



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.11.2002 Bulletin 2002/46

(51) Int Cl.7: **B28B 13/02**

(21) Application number: **02075984.1**

(22) Date of filing: **13.03.2002**

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

(72) Inventor: **Lamberti, Daniele**
41045 Montefiorino (Modena) (IT)

(74) Representative: **Corradini, Corrado et al**
Studio Ing. C. CORRADINI & C. S.r.l.
4, Via Dante Alighieri
42100 Reggio Emilia (IT)

(30) Priority: **27.04.2001 IT RE010044**

(71) Applicant: **Lamberti, Daniele**
41045 Montefiorino (Modena) (IT)

(54) **Method for loading ceramic tile forming moulds, a plant for its implementation, and tiles obtained thereby**

(57) The method for loading ceramic moulds presenting at least one forming cavity (3) to be filled with a layer of powder (51, 52) comprises preparing said layer of powder (51, 52) outside the mould (10), then inserting said layer into said at least one forming cavity (3) without appreciable dislocation and mixing of its constituent powder. The plant for its implementation comprises a

loading carriage (66) provided with a powder restraining device, this latter comprising an enclosure (13) having a plan shape and a depth which are practically equal to the plan shape and the height of the layer of powder required to mould the tile (33), and is provided with means (11, 8) arranged to maintain said layer consistent during its transfer from its preparation station to the mould forming cavity.

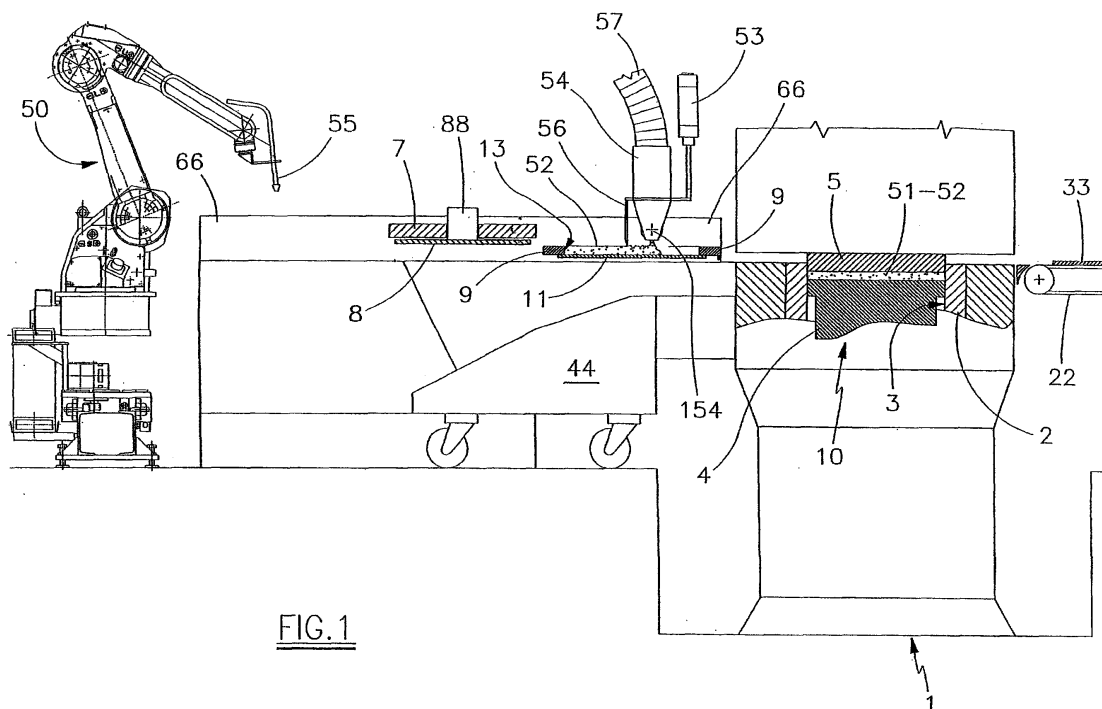


FIG. 1

Description

[0001] This invention generally concerns the manufacture of ceramic tiles, and more particularly relates to a method for loading the materials in powder form into the relative forming moulds.

[0002] The invention also relates to the means for implementing the said method, and the products obtained thereby.

[0003] As is well known, various methods, which will not be listed herein, are used to load the at least one forming cavity of tile pressing moulds.

[0004] In one of said methods, to which the invention specifically relates, both the material, typically powdered clay, for forming the tile body, and the material, typically powdered glaze, for creating the desired tile surface decoration, are loaded into the forming cavity.

[0005] The said two materials are compacted together within the mould cavity, and the crude tile obtained in this manner is fed to firing.

[0006] With said method, usually known as pressure glazing, the moulding cavity is subjected to two separate loading operations, one for the base material and the other for the decoration or finishing material.

[0007] However said double loading involves a relatively lengthy implementation time, which is in strict contrast to modern ceramic technology, notoriously characterised by massive productivity.

[0008] An object of the present invention is to provide a method by which tiles can be obtained having a surface decoration with well defined or precise contours, comparable with those obtainable for example by the said double loading method.

[0009] A further object is to provide a method by which the tile decoration can be easily and quickly varied as required, even during production.

[0010] Another object is to provide means for implementing the said method within the context of a simple, rational, reliable and durable construction. Said objects are attained by virtue of the characterising elements indicated in the claims.

[0011] According to the proposed method, a surface decorated layer of powder required to obtain the pressure-glazed tile is prepared separately, i.e. outside the mould, said surface decorated layer then being inserted into the respective mould forming cavity without appreciable dislocation and mixing between the decorative material and the underlying material.

[0012] Said surface decorated layer is prepared by means of a movable enclosure, described in detail hereinafter, the plan shape and depth of which are practically equal to the plan shape and height of said surface decorated layer, and is provided with means for maintaining the surface decorated layer consistent during its transfer from its preparation station to the forming cavity.

[0013] By virtue of the aforestated solution, the ceramic press can operate substantially at the maximum rate allowable by the production underway, in that the

surface decorated powder layer is prepared separately as stated, outside the mould.

[0014] The characteristics and merits of the invention will be apparent from the ensuing detailed description, given with reference to the accompanying drawings, which illustrate a preferred embodiment of the means for implementing the method of the invention by way of non-limiting example.

[0015] Figure 1 is a partly sectional schematic side elevation showing the means of the invention associated with a ceramic press during the preparation of the mass of powder material intended to form the tile body.

[0016] Figure 2 is a view totally similar to the preceding, but showing the means of the invention during the decoration of said mass.

[0017] Figures 3 to 8 are views totally similar to the preceding, but showing certain characteristic stages of the loading cycle following the two shown in Figures 1 and 2.

[0018] Figure 9 is the section IX-IX of Figure 8.

[0019] Said figures show a usual ceramic press, indicated overall by 1, lying between a structure 44 for supporting the powder loading system, and a conveyor 22 for removing the decorated crude tiles 33 (see Figures 1-8). The press 1 is equipped with a usual ceramic mould, indicated overall by the reference numeral 10, basically comprising a die plate 2 having a single forming cavity 3, a lower die 4 slidably contained within said forming cavity 3, and an upper die 5 carried by the movable crosspiece of the press 1.

[0020] It should be noted that the press 1 can have any number of forming cavities 3. The die plate 4 is positioned on the bed of the press 1 via known means for adjusting its level.

[0021] The structure 44 carries two longitudinal opposing flat bars 6 (see Figures 4 to 9) provided with guide and slide tracks 60 for a main or service carriage indicated by 66.

[0022] The carriage 66 is driven to slide forwards and rearwards in synchronism with the operative stages of the press, between a withdrawn position in which it lies outside the mould 10 (Figures 1-3) and an advanced position in which it lies above it (Figures 4-9).

[0023] The to-and-fro movement of the carriage 66 is obtained by means, not shown as they are of known type, for example in the form of a connecting rod-crank linkage or a linear actuator such as a cylinder-piston unit. Between the sidepieces of the carriage 66 there is a movable assembly which represents the actual loading unit of the system.

[0024] As shown in Figure 9, said movable assembly comprises, proceeding from the top downwards, a slider 7, a punch 8, a holed plate 9, and a thin sheet 11.

[0025] The slider 7 consists of a robust metal plate supported by the sidepieces of the carriage 66 via the guide and slide means indicated by 77, and is connected to the structure of the carriage 66 via a drive unit, not shown for questions of simplicity and clarity.

[0026] Said drive unit can for example consist of a linear actuator, or a pair of opposing motorized chains able to translate in the two opposing directions. To the centre of the slider 7 there is fixed a pneumatic cylinder-piston unit 88 of vertical axis, the piston rod of which supports the said punch 8, which has a plan shape identical to that of the forming cavity 3 of the mould 10.

[0027] It should be noted that the lower active face of the punch 8 is preferably shaped as the upper die 5 of the mould 10.

[0028] The plate 9 is supported by the sidepieces of the carriage 66 via the guide and slide means indicated by 99, and is connected to the structure of the carriage 66 via a suitable drive unit, such as a linear actuator.

[0029] In said plate 9 there is provided an opening 13, the plan dimensions of which are equal to those of the punch 8, and hence also to those of the forming cavity 3.

[0030] The plate 9 has a thickness practically equal to that which a layer of powder must have to obtain the desired thickness of the tile 33. For example, as a typical tile thickness is of the order of 10 mm, and as a typical relationship between clay in powder form and compacted clay is of the order of 2:1, said plate 9 has a thickness of the order of 20 mm.

[0031] The underlying sheet 11, which acts as the base shutter for said opening 13, is carried by the sidepieces of the carriage 66 or alternatively by the upper operating floor of the structure 44, via the guide and slide means indicated by 12 in Figure 9.

[0032] The sheet 11 is of small thickness, of the order of one millimetre, and is contained practically as an exact fit between the plate 9 and the structure 44. In other words, the lower face of the sheet 11 lies practically in the plane defined by the upper face of the die plate 2. In the figures said dimension and said arrangement are different from reality for reasons of clarity.

[0033] Between the carriage 66 and the sheet 11 there is interposed a suitable drive unit, such as a linear actuator, typically a pneumatic cylinder-piston unit.

[0034] It should be noted that the longitudinal dimension of the slider 7, the plate 9 and the sheet 11 is each substantially one third of that of the carriage 66 (Figures 1 to 8), the reason for which will be apparent hereinafter.

[0035] A system for supplying at least two different ceramic materials in powder form is associated with the aforescribed loading means.

[0036] Said supply system comprises a hopper 54 presenting a horizontal discharge mouth of narrow elongate shape positioned transversely to the direction of travel of the carriage 66, and intercepted by a shutter 154, for example in the form of a rotary valve.

[0037] Said hopper 54 is carried by a cylinder-piston unit 53, which is positioned close to the press 1 and also supports a scraper 56 situated on that side of the hopper 54 which faces the rear end of the structure 44.

[0038] A material in powder form 52 is fed into the hopper 54 through at least one hose 57. Said material 52 can comprise a single type of powder or a mixture of

powders of different characteristics, typically different colours.

[0039] In the case of a single powder, this can be either a usual base clay if tiles 33 are to be obtained having their exposed surface completely covered with a decoration, or high quality clay, such as that for fine porcellainized stone tiles, if the decoration is only partial.

[0040] In the second case, the two or more mixed powders, for example intimately mixed together to obtain a final dotted appearance, usually known as "salt and pepper", are both of high quality type, the decoration involving only a part of the exposed face of the tile 33.

[0041] Two or more feed hoses 57 are preferably provided, connected to respective sources of clay, they being activated and deactivated by a programmable electronic unit connected to the general control system of the press 1.

[0042] As a variant, a number of vertically movable adjacent hoppers of the same type as the described hopper 54 could be provided.

[0043] As can be seen in Figure 1, close to the rear end of the structure 44 there is provided a decorating unit comprising a delivery spout 55, also known as a dispenser, which is carried by a robot 50.

[0044] The dispenser 55 is connected to a source of ceramic glaze in powder form 51 by means not shown. Preferably upstream of the dispenser 55 there is a switching unit for connecting said dispenser 55 to different glaze supply sources.

[0045] Alternatively, said robot can present two or more dispensers 55 connected to different sources of glaze, and arranged to operate either together or not together, under the control of a suitable programmable electronic unit connected to the general control system of the press 1.

[0046] It should be noted that said robot 50 is of anthropomorphous type, i.e. it presents a number of degrees of freedom of movement such as to reproduce that of a human hand. By virtue of said mobility, and constant dialoguing with the general control system of the press 1, said robot 50, if desired, can surface-decorate the layer of clay 52 even when is in movement, as described hereinafter.

[0047] The aforescribed arrangement operates as follows.

[0048] On termination of the loading cycle the situation is as shown in Figure 1, in which:

- the press 1 is compacting the decorated tile 33,
- the carriage 66 is completely retracted,
- the slider 7 lies in the central part of the carriage 66 with the punch 8 raised,
- the hopper 54 and scraper 56 are lowered, with the hopper 54 in its open configuration, and
- the plate 9 slides towards the rear end of the carriage 66 together with the sheet 11, which closes the lower mouth of the opening 13 to form a powder

containing enclosure.

[0049] The layer of powder 52, smoothed by the scraper 56, reaches the rear end of the carriage 66 (see Figure 2) where it stops, and the robot 50 applies the decoration 51. As already stated, said decoration 51 can involve all or only part of the upper face of the layer 52.

[0050] It should be noted that application of the glaze (or glazes) by using at least one decorating spout 55 does not produce inconvenient surface striations on the decoration.

[0051] During the decoration the hopper 54 and scraper 56 are raised, and when said decoration is finished the surface-decorated layer 52-51 is transferred below the punch 8 as shown in Figure 3.

[0052] The punch 8 is then lowered into the opening 13 where it maintains the layer 52-51 elastically pressed against the sheet 11 (Figure 3), then the slider 7 and plate 9 slide towards the front end of the carriage 66, after which this latter receives the enabling signal to advance.

[0053] During said movements the decorated layer 52-51 is maintained compacted by the punch 8, and is hence insensitive to the acceleration to which it is subjected, i.e. the clay 52 (or clays) and glaze 51 (or glazes) do not undergo mutual slippage or mixing.

[0054] Simultaneously with said movements the forming of the tile 33 terminates, and before the carriage 66 advances the upper die 5 rises followed by the lower die 4, which moves to the level of the upper face of the die plate 2. The carriage 66 advances to push the tile 33 by means of the plate 9, and stops when the opening 13 is aligned with the cavity 3 (Figure 4). After this the sheet 11 is retracted at high speed (Figure 5), by which the decorated layer 52-51 rests on the die 4 which almost simultaneously receives the enabling signal to move to the end of its lowering or pressing stroke (Figure 6).

[0055] During transfer of the layer 52-51 from the opening 13 to the cavity 3 the decorated layer 52-51 is maintained substantially consistent by the punch 8, i.e. practically free from any inconvenient slippage, dislocation or mixing between the clay 52 and the glaze 51.

[0056] The punch 8 is then raised above the plate 9 (Figure 7); the slider 7 slides towards the rear region of the carriage 66 (Figure 8); the plate 9 becomes superposed on the sheet 11 which at that moment is stationary; the plate 9 and sheet 11 withdraw together; and the hopper 54 and scraper 56 receive the enabling signal to move downwards, by which the entire assembly becomes repositioned as in Figure 1, and a new loading cycle commences, simultaneously with which the layer 52-51 just deposited in the cavity 3 is pressed (Figure 1).

[0057] The merits and advantages of the invention are apparent from the foregoing and from the accompanying figures.

[0058] It should be noted that the decoration of the base powder 52 by means of the dispenser spout 55 can be effected immediately downstream of the hopper

54, as is apparent from Figure 1, this enabling the preparation of the surface-decorated layer to be accelerated.

5 Claims

1. A method for loading ceramic moulds presenting a die plate (2) having at least one forming cavity (3) which receives a vertically slidable die (4) defining the base of said cavity, which is intended to be filled with a powder layer (51-52), **characterised by** comprising the following operative steps:

- preparing said powder layer (51-52) outside the mould (10), and
- into said at least one forming cavity (3) inserting said layer without appreciable dislocation and mixing of its constituent powder.

2. A method as claimed in claim 1, **characterised in that** said preparation step comprises applying onto said powder layer a decorative material in powder form free from surface scrapings.

3. A method as claimed in claim 1, **characterised in that** from the moment of its preparation to its insertion into said at least one forming cavity, said layer is maintained confined within a space the plan and height dimensions of which correspond practically to the loaded configuration assumed by the forming cavity to obtain the desired tile thickness.

4. A method as claimed in claim 1, **characterised in that** said layer is maintained substantially consistent during transfer between its preparation station and the forming cavity.

5. A method as claimed in claim 4, **characterised in that** said consistency is achieved by subjecting the layer to compression.

6. A method as claimed in claim 1, **characterised in that** said layer is deposited on the die at the moment in which it is flush with the die plate.

7. A method as claimed in claim 5, **characterised in that** said compression action also occurs during the deposition of the layer on the die raised flush with the die plate.

8. A method as claimed in claim 5, **characterised in that** said compression action also continues while the die is being lowered to the end of its lowering stroke.

9. A method as claimed in claim 2, **characterised in that** said application of said surface-decorative material is effected by controlled deposition from

above.

10. A method as claimed in claim 9, **characterised in that** application is effected on the underlying material which at that moment is stationary.
11. A method as claimed in claim 9, **characterised in that** said application is effected on the underlying material in movement.
12. A plant for implementing the method claimed in claims from 1 to 11, comprising a loading carriage (66) which presents a powder restraining device and is driven with reciprocating rectilinear movement between a withdrawn position in which it locates said restraining device at a powder supply station, and an advanced position in which it locates said restraining device above the forming cavity (3) of a ceramic mould (10), **characterised in that** said restraining device comprises an enclosure (13) having a plan shape and depth practically equal to the plan shape and height of the layer of powder required to mould the tile (33), and is provided with means (11, 8) to maintain said layer consistent during its transfer from its preparation station to the mould forming cavity.
13. A plant as claimed in claim 12, **characterised in that** said supply station comprises, in succession, starting from the mould, at least one feed source of at least one base material intended to form the lower part of said layer, and at least one feed source of at least one finishing material intended to decorate said lower layer part.
14. A plant as claimed in claim 13, **characterised in that** said at least one feed source of said at least one base material comprises a hopper positioned to the side of the mould and presenting a discharge mouth of narrow elongate shape which is positioned transversely to the travel direction of the enclosure and is intercepted by a valve, said hopper being able to slide vertically between a raised rest position in which it is spaced from the enclosure, and a lowered working position in which it is close to it.
15. A plant as claimed in claim 14, **characterised in that** associated with said hopper there is a scraper situated on the opposite side of the hopper to that occupied by the mould, and arranged to rest on the upper face of the enclosure when the hopper is lowered.
16. A plant as claimed in claim 13, **characterised in that** said at least one feed source of said at least one finishing material comprises at least one movable dispenser arranged to operate within the perimeter defined by the plan shape of the compart-

ment of said enclosure.

17. A plant as claimed in claim 16, **characterised in that** said at least one dispenser consists of a delivery spout carried by a movable assembly under the control of the general control system of the press.
18. A plant as claimed in claim 17, **characterised in that** said movable assembly is a robotized system.
19. A plant as claimed in claim 12, **characterised in that** said enclosure comprises a horizontal frame which is slidably mounted on said carriage and is connected thereto by a drive unit arranged to cause it to slide in the carriage travel direction in order to position the frame correctly relative to said at least two feed sources of said at least one base material and at least one finishing material respectively.
20. A plant as claimed in claim 12, **characterised in that** said means for maintaining said layer consist of two shutter members associated with the bottom and top of the enclosure.
21. A plant as claimed in claim 20, **characterised in that** said bottom shutter consists of a gate arranged to slide parallel to the enclosure travel direction between a working position in which it closes its lower mouth, and a rest position in which it opens it.
22. A plant as claimed in claim 21, **characterised in that** said gate consists of a thin flat sheet, the lower face of which is positioned substantially flush with the upper mouth of the forming cavity.
23. A plant as claimed in claim 20, **characterised in that** the upper shutter of the enclosure consists of a punch having a plan shape equal to that of the loading compartment of the enclosure, said punch being carried by a slider arranged to slide in the enclosure travel direction between a rest position in which it locates the punch to the side of the enclosure compartment, and a working position in which it vertically aligns the punch with said compartment, means being positioned between said punch and said slider to move the punch vertically between a raised position in which it is extracted from the enclosure, and a lowered position in which it is inserted into the enclosure, where it maintains the layer elastically pressed against the gate.
24. A plant as claimed in claim 23, **characterised in that** the lower active face of said punch is shaped as the active face of the upper die of the ceramic mould.
25. A ceramic tile obtained by the method claimed in claims from 1 to 11 by means of the plant claimed

in claims from 12 to 14.

5

10

15

20

25

30

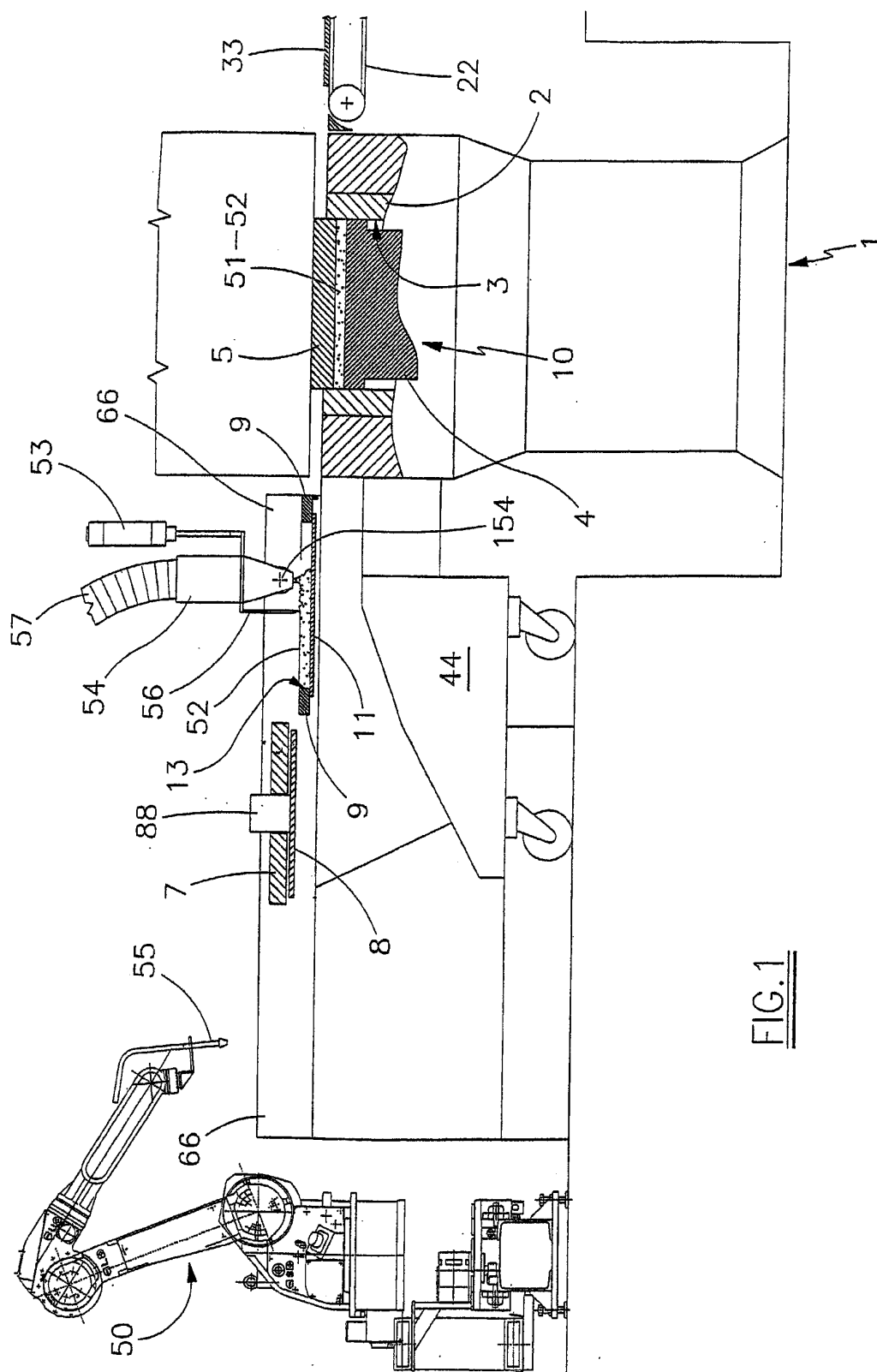
35

40

45

50

55



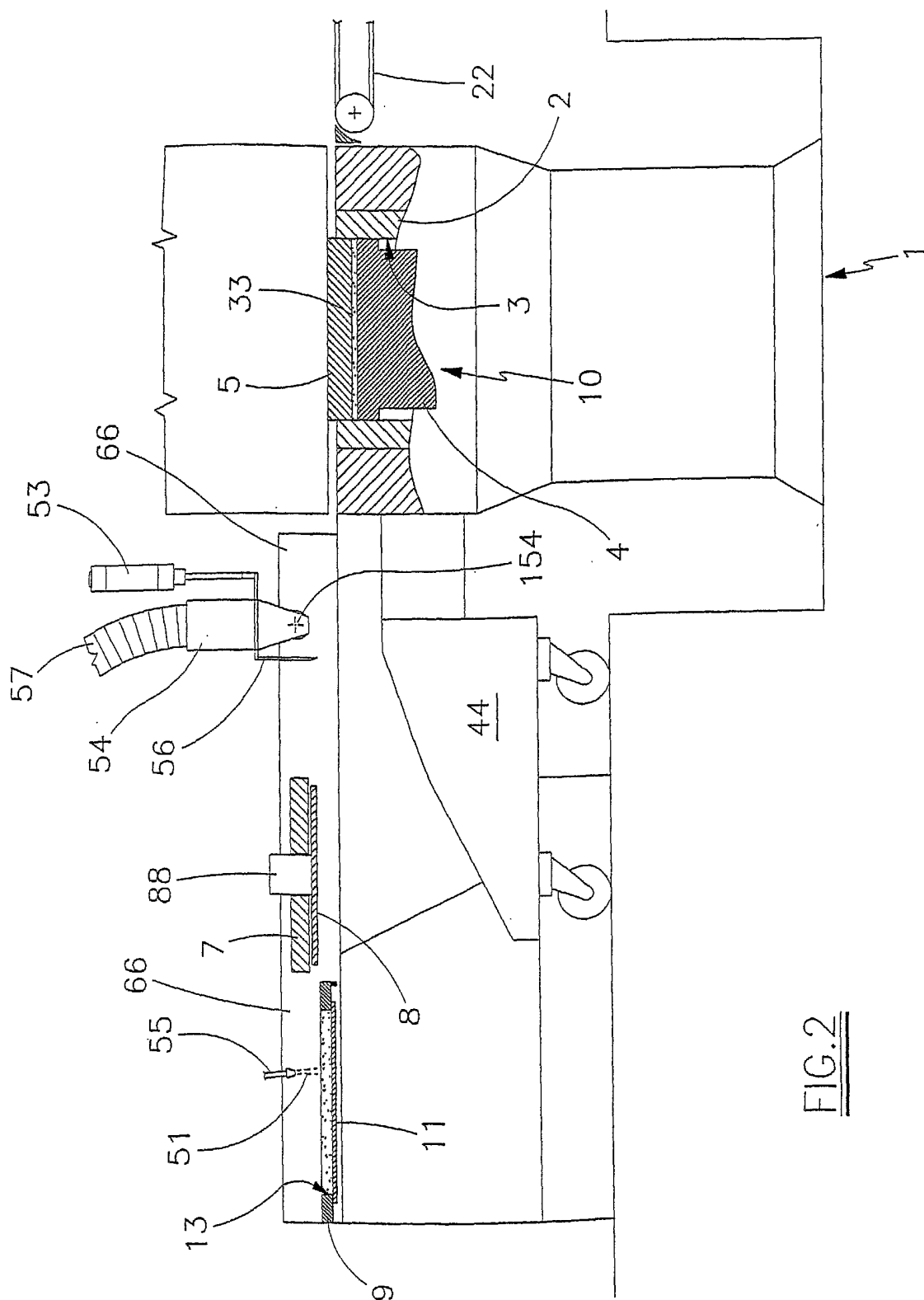


FIG. 2

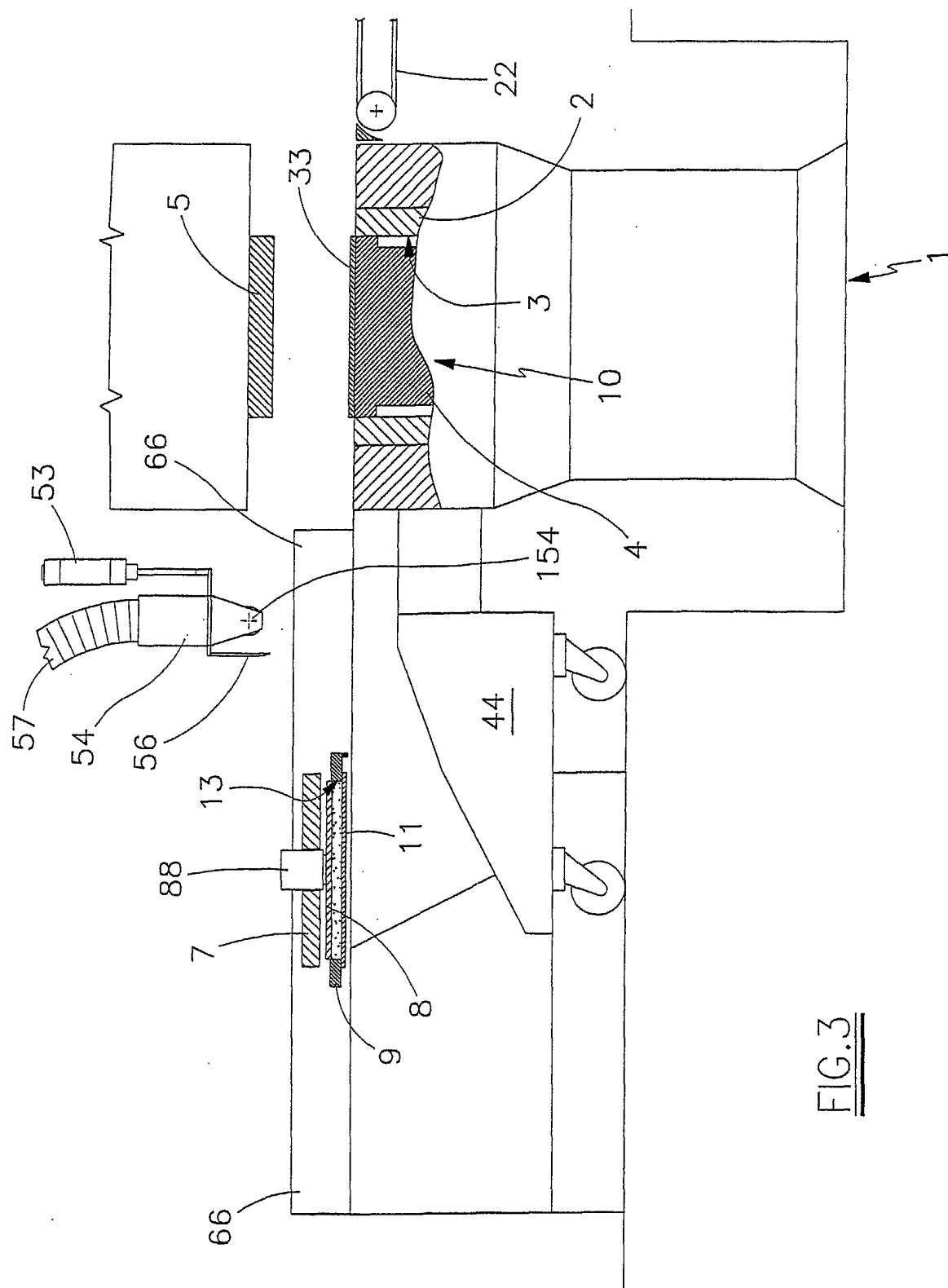


FIG. 3

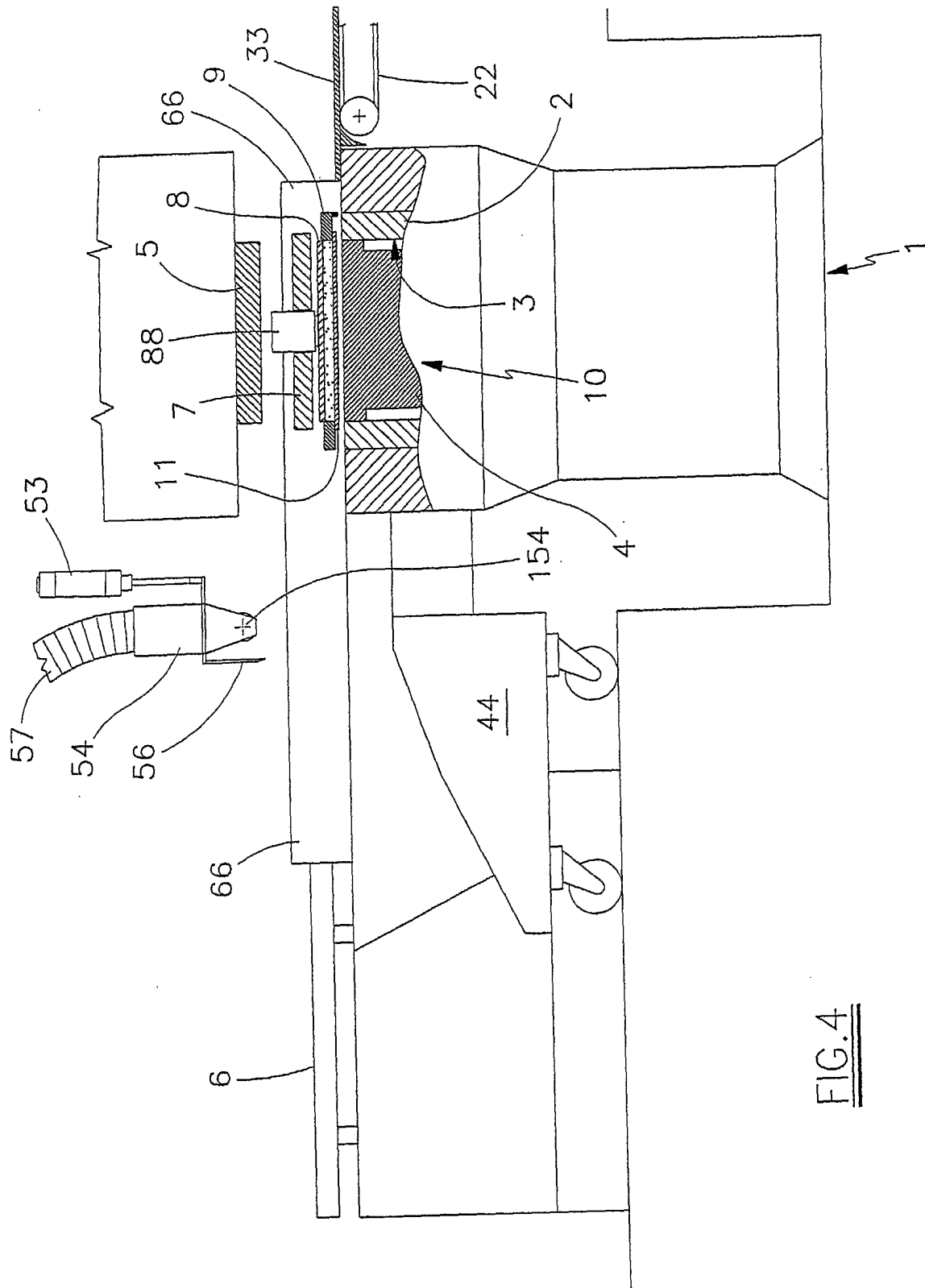
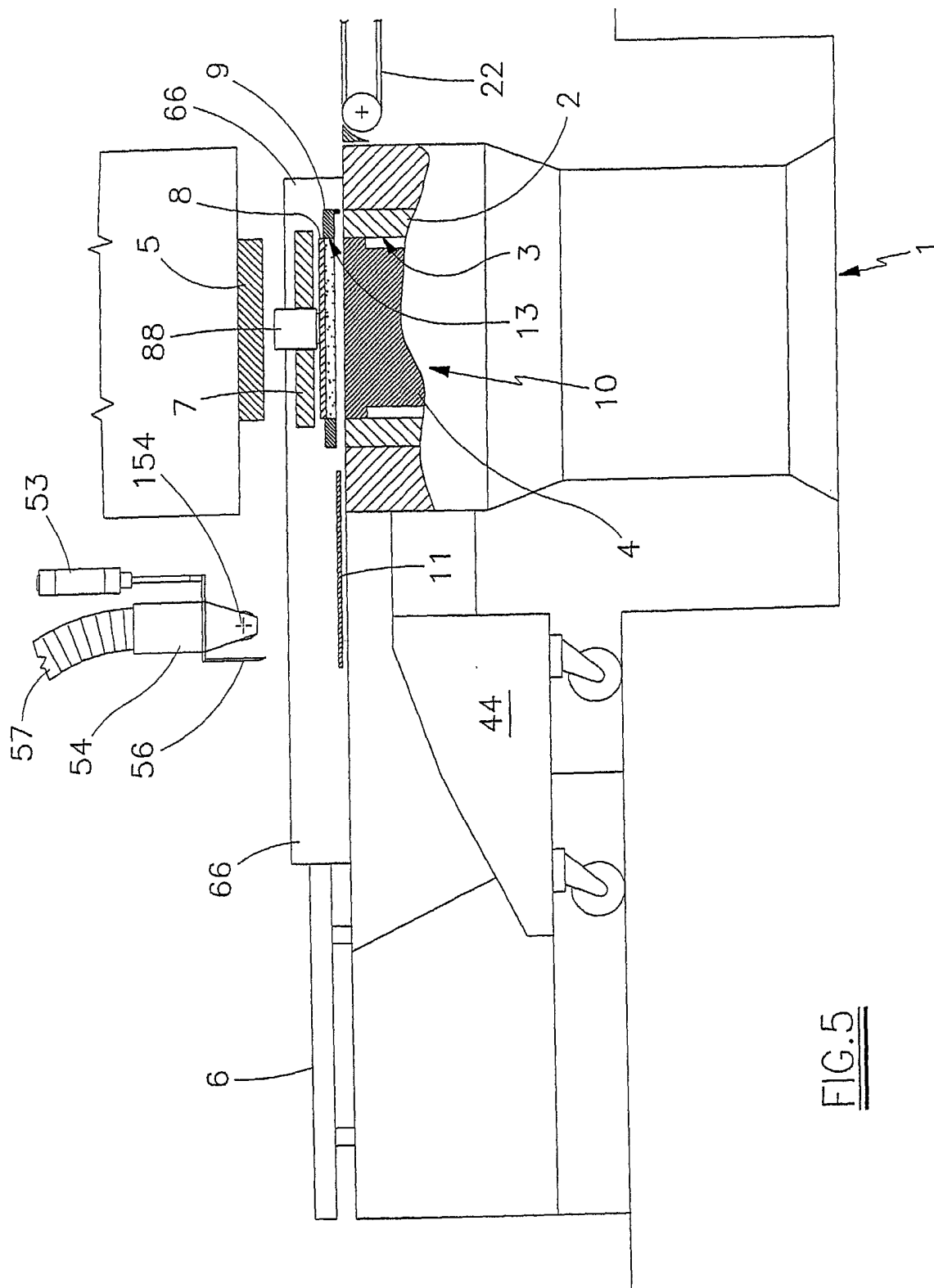


FIG. 4



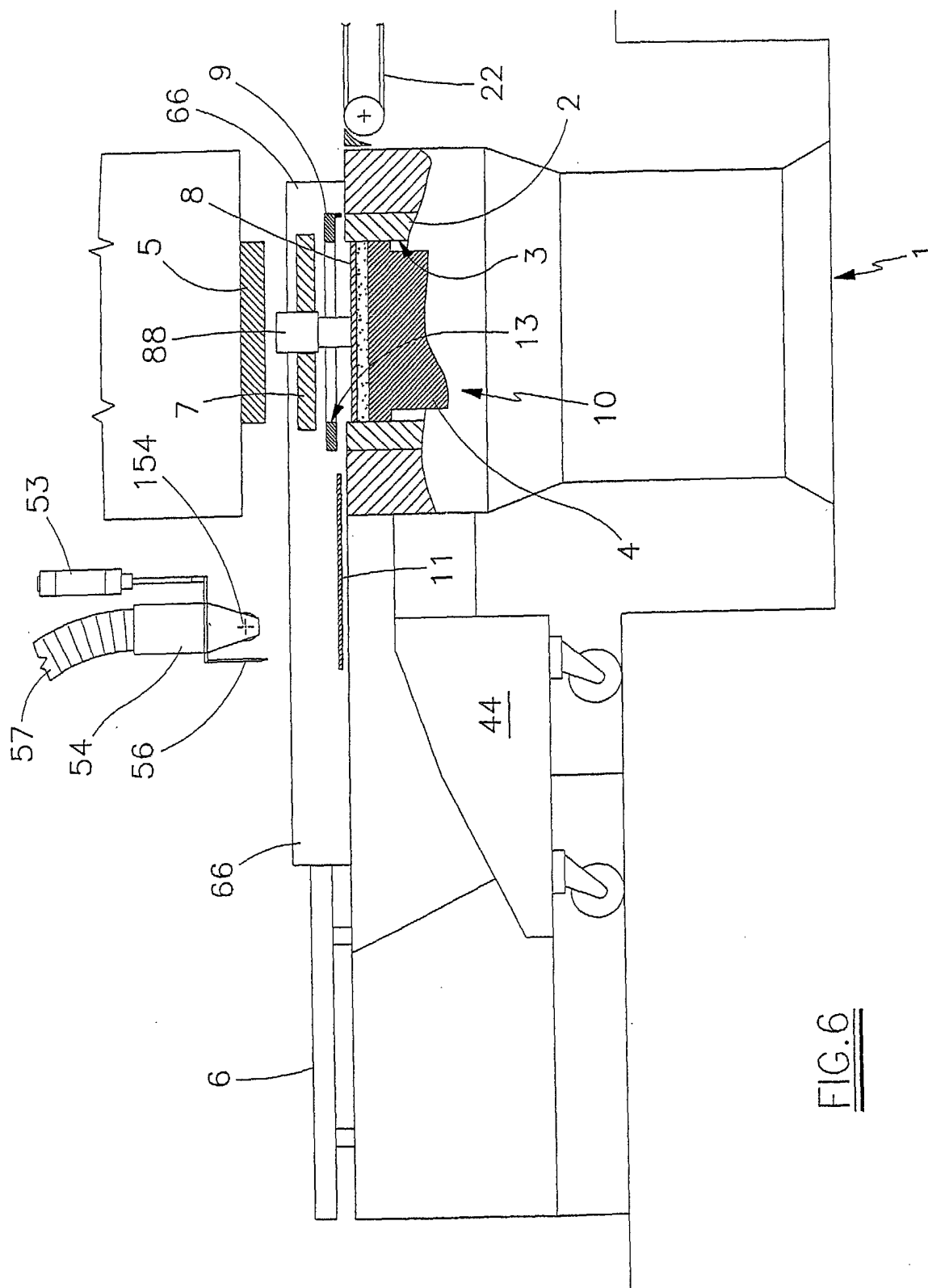


FIG. 6

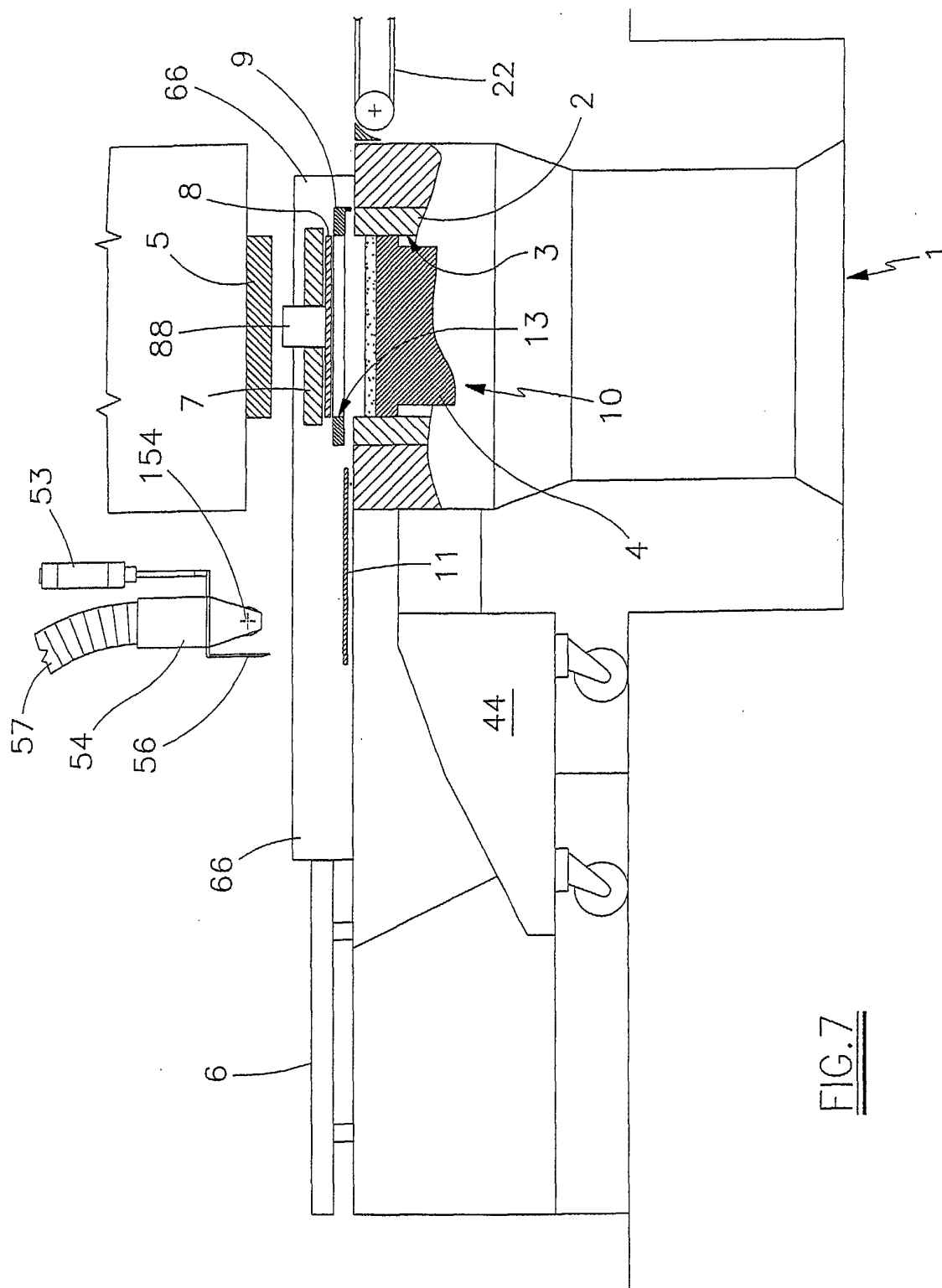


FIG. 7

