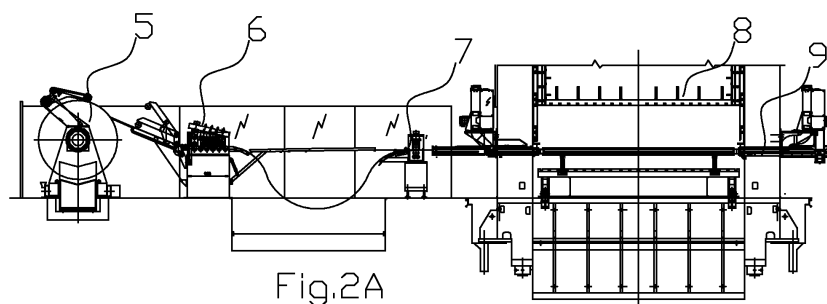


Fig.2A



Fig.2C

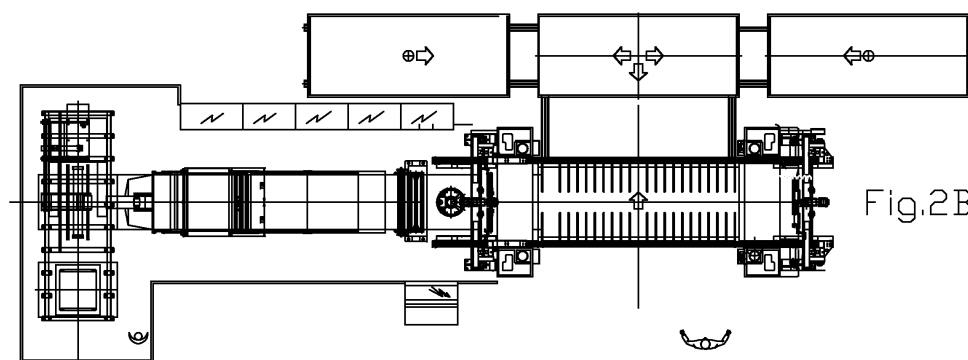


Fig.2B

Fig.2

Description

[0001] The technical field: sheet metal moulding by transfer presses fed by coil: reduction in costs of raw materials of items obtained by moulding.

[0002] Background art: the cost of the raw material also affects the cost of the moulded pieces to a very high percentage that can vary between 50% and 75% of the total cost of production. You can obtain a considerable saving in terms of material costs, optimizing the use of the sheet, so as to minimize the amount of scraps.

[0003] If it is necessary to manufacture approximately circular parts, if the starting material consists of a strip of metal sheet unwinded from a coil, the proper use of the metal sheet suggests to cut the shape of departure on the strip, not on a single row, but on rows staggered between them (Fig.1)

[0004] The transfer press normally allows you to obtain the moulded piece, with a series of dies. Dies are mounted on the press aligned with the axis of the press itself. Dies are equidistant between them and the distance is called "pitch". Pieces to be worked are transferred from one die to another, at the same time, after each stroke of the press, by means of an "iron hand" mounted on two longitudinal bars, a bar at each side of the machine.

[0005] The iron hands, during each stroke of the press ram, advance simultaneously one step the parts to be worked on the series of dies. The first die separates the blank from the strip. The blank generally consists of a flat shaped element. This element is transferred to the second die and so on. You typically use four or five dies aligned among them.

[0006] When the blank detached from the strip with the first die, after having been worked on intermediate dies, abandons the last die, it has been transformed into a part obtained by moulding.

[0007] In the dieing on staggered parallel rows with a transfer press, it is found that:

- at least one row of the figures detached from the sheet metal is misaligned with respect to the row of the dies;
- one of the two figures punched with the first die is spaced from the second mould a different value of the pitch between the subsequent moulds; the first die produces twice the subsequent moulds;
- Various systems have been used for dieing on staggered rows, with problems of space or costs.
- A first system consists in doubling the number of dies: this solution requires a more powerful press, and greater cost of equipments. Not always the demand of moulded pieces justifies the greater production.
- A second system consists in bringing out of the transfer press the first operation, feed the transfer press with a robotic system on a station aligned with the subsequent operations. This system requires the introduction of other elements of the dieing line, with

dimensions and costs that not always justify some of its advantages

- It also uses a system that, by moving across the sheet metal strip, between a stroke of the press and the other, varying at the same time, the length of the stroke of the sheet metal strip itself, feeds the first cutting die to obtain the desired effect of form on the strip two rows of punched staggered shapes. In this case also, there is a complication on all the moulding system, because to move across the sheet metal strip, it is necessary to move laterally the unwinding reel of the coil, and the feeder. This system involves greater need for space and greater cost.
- For this reason it has been studied the system which is the object of the request of the patent

TWO PARALLEL STAGGERED ROWS DIE FORMING SYSTEM FOR APPROXIMATELY CIRCULAR SHAPE PARTS, IN ORDER TO LIMIT SHEET SCRAPS IN PRODUCTIONS BY COIL FED TRANSFER PRESSES

[0008] The purpose of this system is to eliminate the disadvantages of the systems described above, achieving the aim of a substantial reduction in the weight of the sheet scraps.

[0009] The complete system consists of:

- unwinding reel of the sheet metal coil, straightener press;
- feeder of the sheet metal strip to the first mould. This is a normal feeder used to feed sheet metal strip to the presses. In this system the use of the feeder is characterized by the fact that it advances the strip one step every two shots of the press. The feeder stroke is equal to the pitch between the dies in the transfer press;
- Transfer press equipped with a line of dies. This line of dies is characterized by the fact that the first cutting die, which is used to detach from the sheet metal strip the material then will be worked on the series of dies in order to obtain the final moulded piece, is double, with the two punches that can be excluded: the punches will be excluded in correspondence of alternate strokes of the press so as to balance the production of the first blanking operation to following operations. The two punches and the two matrices, in this first cutting die, are positioned between them so as to cut out on the strip two figures that are staggered and almost tangent;
- Transfer system of the piece from one die to another. This system transfers a single piece at a time, for each stroke of the press, from the first blanking station to the second station. It is consisting of two bars that move longitudinally with respect to the press, with the stroke equal to the pitch between the moulds. These two bars have an operation equal to that of a normal transfer system on a transfer press.
- Clamping systems of the piece: the clamping sys-

- tems of the piece, which transfer the pieces that were cut on the first die, are mounted on the bars of transfer in such a way as to permit longitudinal movement and transverse movements of clamping systems themselves, in relation to the transfer bars. The transverse movement allows you to retrieve the offset of the punched piece with respect to the position of the second mould; the longitudinal movement allows you to retrieve the different length of the displacement of the figure from the first mould to the second mould, with respect to the length of the pitch.
- With the moulding system, innovative, which is the object of the present patent application, as described above, you solve the problems of moulding with rows offset:
 - The cross offset of the punched shapes with respect to the axis of the moulds, is recovered with an additional stroke of the clamping systems of the piece, with relative movement respect to the transfer bar;
 - the distance greater than the pitch of one of the two cut blanks with respect to the second mould, is recovered with a relative movement of the clamping system with respect to the transfer bar;
 - there is not an overproduction in the first mould, since at each stroke of the press only one piece is transferred.
 - Further characteristics of the invention will appear clearly from the detailed description below, which refers to a merely illustrative, not limiting embodiment, illustrated in the attached drawings, wherein:
 - Figure 1 shows the component to be produced (1) and the discs that will serve to produce it (1);
 - Figure 2A shows the side view of the transfer system;
 - Figure 2B shows a plan view of the transfer system;
 - Figure 2C represents the side view of the transfer system, perpendicular to the view of Figure 2A,
 - Figure 3 represents the mould of the first punching operation;
 - Figure 4 is the release system of punches;
 - Figure 5 is a side sectional view of the cutting die;
 - Figure 6 shows the transfer system on the transfer press.
 - Part (1) is the part to manufacture by dieing.
 - this particular to realize has a sheet blank represented by details (3) or (4). The details (3) and (4) are characterized by having a slightly different shape each other, but this diversity does not affect the final form of (1): the dieing operations later, not shown, forecast, once the drawing operation is carried out, a trimming operation which makes circular the outer edge (1). The slight differences between (3) and (4) allow to have the punches with a simple shape and the two figures can be almost tangent.
 - Figure 1A represents (3) and (4) punched simultaneously from the strip (2). During the press cycle that realizes this blanking, the part (3) is transferred onto the die of the second operation, as shown in Fig. 1B. The part (4) remains on the first cutting die. During the next cycle of the press, the strip (2) does not move forward, the punches are excluded and therefore there is no cutting of sheet metal. The part (4) is transferred onto the die of the second operation as shown in Fig. 1C.
 - In Figure 2A is a side view of the die forming system where are represented the various components: (5) the unwinding reel of the coils of sheet metal, (6) the rectifier, (7) the power supply (8) the press transfer, (9) The transfer bars.
 - The feeder is adjusted in a characteristic way and feeds the sheet, toward the first die, a step every two strokes of the press ram. The length of a forward step corresponds to the distance between two machining stations, i.e. the distance between two successive dies, mounted on the table of the press. The bars (9) have a longitudinal movement, a transverse movement toward the center of the machine, a vertical movement. Of course, these movements of bars are the same for all the parts being moulded to be transferred. To transfer parts (3) and (4) cut at the first station, these movements are not sufficient and for this, as is shown in Fig. 6, the grip systems, clamps, are mounted on the bar by means of slides that characterize the system and that allow further longitudinal and transverse movements
 - The clamp (26) which transfers the part (3), while closing grasps the particular (3). (26) is mounted on a cross-slide (24) and on a longitudinal slide (22). The slide (24) allows to retrieve the offset of the position of (3) from the central axis of the press, the slide (22) allows to retrieve the extra distance of (3) from the following work station. The extra distance of (3) from the next station depends on the offset of the two rows of blanking: this offset allows the maximum saving of raw material.
 - The clamp (27) is mounted on two cross slides: the slide (24a) and slide (25). The slide (24a) has the same stroke of the slide (24) and is used to return the particular (4) to the center. The slide (25) allows the clamp (27) a further stroke. In the cycle in which the part (3) is transferred to the next station, the clamp (27) must be raised by the transfer bar without moving (4). The slide (25) allows to place back (27) so as not to crush (4) during the vertical movements due to the movement of the bar, during the idle stroke of the same clamp (27).
 - The Figs. 6B and 6C show the movements respectively of the clamps (27) and (26) during the transfer of the part (3): the clamps are advancing toward the center together with bars (9), stroke represented by the vector (23). The clamp (26) grabs the component (3)
 - the clamps rise together with the bars (9),
 - the clamps move longitudinally one step, this stroke is represented by the vector (21),
 - The clamp (26) continues its longitudinal stroke, represented by the vector (22a), to retrieve the pitch

difference,

- the clamp (26) advances toward the center, vector (-24a),
- the clamps are lowered together with bars (9),
- the clamp (26) opens and deposits (3) on the second station. 5
- The bars are widening, vectors (23) and (-23),
- the clamp (26) goes back to its initial position with the stroke represented by the vector (24a),
- the bars(9) return to the starting point with the movement indicated by the vector (-21). 10
- The Figs. 6A and 6D show the movements respectively of the clamps (27) and (26) during the transfer of the part (4):
- the clamps are advancing toward the center together with bars (9), stroke represented by the vector (23),
- the clamp (27) further advances as indicated with the vector (25a) and closes by grasping the component (4) 15
- the clamps rise together with the bars (9), 20
- the clamps move longitudinally one step, stroke represented by the vector (21)
- The clamp (27) advances toward the center, vector (24a),
- the clamps are lowered together with bars (9), 25
- the clamp (27) opens and deposits (4) on the second station.
- The bars are widening, vectors (23) and (-23),
- the clamp (27) goes back to its initial position, with respect to its bar, with the strokes represented by vectors (-24a) and (-25a), 30
- the bars(9) return to the starting point with the movement indicated by the vector (-21).
- The die of the first operation, blanking, must have the two punches that can be excluded. Figg.3 and 4 represent the design of a die which punches can be excluded, suitable for the functioning of this system which is the object of this patent application. 35
- Figure 3A shows the lower part of the die,
- (11) lower blank holder, 40
- (10) matrix,
- figure 3B represents the top of the die.
- (12)upper intermediate plate ,
- (13) upper blank holder ,
- (14) punches, 45
- (15) upper base.
- Figures 4a and 4B represent the upper part of the open die.
- (16) sliding plate
- (17) pneumatic cylinders driving slide plate 50
- (18) cylindrical pressure blocks fixed on the sliding plate
- (19) hollow for blocks (18), to disengage the punches
- (20) cylindrical inserts of reaction attached to the top base 55
- Figure 5 shows a section of the die of the first cutting operation. In detail B you can see the positioning of the blocks (18) resting on blocks (20) at the moment

in which the punches are inserted. In detail C can be seen that the punches are fixed on the movable plate (12) and that therefore if the sliding plate (16) is positioned in such a way that blocks (18) are in the region of the cavity (19), the mobile plate (12) is pushed upward by the sheet metal holder (11) and the blanking does not take place.

- The sliding plate (16) is controlled by the two pneumatic cylinders (17).

Claims

1. two parallel staggered rows die forming system for approximately circular shape parts, in order to limit sheet scraps in productions by coil fed transfer presses , made of:

- (5) the unwinding reel of the coils of sheet metal, (6) the rectifier, (7) the power supply (8) the press transfer, (9) The transfer bars.

- The feeder is adjusted in a characteristic way and feeds the sheet, toward the first die, a step every two strokes of the press ram. The length of a forward step corresponds to the distance between two dies, i.e. the distance between two successive dies, mounted on the table of the press.

- Blanking die, first operation, blanking with punches that can be excluded. The die cuts on the sheet metal strip two disks at the same time. The discs are cut in a staggered manner, with the characteristic arrangement called a "Quinconce" (Fig.1)

During the stop of the feeder, the punches are excluded.

Figure 5 shows a section of the die of the first cutting operation. In detail B you can see the positioning of the blocks (18) resting on blocks (20) at the moment in which the punches are inserted.

In detail C can be seen that the punches are fixed on the movable plate (12) and that therefore if the sliding plate (16) is positioned in such a way that blocks (18) are in the region of the cavity (19), the mobile plate (12) is pushed upward by the blank holder (11) and the blanking does not take place.

The sliding plate (16) is controlled by the two pneumatic cylinders (17) The grip systems, clamps, are mounted on the bar by means of slides that characterize the system and allow further longitudinal and transversal movements. At each stroke of the press a part is fed from the first blanking station to the second station.

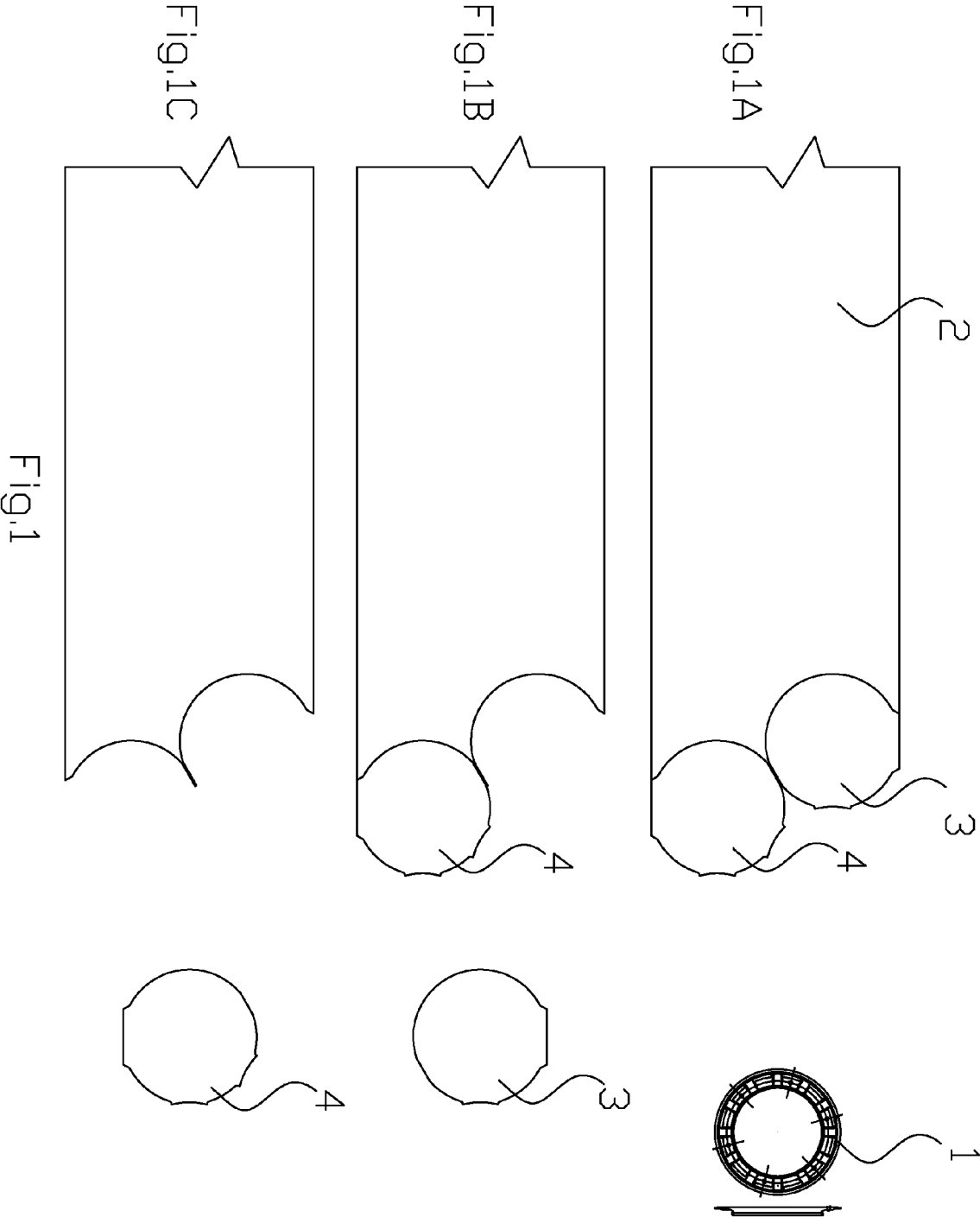
The clamp (26) which transfers the part (3), when closing, clamps the part (3). (26) is mounted on a cross-slide (24) and on a longitudinal

slide (22). The slide (24) allows to retrieve the offset of the position of (3) from the central axis of the press, the slide (22) allows to retrieve the extra distance of (3) from the following work station. The extra distance of (3) from the next station depends on the offset of the two rows of blanking: this offset allows the maximum saving of raw material. The clamp (27) is mounted on two cross slides: the slide (24a) and slide (25). The slide (24a) has the same stroke of the slide (24) and is used to return the particular (4) to the center. The slide (25) allows the clamp (27) a further stroke. In the cycle in which the part (3) is transferred to the next station, the clamp (27) must be raised by the transfer bar without moving (4). The slide (25) allows to place back (27) so as not to crush (4) during the vertical movements due to the movement of the bar, during the idle stroke of the same clamp (27). The Figs. 6B and 6C show the movements respectively of the clamps (27) and (26) during the transfer of the part (3):

the clamps are advancing toward the center together with bars (9), stroke represented by the vector (23). The clamp (26) grabs the component (3)
the clamps rise together with the bars (9), the clamps move longitudinally one step, this stroke is represented by the vector (21), the clamp (26) continues its longitudinal stroke, represented by the vector (22a), to retrieve the pitch difference,
the clamp (26) advances toward the center, vector (-24a),
the clamps are lowered together with bars (9),
the clamp (26) opens and deposits (3) on the second station
The bars are widening, vectors (23) and (-23),
the clamp (26) goes back to its initial position with the stroke represented by the vector (24a),
the bars(9) return to the starting point with the movement indicated by the vector (-21).
The Figs. 6A and 6D show the movements respectively of the clamps (27) and (26) during the transfer of the part (4):

the clamps are advancing toward the center together with bars (9), stroke represented by the vector (23),
the clamp (27) further advances as indicated with the vector (25a) and closes by grasping the component (4)
the clamps rise together with the bars (9),

the clamps move longitudinally one step, stroke represented by the vector (21),
the clamp (27) advances toward the center, vector (24a),
the clamps are lowered together with bars (9),
the clamp (27) opens and deposits (4) on the second station.
the bars are widening, vectors (23) and (-23),
the clamp (27) goes back to its initial position, with respect to its bar, with the strokes represented by vectors (-24a) and (-25a),
the bars(9) return to the starting point with the movement indicated by the vector (-21).



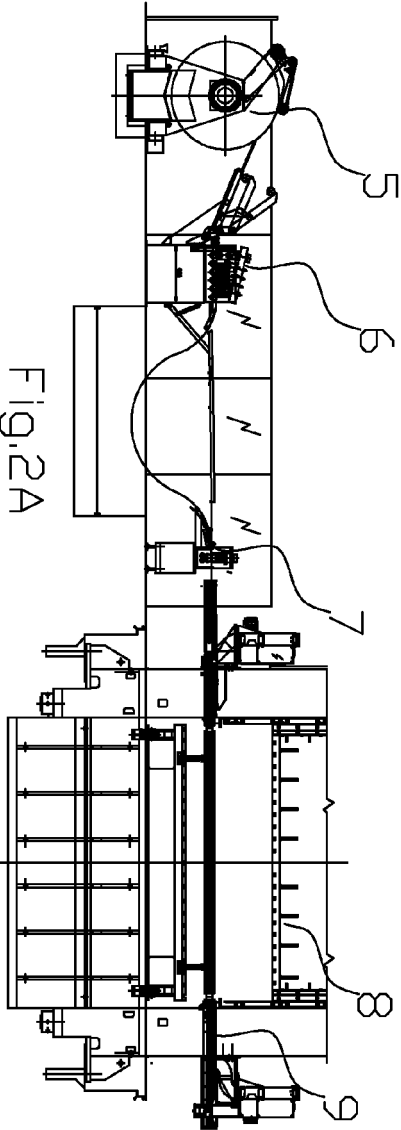


Fig. 2A

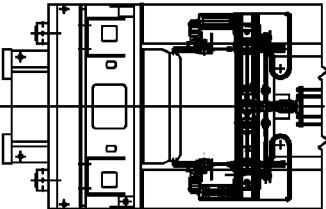


Fig. 2C

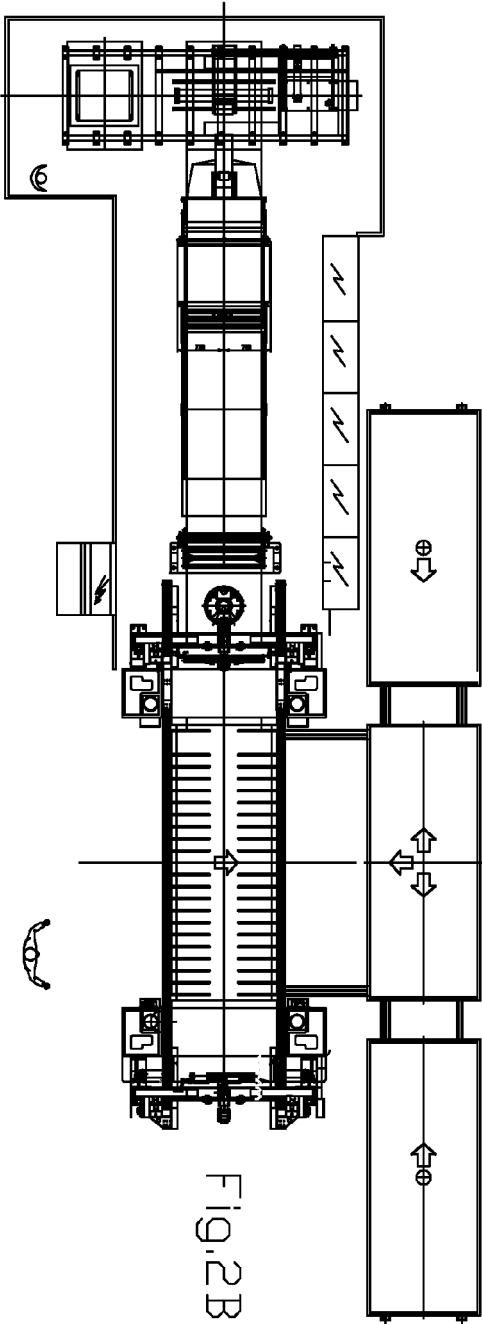
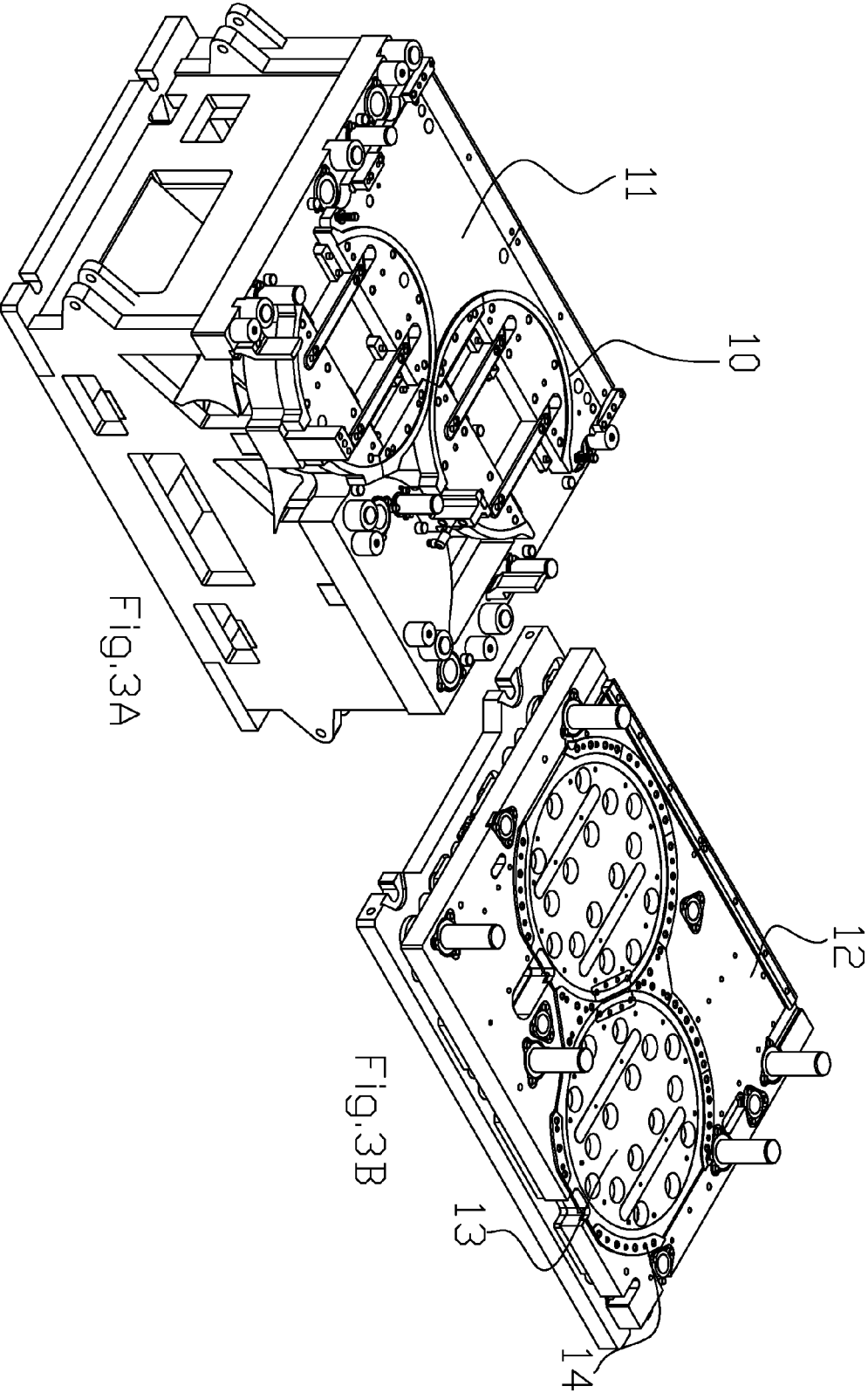
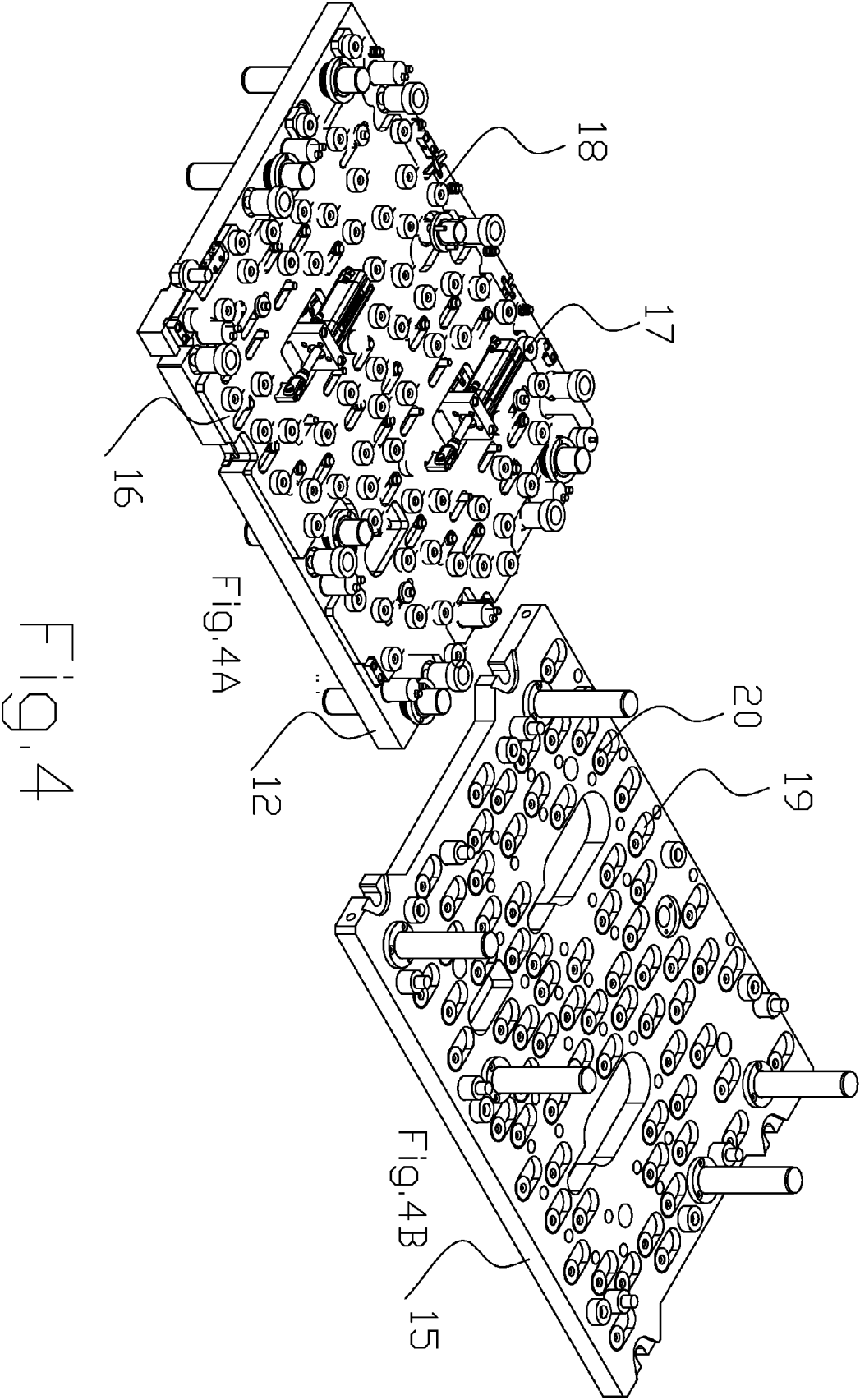


Fig. 2





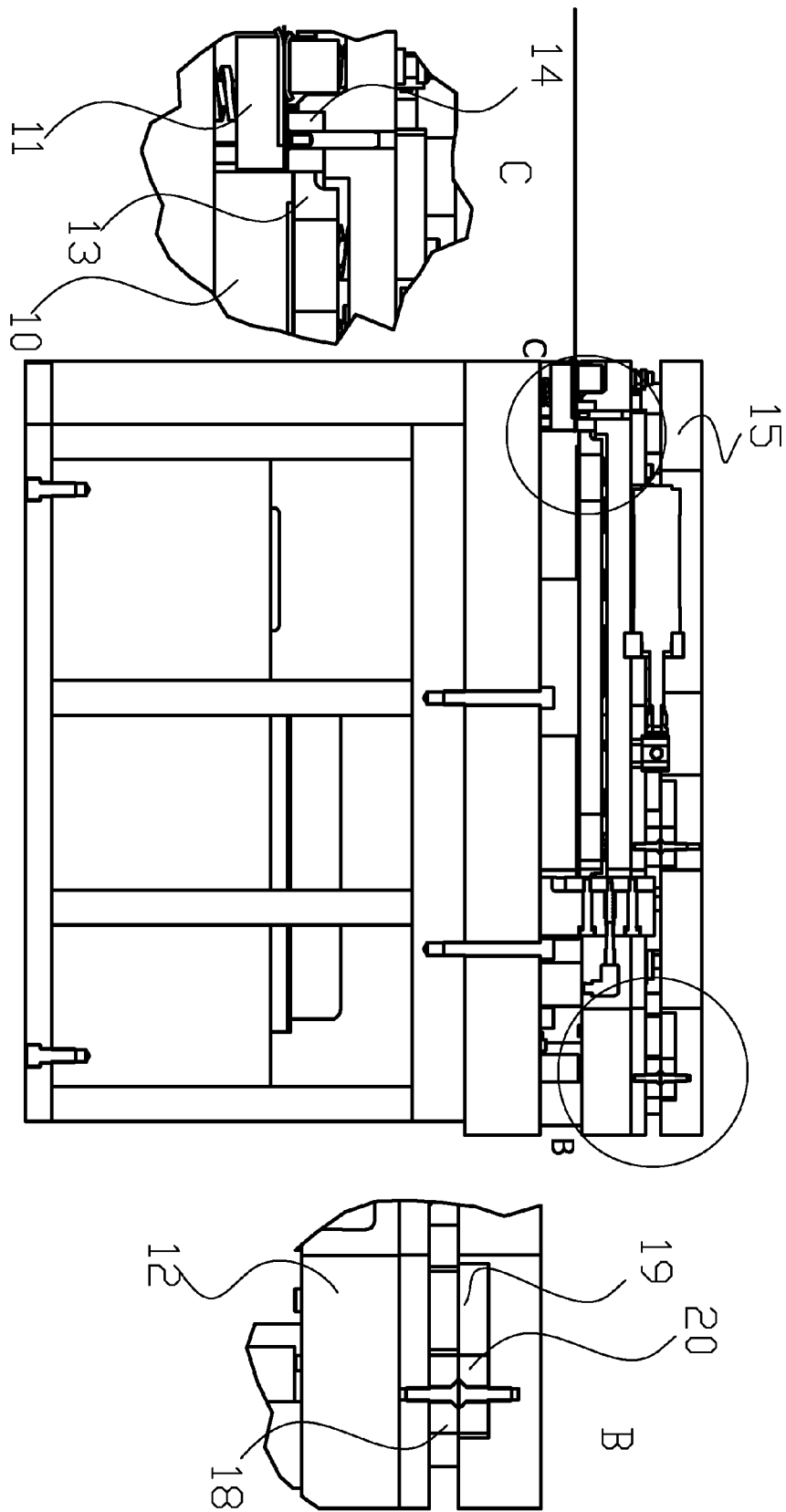
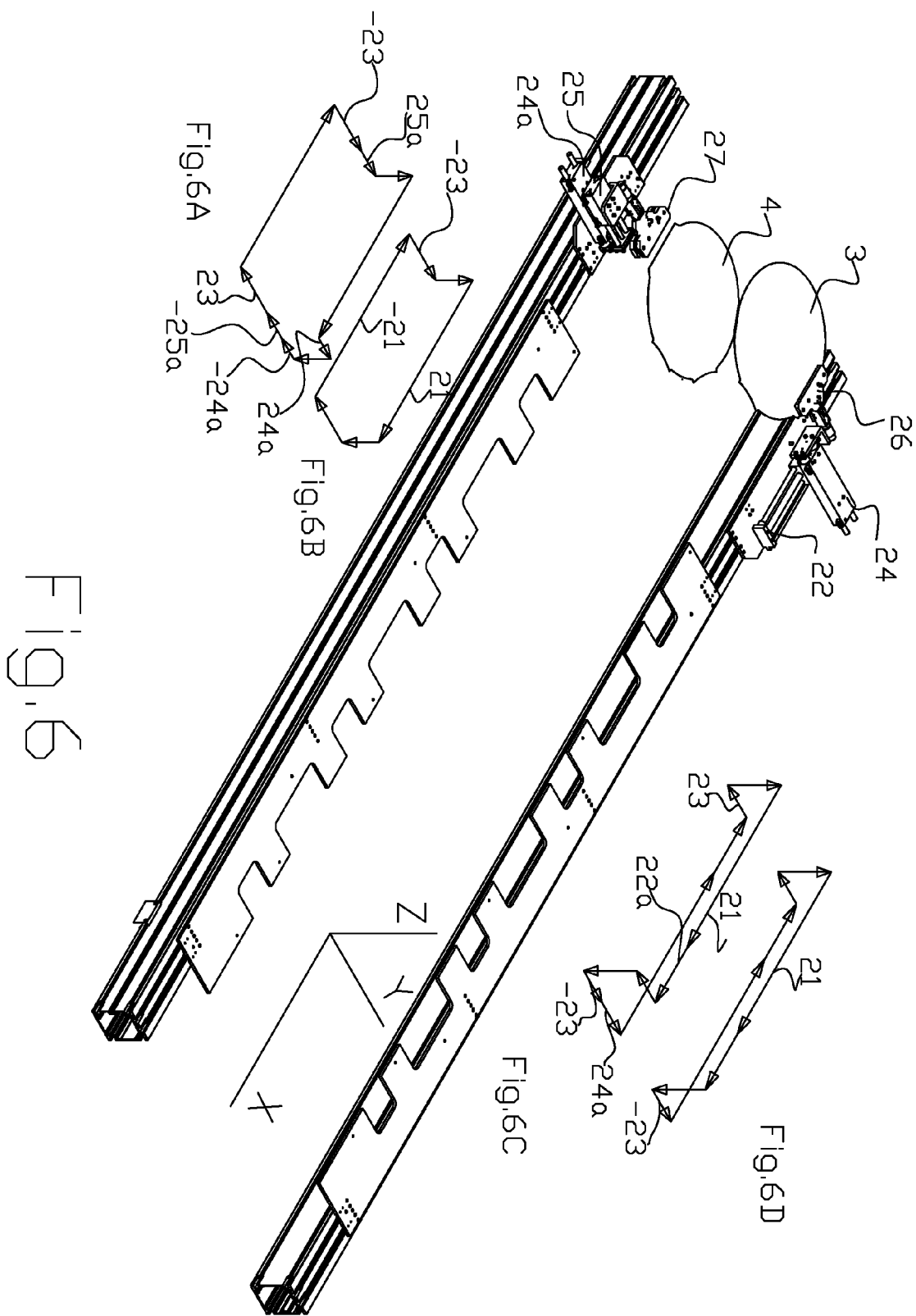


Fig. 5





EUROPEAN SEARCH REPORT

Application Number
EP 13 16 9938

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 3 589 221 A (DEEGAN JAMES J) 29 June 1971 (1971-06-29) * abstract; figures 1,3,6 *	1	INV. B21D28/06 B21D43/02
Y	FR 2 350 900 A1 (WARNKE UMFORMTECH VEB K [DD]) 9 December 1977 (1977-12-09) * figures 1,3,4 *	1	
Y	JP S59 47099 A (MATSUSHITA ELECTRIC IND CO LTD) 16 March 1984 (1984-03-16) * abstract; figures 3-6 *	1	
A	FR 2 237 698 A1 (IWK PRESSEN GMBH [DE] SOLVAY [DE]) 14 February 1975 (1975-02-14) * figures 1-6 *	1	
A	JP 2012 152813 A (AISIN AW CO) 16 August 2012 (2012-08-16) * figures 1-16 *	1	
A	JP S55 165234 A (FUTAKI MASATOSHI) 23 December 1980 (1980-12-23) * abstract; figures 1,2,6 *	1	TECHNICAL FIELDS SEARCHED (IPC)
A	JP S57 50225 A (FUJITA HARUJI; KIKUCHI YOSHIKATSU) 24 March 1982 (1982-03-24) * abstract; figures 1-7 *	1	B21D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 October 2013	Examiner Cano Palmero, A
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 16 9938

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15-10-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3589221 A	29-06-1971	NONE	
FR 2350900 A1	09-12-1977	CS 202686 B1 DD 135972 A3 DE 2719075 A1 FR 2350900 A1 HU 179811 B IT 1116442 B JP S5314303 A JP S6032435 B2 PL 198025 A1 SE 423794 B SE 7705544 A SU 685391 A1	30-01-1981 13-06-1979 24-11-1977 09-12-1977 28-12-1982 10-02-1986 08-02-1978 27-07-1985 02-01-1978 07-06-1982 15-11-1977 15-09-1979
JP S5947099 A	16-03-1984	NONE	
FR 2237698 A1	14-02-1975	DE 2336534 A1 FR 2237698 A1 GB 1483757 A IT 1019694 B	06-02-1975 14-02-1975 24-08-1977 30-11-1977
JP 2012152813 A	16-08-2012	NONE	
JP S55165234 A	23-12-1980	JP S5738331 B2 JP S55165234 A	14-08-1982 23-12-1980
JP S5750225 A	24-03-1982	JP S5750225 A JP S6036847 B2	24-03-1982 22-08-1985

EPO FORM P0459

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