(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 027 971 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.08.2000 Bulletin 2000/33

(21) Application number: **98106179.9**

(22) Date of filing: **03.04.1998**

(51) Int Cl.[7]: **B28B 5/04**, B28B 13/02, B28B 7/08, B28B 7/38, B28B 7/00

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **08.04.1997 IT SI970001 U**

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(54) automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling of any shape by using very moist clay to form parts having a shape similar to hand-manufactured products

(57) An automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling components of any shape comprises: a moist clay mixer (2); a part forming machine (3); a station (4) for supporting a mold holder (5) provided with means for fixing at least one mold, the station being arranged below the forming machine; a unit (6) for the wire cutting of the formed parts; and a transfer line for the mold holder (5).

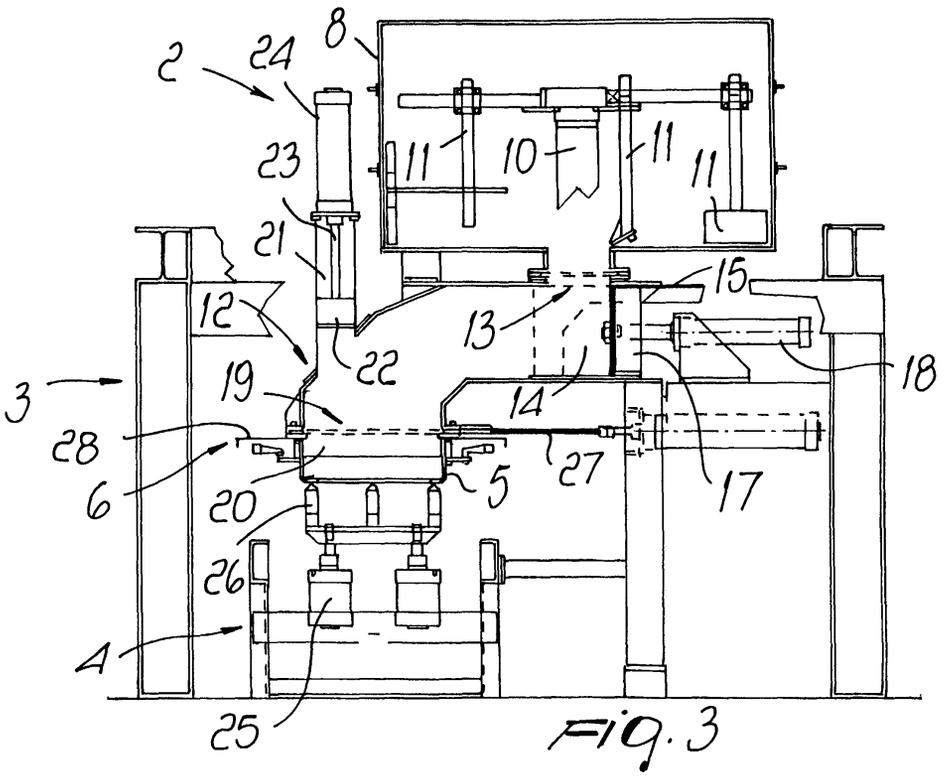

Fig. 3

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Description

[0001] The present invention relates to an automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling of any shape.

[0002] Currently the production of tiling in general entails using conventional vacuum drawing systems or, as an alternative, systems which are adapted to manufacture the individual parts with characteristics which are similar to those of hand-made bricks, using clays which are mixed with water and loaded in specifically provided molds to give the final shape to the parts to be produced.

[0003] These systems include equipment which allows to obtain products which are particularly interesting both for restoring historical buildings and for building new structures and are aimed, as mentioned, at obtaining parts which, by filling molds with very moist clay, resemble as closely as possible those obtained manually.

[0004] Some of these systems comprise a conveyor chain to which a plurality of molds are applied; said molds are conveyed below a clay feeding hopper to simultaneously fill one or more side-by-side molds.

[0005] These systems are not free from drawbacks, including the fact that since the molds are fixed to the chain, changing the type of part to be produced entails replacing all the molds and/or the chain itself and accordingly entail considerable downtimes, which are detrimental to productivity, and high tooling costs.

[0006] Moreover, these systems provide for a preset position of the clay feeding hopper with respect to the molds which entails inevitable friction and wear due to the mutual sliding of the mold and the outlet of the hopper.

[0007] Systems using free-moving molds are known as an alternative to these systems: some of said systems with free-moving molds provide for a preset position of the clay feeding hopper with respect to the molds, with the same drawbacks mentioned above, while other systems entail filling the free-moving molds by pouring the corresponding doses of clay.

[0008] However, in this case the molds are filled inaccurately, requiring additional operations for spreading, pressing and skimming the molds, with problems in terms of recovering the clay that has escaped from the molds during the additional operations owing to inaccurate mold filling.

[0009] The aim of the present invention is to eliminate the above drawbacks of conventional systems, providing an automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling components of any shape which allows to perfectly dose the clay during mold filling, to eliminate additional pressing, skimming and dosage operations, to adjust the mold filling pressure and to reduce friction and wear between the mold and the clay outlet.

[0010] The system according to the invention further allows high operating flexibility and increases productivity, reducing both downtimes and tooling costs.

[0011] Within the scope of this aim, an object of the present invention is to achieve the above aim with a structure which is simple, relatively easy to provide in practice, safe to use, effective in operation, and has a relatively low cost.

[0012] This aim and this object are both achieved by an automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling components of any shape, characterized in that it comprises: a moist clay mixer; a part forming machine; a station for supporting a mold holder provided with means for fixing at least one mold, said station being arranged below said forming machine; a unit for the wire cutting of the formed parts; and a transfer line for said mold holder.

[0013] Further characteristics and advantages of the present invention will become apparent from the detailed description of a preferred but not exclusive embodiment of an automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling components of any shape, according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a plan view of an automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling components of any shape, according to the invention;

Figure 2 is a front view of the mixer and of the forming machine of the system according to the invention;

Figure 3 is a side view of the mixer and of the forming machine of Figure 2;

Figure 4 is a front view of the mold holder of the system according to the invention;

Figure 5 is a side view of the mold holder of Figure 4;

Figure 6 is a top view of the mold holder of Figure 4;

Figure 7 is a plan view of an alternative embodiment of the system according to the invention.

[0014] With particular reference to the above figures, the reference numeral 1 generally designates an automatic system or apparatus for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling components of any shape, according to the invention.

[0015] The system 1 is constituted by a moist clay mixer 2, a part forming machine 3, a station 4 for supporting a mold holder 5 located below the machine 3, a unit 6 for wire-cutting the formed parts and a line 7 for transferring the mold holder 5.

[0016] Figures 2 and 3 are views of a mixer 2 of the rotary type, which comprises a tank 8 which has a vertical axis to which the clay is sent, through a feeder conveyor 9, after being already mixed and moistened by other devices arranged upstream.

[0017] The tank 8 is cylindrical and is internally provided with a central rotating shaft 10 which has radially

arranged blades and skimming elements 11 that provide distinct functions for mixing, moving the moist clay radially as well, and for removal from the walls of the tank 8.

[0018] The forming machine 3 has a clay filling and pressing chamber 12 which is arranged below the tank 8 of the mixer 2 and is connected thereto through an inlet 13, through which the overlying clay is conveyed.

[0019] The chamber 12 has a first tubular portion 14 at which the inlet 13 is tangent to the chamber 12; a guillotine 15 can be interposed which is associated with actuation means 16 adapted to move it from a configuration in which the inlet 13 is open to one in which said inlet is closed.

[0020] The machine 3 comprises a piston 17 which is installed so that it can move longitudinally in the portion 14 of the chamber 12 and is associated with a fluid-actuated jack 18 whose actuation in one direction, with the guillotine 15 in the closing configuration, is adapted to propel the clay inside the chamber 12 towards an opening 19 for loading the clay into a mold 20 of the underlying mold holder 5.

[0021] Once the chamber 12 has been filled and before propelling the mass of clay, the guillotine 15 is closed so as to prevent the clay from flowing back towards the tank 8.

[0022] The propelling action is performed by the piston 17, which moves forward all of the continuous mass of clay until the mold 20 is filled.

[0023] The actuation of the jack in the opposite direction, with the guillotine 15 in the open configuration, is instead adapted to suck the clay from the tank 8.

[0024] This operation occurs during the cutting of the underlying clay, and while the opening of the guillotine 15 produces an immediate inflow of clay from the overlying mixer 2, the simultaneous retraction of the piston 7 allows to fill the chamber 12.

[0025] Conveniently, the chamber 12 is provided with a first cylinder 21 which has a vertical axis and inside which the excess clay is accumulated simultaneously with the filling of the underlying mold 20.

[0026] The cylinder 21 contains a hermetic secondary piston 22 which, by means of a stem 23, is rigidly connected to a second cylinder 24 of the pneumatic or fluid-actuated type.

[0027] An adjustable pressure is set in the upper chamber of the second cylinder 24 and, by means of the secondary piston 22, produces a counterpressure which determines the actual pressing pressure of the clay inside the mold 20.

[0028] By varying this counterpressure, it is possible to obtain components having different densities and degrees of mold filling. By acting on this parameter also during production, it is possible to obtain mutually different products, as indeed occurs in manual-type production.

[0029] The supporting station 4 is arranged below the filling opening 19 of the chamber 12 and has elements 25 for quickly lifting and lowering the mold holder 5 in two steps.

[0030] The elements 25 comprise a grid 26 adapted to lift the mold holder 5 from the transfer level and to position the mold 20 so that it adheres to the filling opening 19.

[0031] The filling opening 19 is provided with closure means 27 of the fluid-actuated type which are controlled so as to facilitate maintenance or replacement of said opening.

[0032] The dimensions of the opening 19 are chosen so that it couples hermetically to the mold 20 to be filled, so as to allow the pressurized clay to pass from the chamber 12 to the mold 20 without any outward loss of excess clay.

[0033] The cutting unit 6 is constituted by a wire 28 which is supported and stretched between two lateral supports, not shown in the various figures, which are associated with movement means adapted to pass the wire 28 between the filling opening 19 and the mold 20.

[0034] The mold holder 5, which accommodates the mold 20 to be filled, is moved below the opening 19 by a device of the quick-moving pilgrim-progress type or by a transfer chain (for smaller productions); once in position, it is lifted by the moving grid 26 until it adheres to the filling opening 19.

[0035] Once filling has been completed, the moving grid 26 descends to a cutting level which lies directly below the filling level, depositing the mold holder 5 on the quick-moving device so as to space the mold 20 slightly from the opening 19 and allow the wire 28 to separate the flow of clay that fills the mold 20 from the rest of the flow inside the chamber 12.

[0036] Then the mold holder 5 is lowered to the transfer level and then moved forward so as to make the mold 20 exit from the forming machine 3 without causing any friction and/or wear between the opening 19 and said mold and between the component and the clay remaining in the opening.

[0037] With this step, the operation for filling and skimming of the mold is fully concluded and, as implicitly described, occurs in a single station.

[0038] Once filling of the mold 20 has been completed, the mold holder 5 advances along the transfer line 7, on which the following elements are installed in succession: a station 29 for placing the mold holders mutually adjacent; a station 30 for resting an inverted platform on the mutually adjacent mold holders; a station 31 for overturning the mold holders together with the associated platform; a station 32 for emptying the molds; a cleaning station 33; a sanding station 34; and a mold holder overturning station 35.

[0039] At the station 29 for arranging the mold holders adjacent to each other, the mold holder 5 is arranged laterally adjacent to the mold holders that precede it or follow it, so as to form a compact group 36 whose length approximately corresponds to the length of a platform 37 superimposed thereon in the subsequent resting station 30.

[0040] The mold holders are arranged mutually side by side automatically, and the platforms 37 are placed on the respective groups 36 through automatic-movement means such as a mechanical arm 38 which removes the platform from a conveyor line 39 or, as an alternative, from a previously accumulated stack.

[0041] It is also possible to use, instead of the above platforms, individual platforms whose number and dimensions correspond to those of the individual mold holders.

[0042] The groups 36, with corresponding platforms 37, arrive in succession at the overturning station 31, which turns each group through 180 degrees for the subsequent operation for emptying the molds and releasing the components contained therein.

[0043] In Figure 1, the group/bed assembly is transferred laterally by means of a rotation through 180 degrees which transfers the overturned assembly to an auxiliary advancement line 40 arranged to the side of the line 7.

[0044] As an alternative, in the embodiment of Figure 7 the auxiliary advancement line is not provided and the units are overturned coaxially to the transfer line 7.

[0045] The subsequent station 32 for emptying the molds 20 is constituted by a clamp which, by means of a pick-and-place device 42 with double lateral grip, removes the mold holders 5 and, with a lifting movement accompanied by a vertical-type vibration, empties the molds 20, releasing the components onto the platform 37, and sends the mold holders 5 along the transfer line 7.

[0046] Simultaneously, the components extracted from the molds 20 and placed on the platforms 37 are sent, with conventional devices, to the subsequent processing steps.

[0047] In the cleaning station 33, the mold holders 5, with the corresponding molds 20, are cleaned in a sort of tank 43 with jets of pressurized water that arrive from a plurality of finely perforated ducts arranged in a downward region or as in the solution of Figure 7, in which the molds are cleaned while they move by means of movable and/or fixed nozzles.

[0048] Advantageously, between the cleaning station 33 and the sanding station 34 a station 44 is provided for partially drying the cleaned mold holders by aspirating the larger water droplets.

[0049] The sanding station 34 is located downstream of the cleaning station and comprises a centrifugal vane sandblasting machine with an adjustable supply of sand, powder, wood sawdust or other materials.

[0050] It is possible to arrange, sequentially after the sandblasting machine, a station for treating the molds 20 with vegetable/mineral oil or release agent which has a tank for recovering the excess product.

[0051] At the overturning station 35, the mold holders 5 are rotated through 180 degrees so that the molds 20 are directed upwards again.

[0052] Finally, it is possible to provide a station 45 for treating the molds 20 with wood sawdust or powders, particularly chamotte powder for producing non-sanded material; the molds exit from said station ready for a new forming operation.

[0053] Figures 4, 5 and 6 illustrate a mold holder 5 according to the invention. As mentioned, the dimensions of the mold holder are chosen according to the maximum dimension of the filling opening 19 or in any case according to the dimensions of the parts to be manufactured, and the mold holder is provided with means 46 for fixing at least one mold 20.

[0054] The mold holder comprises a container 47 which is shaped like a parallelepiped and constitutes a casing in which the molds 20 are inserted regardless of their size: molds having different dimensions and shapes can also be installed in a same mold holder.

[0055] Two lateral wings 48 are located laterally to the container 47 and are used as sliding surfaces for the mold holder along the transfer line 7 so that although the dimensions and the thickness of the installed molds vary, the sliding surfaces remain unchanged and require no additional adjustment.

[0056] In each mold holder 5, the mold can be replaced easily by simply removing the fixing means 46, constituted for example by eight conventional bolts.

[0057] Conveniently, it is also possible to provide on the mold holder a mechanism for opening one of the sides of the mold, so that it is optionally possible to produce also components having undercut surfaces.

[0058] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0059] Moreover, all the details may be replaced with other technically equivalent ones.

[0060] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the protective scope of the appended claims.

[0061] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An automatic system for manufacturing standard and special bricks, floor tiles, plain roofing tiles and other tiling components of any shape, characterized in that it comprises: a moist clay mixer; a part forming machine; a station for supporting a mold holder provided with means for fixing at least one mold, said station being arranged below said forming machine; a unit for the wire cutting of the formed parts; and a transfer line for said mold holder.

2. A system according to claim 1, characterized in that said forming machine comprises at least one clay filling and pressing chamber which is located below said mixer and is connected thereto through an inlet.

3. A system according to claim 2, characterized in that said chamber has a first tubular portion and in that said inlet is tangent to said first portion.

4. A system according to claim 2, characterized in that said forming machine has a guillotine-type device for closing said inlet which is associated with actuation means adapted to move it from a configuration in which said inlet is open to a configuration in which said inlet is closed.

5. A system according to claim 4, characterized in that said forming machine comprises a piston which is installed so that it can move longitudinally in said first portion of the chamber and is associated with a fluid-actuated jack whose actuation in one direction, with the guillotine in the closure configuration, is adapted to propel the clay inside said chamber towards an opening for loading the clay into an underlying mold, while actuation in the opposite direction, with the guillotine in the opening configuration, is adapted to suck clay from said mixer.

6. A system according to claim 5, characterized in that said chamber is connected to a cylinder for accumulating the excess clay, inside which a secondary piston can slide hermetically, said secondary piston being rigidly connected to a cylinder in the chamber of which an adjustable pressure is set, said pressure being adapted to determine, by means of said secondary piston, a counterpressure which determines the actual pressing pressure of the clay in the underlying mold.

7. A system according to claim 5, characterized in that said supporting station is located below said chamber filling opening.

8. A system according to claim 1, characterized in that said wire cutting unit is constituted by a wire which is stretched and supported between two lateral supports which are associated with movement means adapted to pass the wire between said forming machine and said mold.

9. A system according to claim 1, characterized in that said wire cutting unit is adapted to perform skimming at said molding machine.

10. A system according to claim 1, characterized in that the following stations are installed on said transfer line: a station for arranging mold holders mutually adjacent in groups; a station for resting a platform on each group of mold holders; a station for overturning the group with the corresponding platform; a mold emptying station; at least one station for cleaning, sanding, treating with powders or release agent and for overturning the mold holders.

11. A system according to claim 1, characterized in that said mixer is of the rotary type, comprises a tank which has a vertical axis and is provided with vanes adapted to mix, homogenize and remove the clay from the walls of the tank.

12. A system according to claim 1, characterized in that said supporting station has elements for quickly lifting and lowering, in two steps, said mold holder in order to move the mold from a transfer level to a filling level, then to a cutting level which lies directly below the filling level, and finally to a transfer level.

13. A system according to claim 12, characterized in that said lifting and lowering elements comprise a grid which is adapted to lift said mold holder and to position said mold so that it adheres to said filling opening.

14. A system according to claim 10, characterized in that said supporting station is provided with automatic platform feeding and handling.

15. A system according to claim 10, characterized in that said overturning station comprises automatic means which are adapted to rotate through 180 degrees each group of mold holders with the corresponding platform.

16. A system according to claim 10, characterized in that said mold emptying station comprises at least one automatically-actuated clamp adapted to lift the mold holder and to produce a vertical vibration for the release of the part from the corresponding mold.

17. A system according to claim 16, characterized in that said clamp is of the vibrating type.

18. A system according to claim 10, characterized in that said cleaning station comprises, in a downward region, a plurality of finely perforated ducts for feeding pressurized water.

19. A system according to claim 18, characterized in that said ducts are of the orientatable type.

20. A system according to claim 10, characterized in that said cleaning station comprises a plurality of spray nozzles which are adapted to clean said mold holders as they move along said transfer line.

21. A system according to claim 10, characterized in that it comprises a station for drying said mold holders between said cleaning station and said sandblasting station.

22. A system according to claim 10, characterized in that said sandblasting station comprises a centrifugal vane sandblasting machine with adjustable feeding of sand, dust or wood sawdust.

23. A system according to claim 10, characterized in that upstream of said mold holder overturning station a station is provided for treating the mold with vegetable/mineral oil or release agent.

24. A system according to claim 10, characterized in that downstream of said mold holder overturning station a station is provided for treating the mold with powder for example chamotte powder.

25. A system according to claim 1, characterized in that said mold holder comprises a container which is shaped substantially like a parallelepiped and on which at least one mold is insertable, said container being laterally extended by two flat wings adapted to slide along said transfer line.

26. A system according to claim 25, characterized in that the relative distance between said wings and the top of the inserted mold is constant.

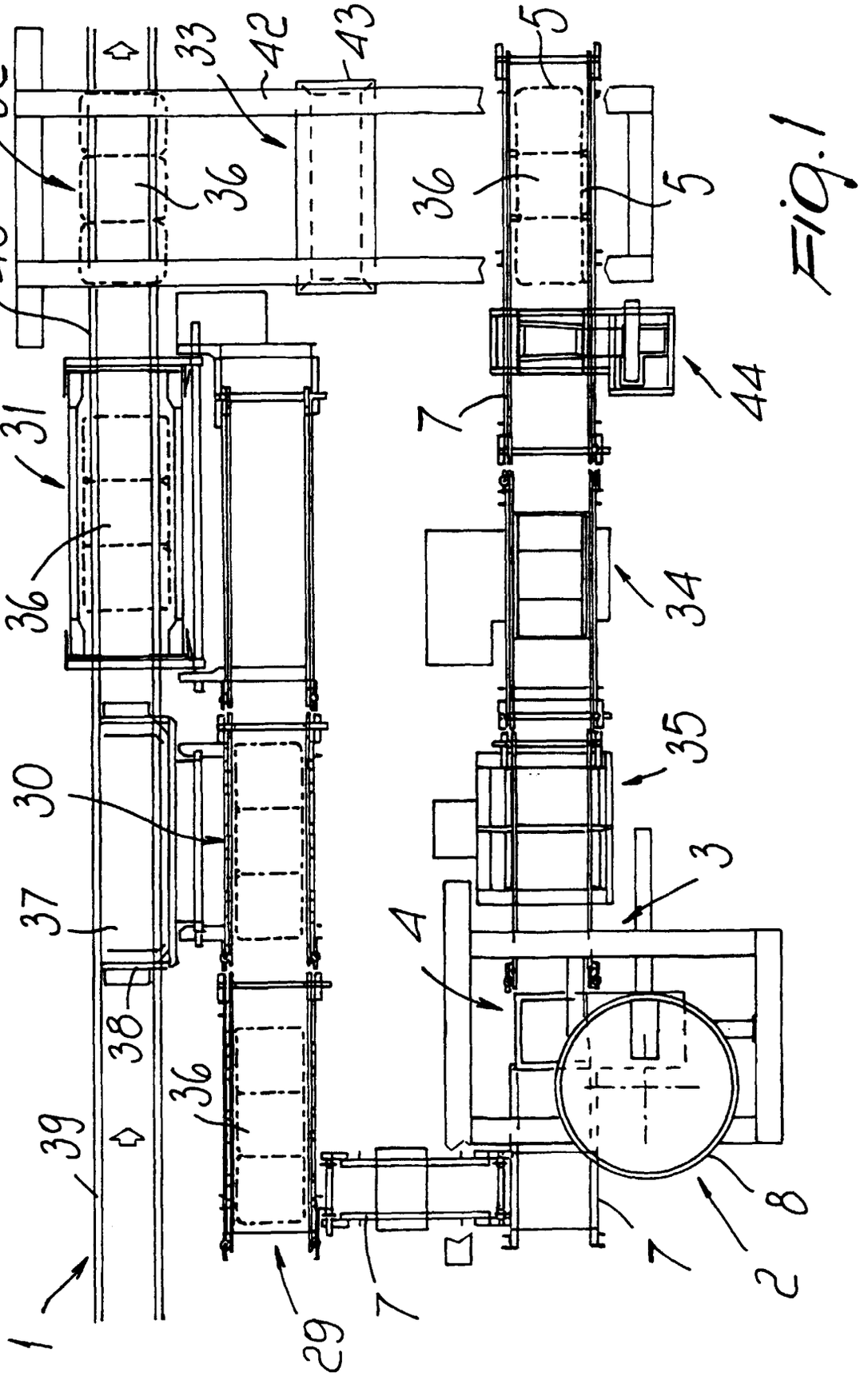

Fig. 1

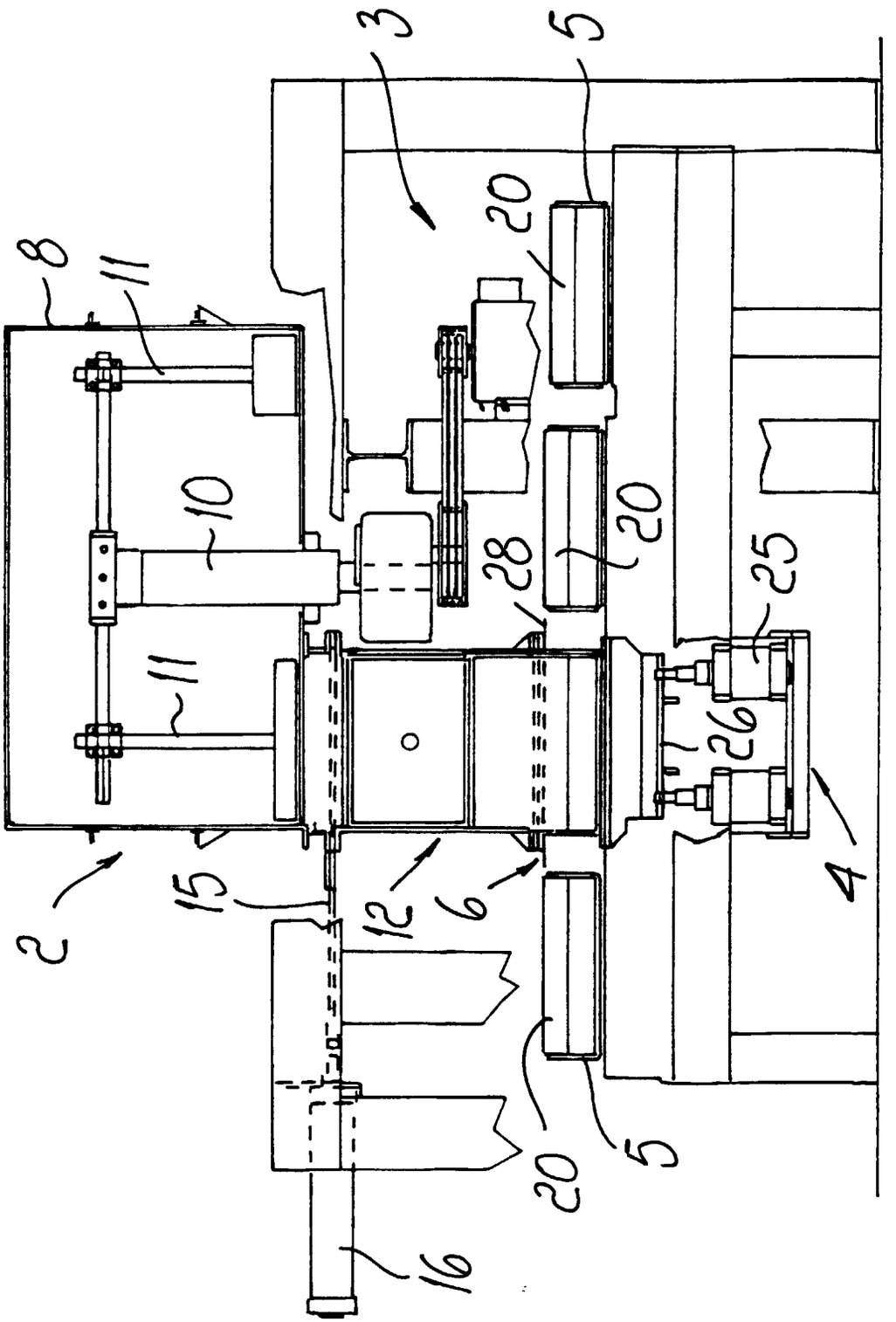

Fig. 2

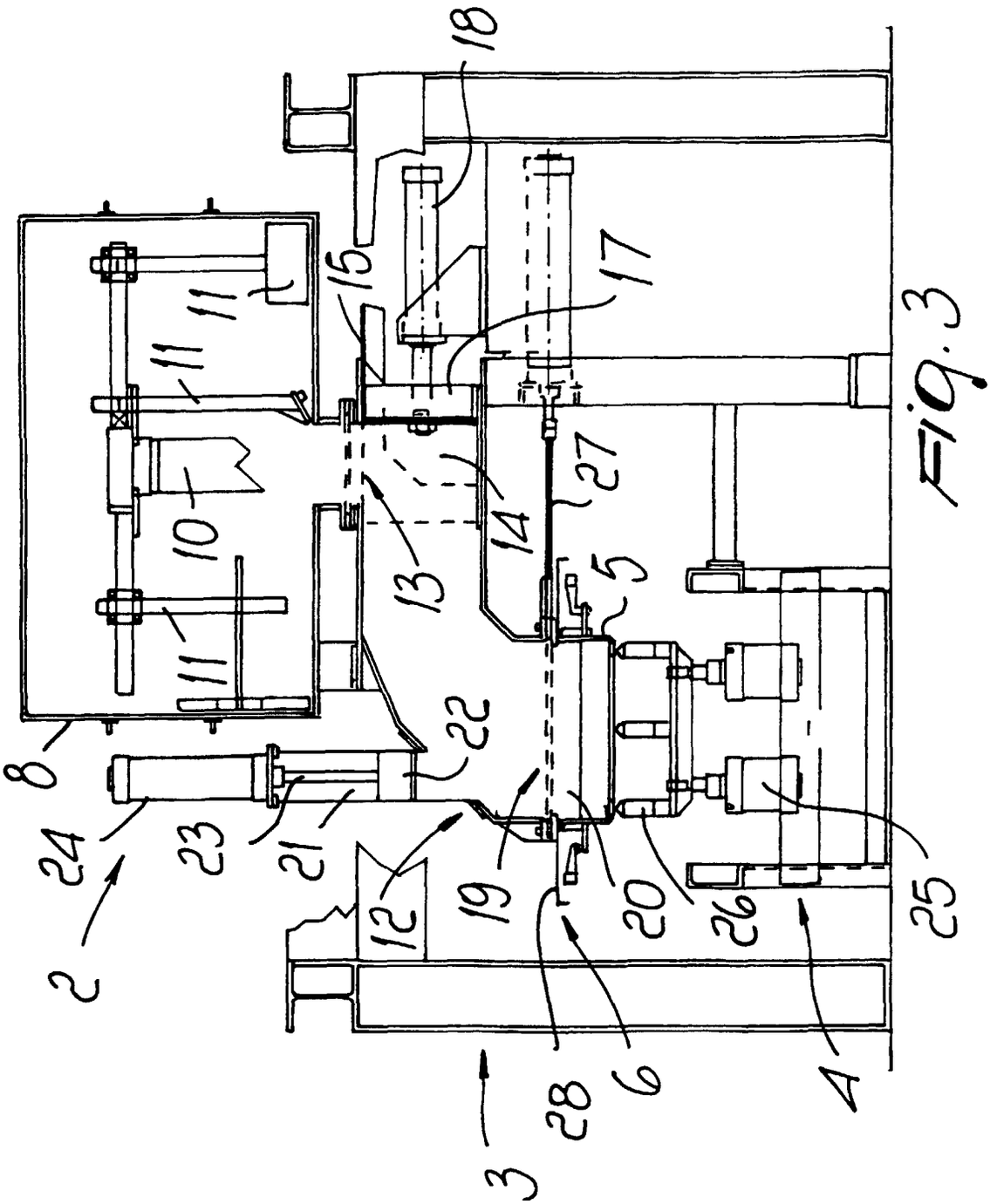

Fig. 3

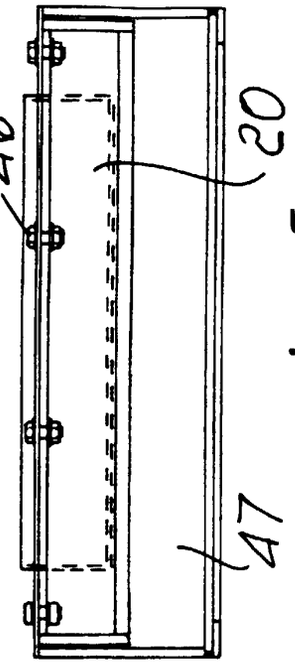

Fig. 5

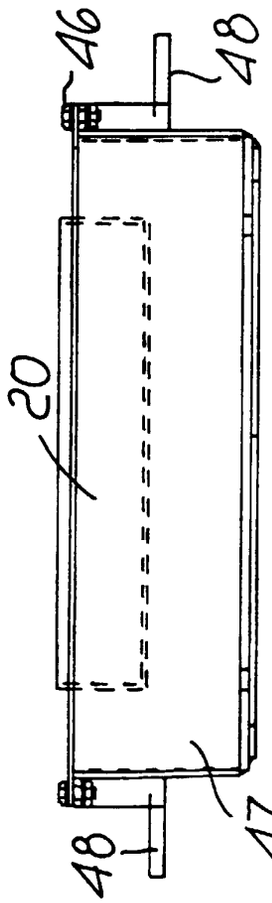

Fig. 4

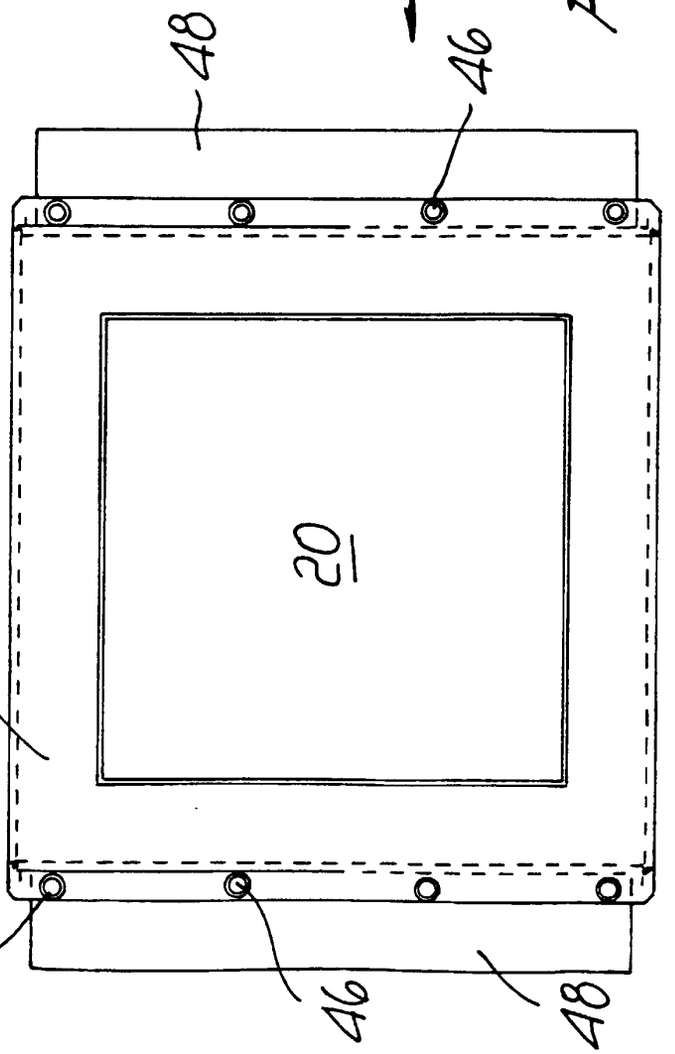

Fig. 6

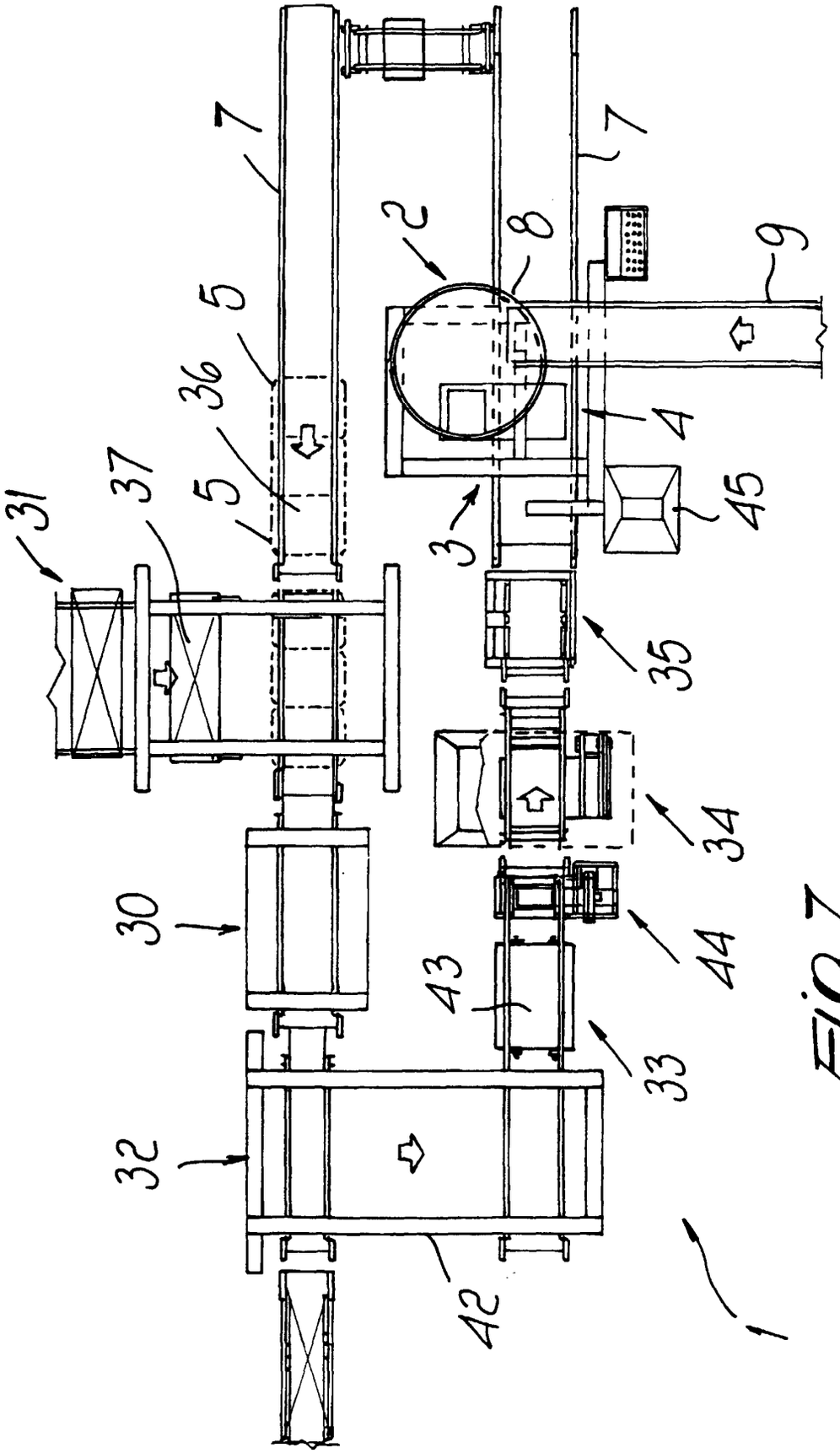

Fig. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 10 6179

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB 426 806 A (J. W. EDWARDS) * the whole document * * page 2, line 117 - page 3, line 62 * * page 5, line 61 - page 6, line 25 *	1,2,8	B28B5/04 B28B13/02 B28B7/08 B28B7/38
A		5,10,11, 22	B28B7/00
X	DE 20 737 C (E. MUNCKELT) * the whole document *	1,2,8	
A		5,7, 10-12	
A	GB 27 A A.D. 1914 (H. J. ORMAN) * the whole document *	1-5,8,9	
A	DE 98 549 C (R. KAUDELKA) * the whole document *	1,5,8	
A	US 1 454 165 A (H. W. B. GRAHAM) 8 May 1923 (1923-05-08) * the whole document *	1,2,10, 11,14,15	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	US 1 452 152 A (H. W. B. GRAHAM) 17 April 1923 (1923-04-17) * the whole document *	1,2,10, 22	B28B
A	EP 0 251 367 A (BOER MASCHF BV) 7 January 1988 (1988-01-07) * the whole document *	1,10,14, 15,18, 21-23	
A	BE 638 393 A (SAMENWERKING N. V.) * figures 1,2 *	1,10,20	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 March 2000	Gourier, P

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-03-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 426806 A		NONE	
DE 20737 C		NONE	
GB P27 A		NONE	
DE 98549 C		NONE	
US 1454165 A	08-05-1923	NONE	
US 1452152 A	17-04-1923	NONE	
EP 0251367 A	07-01-1988	NL 8601671 A	18-01-1988
		AT 48790 T	15-01-1990
		AU 597072 B	24-05-1990
		AU 7419487 A	07-01-1988
		CA 1300355 A	12-05-1992
		DK 171806 B	16-06-1997
		US 4832587 A	23-05-1989
		US 5173311 A	22-12-1992
		US 4917838 A	17-04-1990
BE 638393 A		NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82