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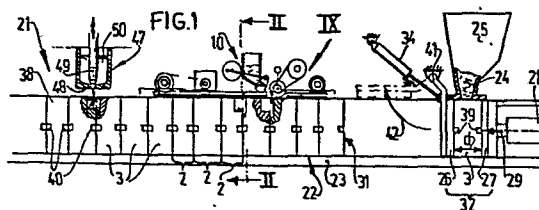
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54 Method of casting metal objects, mould and production line for carrying out said method, pattern and mould machine for manufacturing such mould, objects made by said method, dosed amount of additive, dosing device and fusible plug administering device.

57 When casting metal objects, first of all in a preparation step liquid metal and additive are joined to one another in a preparatory chamber giving access to a mould cavity of a mould, subsequently the cast metal is led on to the mould cavity during a leading-in step.



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Method of casting metal objects, mould and production line for carrying out said method, pattern and mould machine for manufacturing such moulds, objects made by said method, dosed amount of additive, additive dosing device and fusible plug administering device.

The invention relates to a method of casting metal objects in which for preparing a cast metal liquid metal and additive are joined in at least one preparatory chamber having at least one outlet giving access to a mould cavity.

5 The cast metal to be prepared may be an alloy. In general the additive to be alloyed is added to the molten metal before the cast metal is poured into the mould as an alloy. This may be carried out by a dipping method performed in an additional dipping pan. This additional operation
10 required a higher melting temperature. However, the additive oxidizes partly at the temperature of the molten metal and/or it partly volatilizes or vaporizes. The invention is particularly applicable to nodularization of cast iron. Herein laminated graphite is converted into pellet graphite by the

addition of an additive consisting, for example, of magnesium, calcium, lithium, strontium, barium, cerium, didymium, lanthanum and/or yttrium. Since in a foundry the duration of time between the addition and pouring into the mould is not
5 under control due to transport and waiting time, a greater or smaller part of the effect of the additive may get lost. This results in a loss of strength and other properties prior to pouring the cast metal into the mould. Since, moreover, the extent of loss is beyond control, castings of different
10 qualities and properties may be obtained. Fully continuously operating casting machines, for example, in an iron foundry can cast only untreated cast iron because, for example, in the case of magnesium-treated cast iron the calibrated run of the casting machine becomes wholly or partly clogged by adhering
15 ring slags. Accurate dosing is then out of the question. The run should constantly be made free of slags.

In order to mitigate these drawbacks US Patent Specification 3 703 922 proposes to add the additive to the molten metal not until it is in the mould. Herein the liquid
20 metal is brought into contact in a preparatory chamber arranged in the lead or inlet with the additive contained therein, after which the cast metal flows to the mould cavity through an outlet formed by a regulated narrowed part. The narrowed part serves to ensure that the liquid metal is
25 retained in the preparatory chamber for a sufficiently long time for obtaining an adequate time of contact between the molten metal and the additive.

To this known method the following disadvantages are inherent:

- 30 a. The slow flow through the narrowed outlet involves the necessity of accurately adapting the casting rate to the selected narrowing of the outlet. This is difficult because the filling rate can only be poorly controlled. If the filling rate is too high, the liquid metal will flow over
35 the mould and if the filling rate is too low, air occlusions will be formed in the mould cavity. This problem is serious particularly because it will be necessary to proportion the narrowing each time in dependence upon the volume of the mould cavity and the required cast metal.

b. The preparation of the cast metal takes place both in the preparatory chamber and in the mould cavity. During the preparation of the cast metal both in alloying and nodularizing slags and gases are formed, which enter the 5 mould cavity and which become manifest as slag conclusions and gas bubbles in the casting made.

c. The preparatory chamber located at the level of the mould cavity occupies an important part of the volume of the mould, so that the useful space of the mould is 10 materially reduced.

d. Much cast metal is left as a waste in the preparatory chamber located at the same level as the mould cavity.

These drawbacks are due to the fact that the liquid 15 metal on its way to the mould cavity is brought into contact with the additive. In order to enhance the contact time after the establishment of the contact, the path of flow is narrowed. However, the cast metal enters the mould cavity as a liquid metal with its still active additive. Therefore, the 20 disadvantageous constituents continually adversely affect the casting and the model is not rapidly filled out. The preparation process is accomplished in a closed and hence unchecked space, from which gas and slags cannot escape.

The present invention provides an improved method 25 in this respect, which is characterized by at least two successive steps, that is to say:

a preparation step in which the additive and the liquid metal are joined to one another in the preparatory chamber, whilst each outlet leading to the mould cavity is closed and 30 a leading-in step in which the cast metal is led on to the mould cavity through an outlet provided on the bottom side of the preparatory chamber, which is opened only some time after the liquid metal and the additive have been joined to one another in the preparation step.

35 During the preparation step the reaction takes place in the preparatory chamber containing the mixture of liquid metal and additive. This preparatory chamber may be open on the top side so that gas can readily escape and the process can be easily supervised. The slags produced will

rise up and are retained in the preparatory chamber, because the prepared cast metal leaves the preparatory chamber through an outlet on the bottom side during the leading-in step. The filling rate for the mould cavity may be sufficiently high to obtain a casting of satisfactory and reproducible quality and the filling rate of the preparatory chamber is not critical, because it is independent of the filling rate of the mould cavity. The preparatory chamber can be readily filled by means of an automatic casting machine, because untreated cast iron can be poured into the preparatory chamber, which iron can be readily handled by an automatic casting machine, because formation of slags takes place after casting in the preparatory chamber. The preparatory chamber may be wholly or substantially wholly emptied.

When during the preparation step the preparatory chamber is charged with an exactly adequate amount of liquid metal for filling out the mould cavity during the leading-in step, whilst the outlet is shut off, metal and additive are saved.

During the preparation step the outlet is preferably held closed by means of additive. This is a simple and automatic way of closing. The outlet is opened not until has the additive been worked up. In order to prevent flusing upwards of the additive in the case of awkward filling and floating of the same on the liquid metal, the additive may be encapsulated in a fusible material.

In order to ensure that the outlet is opened not until has all additive reacted with the liquid metal, the outlet is held in the closed state during the preparation step by means of a fusible plug. Additional safety in this respect is obtained when during the preparation step the fusible plug is at least temporarily protected by means of the additive.

The invention furthermore relates to and provides a mould for carrying out the method according to the invention, said mould comprising at least one mould cavity and at least one preparatory chamber having at least one outlet giving access to the mould cavity. This mould is characterized in

that the outlet is provided on the bottom side of the preparatory chamber and in that said outlet can be closed during the preparation stage and be opened during the leading-in stage.

5 Furthermore the invention relates to and provides a pattern for manufacturing a mould for carrying out the method according to the invention: for making each mould from moulding material, for example, sand, the pattern comprises at least one mould cavity gauge making the recess for the
10 mould cavity in the moulding material and at least one preparatory chamber gauge making the recess for the preparatory chamber in the moulding material and an outlet gauge to form in the moulding material an outlet for the communication between the preparatory chamber and the mould cavity. This
15 pattern is characterized in that the preparatory chamber gauge is disposed at a higher level than the mould cavity gauge and in that the outlet gauge is disposed at a level between the preparatory chamber gauge and the mould cavity gauge.

20 A homogeneous cast metal is obtained when the mould is manufactured with a pattern characterized by a gutter gauge disposed above the outlet gauge to form a gutter receiving a dam of additive.

The invention is particularly important for use in
25 an automatically operating moulding machine. A further development of the pattern is characterized in that the pattern is designed for use in a moulding machine to manufacture a mould string and in that the pattern comprises at least one scanning member gauge for casting a scanning member to the
30 outer side of each mould.

The invention, moreover, relates to and provides a moulding machine for the manufacture of a mould string. It is characterized by a repeatedly removable device for inserting every time the closing means into the outlet of the preparatory chamber. These closing means may be formed, if desired, by an envelope containing the dosed amount of additive. Preferably said moulding machine is furthermore characterized by a dosing device administering each time a dosed amount of additive to the preparatory chamber.

A particularly elegant, that is to say, a simple and safe closure of the preparatory chamber is obtained when the inserting device inserts each time a tubular fusible plug as the removable closing member into the outlet of the preparatory chamber. This fusible plug can be readily formed when the inserting device comprises a device deforming a flat metal strip into a tube and/or when the inserting device comprises a separator severing each time a length of a tube from a pipe. This tubular fusible plug may contain the dosed amount of additive.

A uniform dosing and hence a homogeneous reaction between liquid metal and additive are obtained when the dosing device administers each time a dam of additive parallel to the preparatory chamber extending transversely of the string of moulds.

A simple adaptation of the amount of additive to the contents of the mould cavity can be achieved when the dosing device is provided with adjusting means for varying the length of the dam of additive to be administered to the preparatory chamber. If the fusible plugs are previously provided with additive, the local dosing can be omitted and the fusible plug need only be provided with an inserting device. If desired, said fusible plug may be manually inserted.

Since the moulds of a string of moulds manufactured by an automatic moulding machine do not have an accurately defined thickness, the place of the mould is not exactly determined every time so that the inserting device and the dosing device cannot be disposed at a fixed place. This problem is nevertheless solved in a simple manner in that a further development of the moulding machine is characterized by rails extending parallel to the string of moulds to be manufactured, by a support displaceable along said rails and carrying the inserting device and by a finder connected with the support for co-operation with scanning members each time cast to the moulds in order to position the inserting device each time with respect to the mould.

The invention furthermore covers objects made by carrying out the method according to the invention and thus having improved or at least more clearly defined quality.

The invention furthermore relates to and provides a fusible plug inserting device, an additive dosing device and/or a fusible plug apparently intended for use in the method according to the invention.

5 In particular the invention relates to and provides a dosed amount of additive shaped into a form suitable for administration to a mould.

The invention furthermore relates to and provides a production line for a foundry, comprising a mould machine
10 according to the invention and furthermore characterized by an automatic moulding machine having an effluent nozzle each time opening out above a preparatory chamber.

The preparatory chamber and the mould cavity need not necessarily be united into a monolithic mould. Existing
15 moulds may be provided with an extension piece comprising the preparatory chamber and the obstructible outlet.

The invention will be described more fully hereinafter with reference to a drawing.

The drawing shows in:

20 figure 1 a side elevation partly broken away of a production line of a foundry,

figure 2 an enlarged sectional view taken on the line II-II in figure 1,

figure 3 a sectional view taken on the line III-III
25 in figure 2,

figure 4 on an enlarged scale detail IV of figure 2,

figures 5, 6, 7 and 8 each a variant of detail IV of figure 4,

30 figures 9 and 10 on an enlarged scale a perspective and a plan view respectively of detail IX in figure 1,

figure 11 on an enlarged scale detail XI of figure 10,

figure 12 on an enlarged scale detail XII of
35 figure 11,

figure 13 an enlarged side elevation of detail XIII of figure 10,

figure 14 an enlarged, perspective view of detail XIV of figure 10,

figure 15 a circuit diagram associated with the device shown in figures 9 to 14,

figures 16 and 17 perspective views of model plates to form moulds intended for use in the method according to the invention,

figure 18 a mould provided with means for carrying out the method in accordance with the invention, and

figure 19 a variant of figure 2.

The production line 21 of figure 1 of a foundry comprises a moulding machine 1 for manufacturing a string of moulds 22 consisting of a sequence of moulds 2. The moulding machine 1 comprises a slide table 23, on which each time a slice 3 of mould material 24, for example, mould sand is formed in that the mould material 24 drops from a bunker 25 down passing between two model plates 26 and 27 of a model 32 and subsequently compressed into an undeformable slice 3 since towards the model plate 26 held in place by a hydraulic ram 34 is forced the model plate 27 by means of a hydraulic ram 28 in the direction of the arrow 29 in order to cause the gauges provided on the model plates 26 and 27 to form corresponding recesses in the slice slides 30 and 31.

The model plate 32 has on each model plate 26 and 27 a mould cavity gauge 33 (see figures 16 and 17) for making together a mould cavity 4. This mould cavity 4 may have the form of a single object, but as is shown and as is known per se it may as an alternative consist of a tree of objects provided with a casting run 122. The model 32 according to the invention comprises furthermore on each model plate 26 and 27 a preparatory chamber gauge 35 to form together a preparatory chamber 5 in the mould material 24, a gutter gauge 36 for making a gutter 6 bounding the lower side of the preparatory chamber 5 and an outlet gauge 37 for making the recess for an outlet 7 on the bottom side of the gutter 6. The model 32 is preferably designed for use in the moulding machine 1 for the automatic manufacture of a mould string 22 and is provided on each model plate 26 and 27 with a scanning member gauge 39 to form each time a scanning member 40 (figures 1 and 8) on the outer side 38 in the form of a semi-cylindrical recess.

From figures 16 and 17 it will be apparent that the preparatory chamber gauge 35 is disposed at a higher level than the mould cavity gauge 33 and the outlet gauge 37 is disposed at the level located between the preparatory chamber 5 gauge 35 and the mould cavity gauge 33. After a slice 3 is formed the model plate 26 is moved off the path of the string 22, for example, by turning it upwards by means of the ram 34 about the hinge 41 in the direction of the arrow 42, after which the slice 3 is pressed against the string 22 already made by means of the ram 28, the slice sides 30 and 31 being pressed one against the other, whilst between them the required recesses described above are present. Before pouring cast metal into the moulds 2, the outlet 7 is each time first closed. This may be done with all kinds of removable closing means, for example, a stop 123 of figure 5 that can be drawn up, or a lump 43 (figure 6) or a granular mass 44 (figure 7) or a tablet 45 (figure 8) of additive, which releases the outlet 7 after solution and hence after the reaction of the additive with the liquid metal, so that the cast metal is passed on to the mould cavity 4.

Great preference deserves the embodiment shown in figures 1 to 4, in which the outlet 7 of the preparatory chamber 5 is held closed by means of a fusible plug 8, which is temporarily screened by a dam 46 of additive 9 lying thereon in the gutter 6.

The production line 21 furthermore comprises an automatic casting machine 47 having an outlet nozzle 48 opening out each time above a preparatory chamber 5 and each time closed by a plug 49. At the formation of each slice 3 the string 22 is stepped forward over a distance in the direction of the arrow 29, said distance corresponding to the thickness $\underline{d}$ of the slice 3 formed.

In carrying out the method according to the invention for casting metal objects liquid metal, for example, untreated cast iron 50 is poured during the preparation stage into the preparatory chamber 5 and thus joined to additive 9, for example, magnesium grains lying in the form of a dam 46 in the gutter 6. In this reaction known as the nodularisation laminated graphite is converted into pellet graphite. Gas and

slags are then developed, which rise up in the direction of the arrow 51, so that owing to the asymmetric disposition of the supplied substance a whirl 52 and an attended mixture are produced. After a given reaction time the whole amount of
5 additive 9, which first screened the fusible plug 8, is worked up and the fusible plug 8 fuses owing to the contact with the hot cast metal prepared in the preparation stage and formed in this case by nodular cast iron. In the preparation stage the outlet 7 is closed by the fusible plug 8, so that
10 neither the untreated cast iron nor the cast iron reacting with the additive 9 can enter the mould cavity 4, not until the fusible plug 8 has melted, which takes place after an adequate reaction time, the leading-in stage of the method starts and the prepared cast metal will then rapidly fill out
15 the mould cavity 4 at the desired casting rate. The preparatory chamber 5 has a size such that a preparatory chamber 5 completely filled out with cast iron contains, after the preparation stage, exactly a sufficient amount of cast metal to completely fill out the mould cavity 4. The slag produced in
20 the preparation stage and floating on the cast metal is left behind in the preparatory chamber. The preparatory chamber 5 has a bottom 53 inclined downwards towards the outlet 7.

The moulding machine 1 comprises, in accordance with the invention, an inserting device 10 each time inserting
25 a tubular fusible plug 8 into the outlet 7 of the preparatory chamber 5 (figures 1 and 9 to 14), which device is combined with a dosing device 11 supplying each time a dosed amount of additive 9 to the preparatory chamber 5. The moulding machine 1 comprises on both sides of the string
30 rails 12 extending parallel thereto, a support 13 displaceable by means of rollers 15 along said rails 12 and carrying the inserting device 10 and the dosing device 11 and a finder 14 connected with said support 13 and co-operating with the scanning members 39 each time formed on the moulds 2 for
35 separately positioning the inserting device 10 with respect to the mould 2, since the slices 3 do not have an accurately predetermined thickness d. The inserting device 10 comprises a rotatable carrier 16 for receiving a coiled tape 17 of metal having a sheet thickness of, for example, 0.2 mm and a

guide roller 18 for directing the tape 17 into a deformation device 19. The deformation device 19 comprises a round, rod-shaped core 20, around which the tape 17 is deformed into a tube 54, a length l of, for example, 8 cm of which is severed to serve as a fusible plug by means of a grinding disc 55 serving as a separator. The deformation device 19 has two pneumatic rams 56 rigidly secured to the support 13, the double-acting pistons 57 of which are connected with a core 20, the guide roller 18 and a tube clamp 58. To the support 13 is fastened a corresponding clamp 59 coaxial with the tube 54. The deformation device 19 operates as follows. When the rams 56 are energized for moving the pistons 57 in the direction of the arrow 60, the tape 17 and the tube 54 are advanced over a distance $l + \text{width of sawcut } l'$, because the clamp 58 is then operative and the clamp 59 is non-operative. The tape 17 is bent around the core 20 in a deformation cone 61 to form the tube 54.

Subsequently, the grinding disc 55 constantly driven by means of an electric motor 68 via a driving gear 69 in the direction of the arrow 62 is moved into a path of the tube 54, so that the fusible plug 8 is severed. Then the grinding disc 55 is moved back in the direction of the arrow 63, whilst the pistons 57 with the core 20 and the clamp 58 are moved back in the direction of the arrow 64, whilst the clamp 58 is inoperative and the clamp 59 is operative. The clamps 58 and 59 have a housing 124 including a conical chamber 65 for receiving jaws 66 pushed into a clamping position by means of springs 67. The spring force is proportioned so that a movement of the tube 54 in the direction of the arrow 60 only the clamp 58 is operative and at the return movement of the clamp 58 the clamp 59 is operative.

For displacement along the rails 12 the support 13 is driven by an electric motor 71 via a driving gear 70. The support 13 carries furthermore an electric motor 72, which reciprocates a cam disc 76 through a driving gear 73 and an eccentric connecting rod mechanism 74 and rotatably drives stepwise in only one direction a dosing roller 77. The cam disc 76 co-operates with a guide roller 78, which is arranged on an arm 79 of a balance 81 carrying the grinding disc 55

and its motor 68 with the driving gear 69 and turning around a shaft 80 for moving the grinding disc 55 in the direction of the arrows 62 and 63.

5 The dosing device 11 comprises a bunker 82 for receiving additive 9 having an outlet 83 at a uniform height h above the dosing roller 77. By turning the dosing roller 77 each time through the same angle in the direction of the arrow 125 the same amount of additive 9 per running centi-
10 metre is each time given off to the outlet 83. The adaptation of the amount of additive 9 to the capacity of the mould cavity 4 is achieved by matching the length u of the outlet 83, that is to say rendering it substantially equal - to the length y of a preparatory chamber 5 extending parallel thereto. The height m and the width n of the preparatory
15 chamber 5 are preferably chosen, so as to have a constant value in order to maintain a constant flow rate to the mould cavity 4 irrespective of the capacity of the mould cavity 4, but the length y of the preparatory chamber 5 is adapted to the capacity of the mould cavity 4. The corresponding adap-
20 tation of the amount of additive 9 is achieved by setting the displaceable edges 84 of the outlet 83, since each edge 84 is connected by a slot-bolt-and-screw connection with the bunker 82.

25 The inserting device 10 and the dosing device 11 cyclically operate as follows.

When the string 22 is advanced by the energized ram 28, the scanning member 40 urges the finder 14 outwards as a result of which the switch 87 connected herewith is closed and relay 88 is energized. Relay 88 causes switch 88a to
30 close so that the electric motor 71 is started via a change-over relay 95 and a switch 95a to displace the support 13 in the direction 29. At the same time relay 88 closes switch 88b, so that a time relay 92 is switched on, which changes over a change-over relay 92a after a given period of time for
35 changing over the change-over relay 95 and hence the switch 95a for inverting the direction of rotation of the electric motor 71. The latter drives the support 13 back until the finder 14 encounters the next-following scanning member 40, after which the switch 87 is opened for de-energizing

relay 88. After the switch 88b is opened, that is to say after relay 92 is de-energized and the change-over switch 92a is changed over, the electric motor 71 is stopped.

Moreover, the finder 14 actuates the switch 94 for
5 closing a relay 96 in order to start the motor 72 via the make contact 96a and the switch 96b, now with certainty the inserting device 10 and the dosing device 11 are positioned with respect to a following preparatory chamber 5. Through the first 180⁰ of the revolution of the eccentric disc 98
10 the motor 72 moves the grinding disc 55 in the direction of the arrow 62, so that a fusible plug 8 is severed and drops into the outlet 7. During the next 180⁰ of the eccentric disc 98 the dosing roller 77 is driven and a dosed amount of additive 9 drops into the gutter 6. When the eccentric disc
15 98 has turned through 360⁰, a lug 99 carried by the disc 98 actuates a magnetic switch 100, which energizes a time relay 101, which in turn switches on relay 102 via a switch 101a. The switch 102a is opened for stopping the motor 72 via relay 96 and switch 96b and switch 102b is closed for energizing a
20 relay 105 of a two-way valve 106 for actuating the pneumatic rams 56 in the direction of the arrow 60 for deforming the tape 17 into a tube 54. In the meantime time relay 101 is de-energized, the relay 102 remaining energized via switch 102b and a terminal switch 107. When the terminal switch 107
25 is actuated by the deformation device 19, relay 102 is de-energized, so that switch 102b is opened and switch 102a is closed. As a result relay 105 is disengaged and relay 104 of the two-way valve 96 is energized for returning the deformation device 19 in the direction of the arrow 64. At the
30 same time a relay 110 of a switch 110a is energized in order to retain relay 104 in the energized state until the deformation device 19 opens a terminal switch 108. Then the inserting device 10 and the dosing device 11 are again in the rest position.

35 Figure 15 shows furthermore the motor 68 with its manual switch 111 which continuously operates during operation.

Figure 18 shows that a conventional mould 114 filled with sand 116 comprising a lower casing 117 and an

upper casing 118 can be provided in accordance with the invention with an extension casing 119. Then the mould cavity 4 with the casting run 120 and the riser 121 is arranged in the casings 117 and 118, whilst the preparatory chamber 5 is arranged in the extension casing 119 with an outlet closed by a fusible plug 8 and with the additive 9.

According to the invention an automatic check of an adequate casting temperature and hence of the quality of the product is obtained. If the casting temperature is too low, the fusible plug 8 will not fuse and the metal remains in the preparatory chamber 5. In this respect the matching thickness of the tape 17 may be chosen to be, for example, 0.1, 0.15, 0.2, 0.25, or 0.5 mm. Instead of using a tubular fusible plug 8, a different fusible plug may be employed; for example, a metal plate.

The outlet 7 comprises a down channel 112 having a width z and a superjacent chamber 113, receiving the fusible plug and having a length y , which exceeds the width z . The length w of the tubular fusible plug 8 may be 9 cm and is slightly smaller than the length y and is sufficiently larger than the width z to ensure a contact surface 126 at each end of the fusible plug 8 in order to slide the fusible plug 8 to a sealing position, the chamber 113 is preferably converging in downward direction.

In a variant of the method illustrated in figure 19 the outlet 7 of the mould 2 is temporarily closed by means of a fusible plug 8 deposited therein, for example, by hand formed by a tubular envelope 89 containing a dosed amount of additive 9 and being pinched at both ends. In this case the top side of the envelope has the function of a screen, which will prevent with certainty the additive 9 from being flushed away through the outlet 7 and from directly getting to the top layer of the preparatory chamber 5 when the liquid metal is being poured into the preparatory chamber 5.

The envelope 89 serves as a commercial packing of additive 9, which is thus in an adequate dosed amount ready for administration to a mould, like a tablet 45 or a lump 43 of a given weight.

- 1 -

C L A I M S

1. A method of casting metal objects in which for preparing a cast metal liquid metal and additive are joined to one another in at least one preparatory chamber having at least one outlet giving access to a mould cavity, characterized by at least two successive steps to wit:

a preparation step in which the additive and the liquid metal are joined to one another in the preparatory chamber, whilst each outlet leading to the mould cavity is closed and

a leading-in step in which the cast metal is led to the mould cavity through an outlet provided on the bottom side of the preparatory chamber, which is opened only some time after the liquid metal and the additive have been joined to one another in the preparation step.

2. A method as claimed in claim 1, characterized in that whilst the outlet is closed during the preparation stage an exactly adequate amount of liquid metal is charged in the preparatory chamber to fill out the mould cavity with cast metal during the leading-in stage.

3. A method as claimed in claim 1 or 2, characterized in that during the preparation stage the outlet is held in the closed state by means of additives.

4. A method as claimed in claim 1, 2 or 3,
5 characterized in that during the preparation stage the outlet is held in the closed state by means of a fusible plug.

5. A method as claimed in claim 4, characterized in that during the preparation stage the fusible plug is at least temporarily screened by additive.

10 6. A method as claimed in claim 4 or 5, characterized in that the additive is screened by a fusible material.

7. An object manufactured by carrying out the method claimed in any one of claims 1 to 6.

15 8. A pattern for manufacturing a mould for carrying out the method claimed in any one of claims 1 to 5, said pattern having for the formation of every mould from moulding material, for example, sand, at least one mould cavity gauge recessing a mould cavity in moulding material and at least
20 one preparatory chamber gauge recessing a preparatory chamber in moulding material and an outlet gauge to form in the moulding material an outlet establishing the communication between the preparatory chamber and the mould cavity, characterized in that the preparatory chamber gauge is disposed at
25 a higher level than the mould cavity gauge and in that the outlet gauge is disposed at a level located between the preparatory chamber gauge and the mould cavity gauge.

9. A model as claimed in claim 8, characterized by a gutter gauge arranged above the outlet gauge to form a
30 gutter receiving a dam of additive.

10. A model as claimed in claim 8 or 9, characterized in that it is designed for being used in a mould machine for the manufacture of a mould string and in that the model comprises at least one scanning member gauge for
35 casting a scanning member to the outer side of each mould.

11. A mould machine for the manufacture of a mould string, said machine for carrying out the method claimed in any one of claims 1 to 5 being characterized by a repeatedly removable inserting device for inserting closing means into
40 the outlet of the preparatory chamber.

12. A mould machine as claimed in claim 11, characterized by a dosing device administering each time a dosed amount of additive to the preparatory chamber.

13. A mould machine as claimed in claim 11 or 12,
5 characterized in that the inserting device inserts each time a tubular fusible plug as removable closing means into the outlet of the preparatory chamber.

14. A mould machine as claimed in claim 13, characterized in that the inserting device comprises a device
10 deforming a flat metal strip into a tubular member.

15. A mould machine as claimed in claim 13 or 14, characterized in that the inserting device comprises a separator severing each time a length from a tube.

16. A mould machine as claimed in claim 12, 13, 14
15 or 15, characterized in that the dosing device each time administers to the preparatory chamber extending transversely of the mould string a dam of additive lying parallel to the preparatory chamber.

17. A mould machine as claimed in claim 16, characterized in that the dosing device is provided with adjusting
20 means for varying the length of the dam of additive to be administered to the preparatory chamber.

18. A mould machine as claimed in any one of claims 11 to 17, characterized by rails extending parallel to the
25 mould string to be manufactured, by a support displaceable along said rails and carrying the inserting device and by a finder connected with said support for co-operating with scanning members each time cast to the moulds for positioning each time the inserting device relatively to the mould.

19. A production line for a foundry, comprising a
30 mould machine as claimed in any one of claims 11 to 18, characterized by an automatic casting machine having an effluent nozzle opening out each time above a preparatory chamber.

20. A fusible plug for carrying out the method as
35 claimed in any one of claims 4, 5 or 6, characterized in that it mainly consists of fusible envelopes containing a dosed amount of additive.

21. A fusible plug inserting device apparently

intended for use in the method claimed in any one of claims 4 to 6.

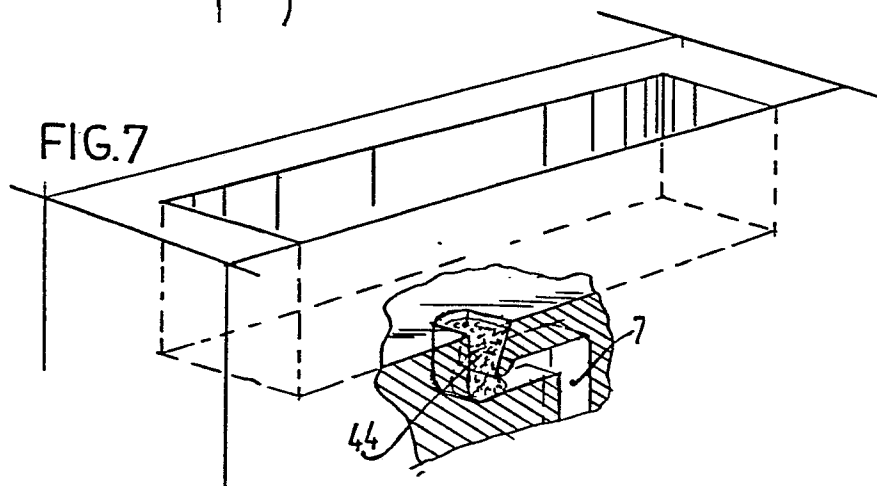
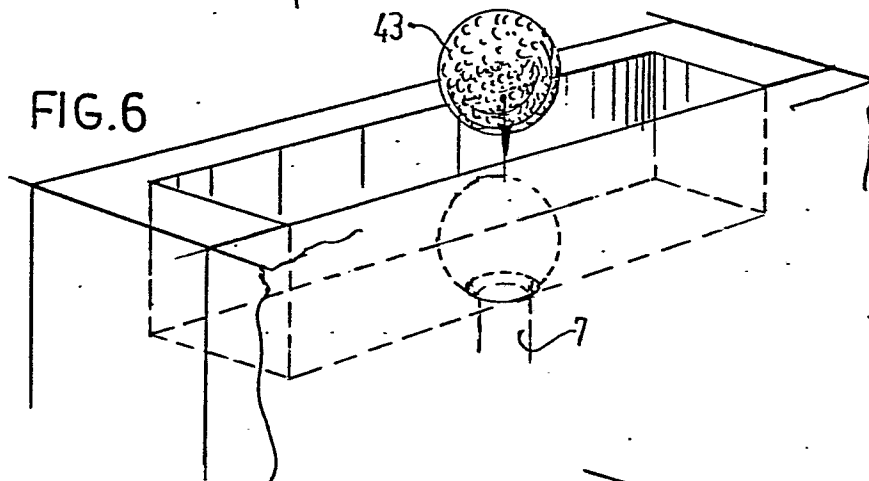
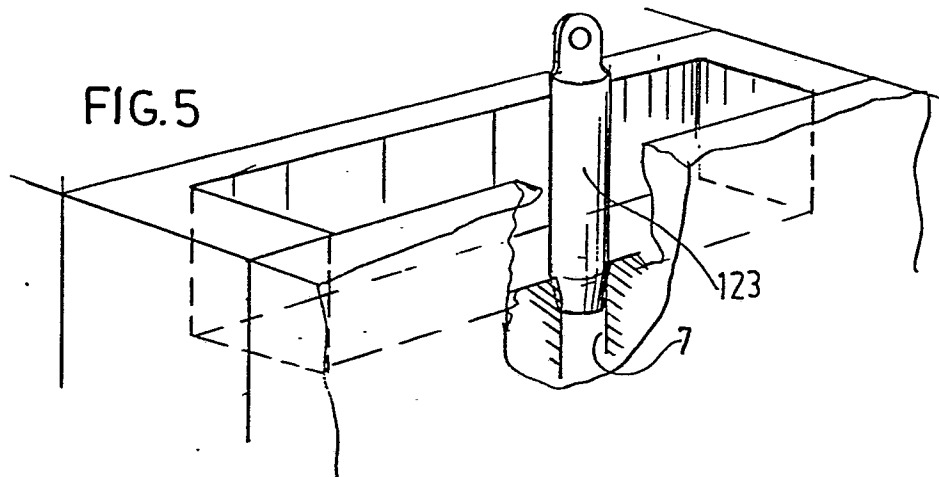
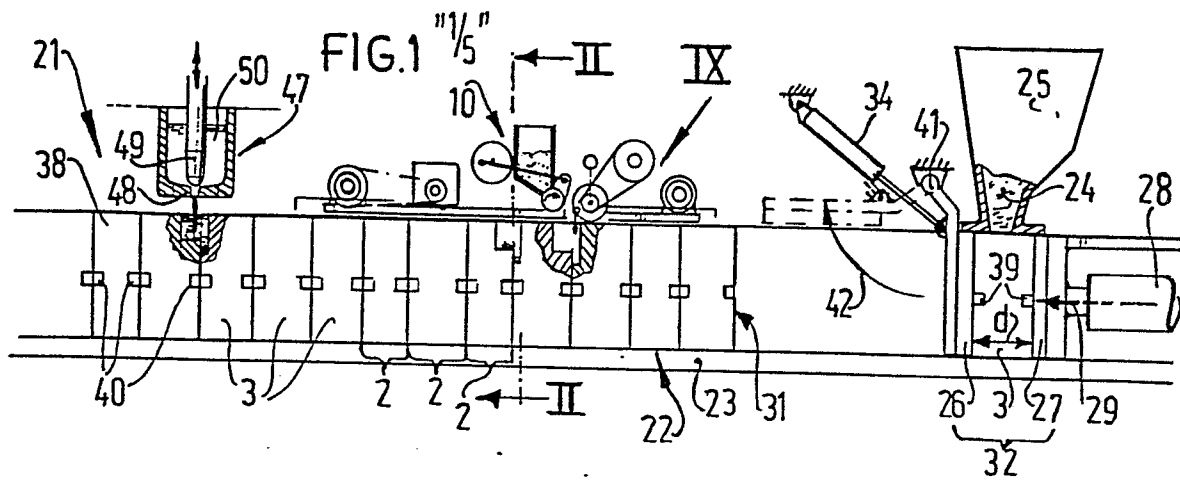
22. An additive dosing device intended for use in the method claimed in any one of claims 1 to 6.

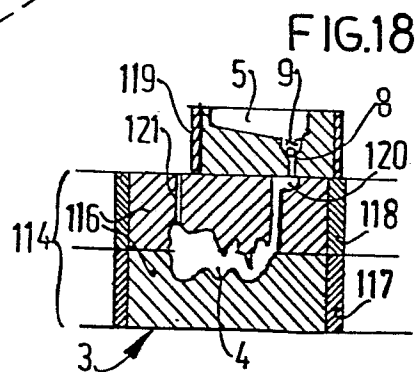
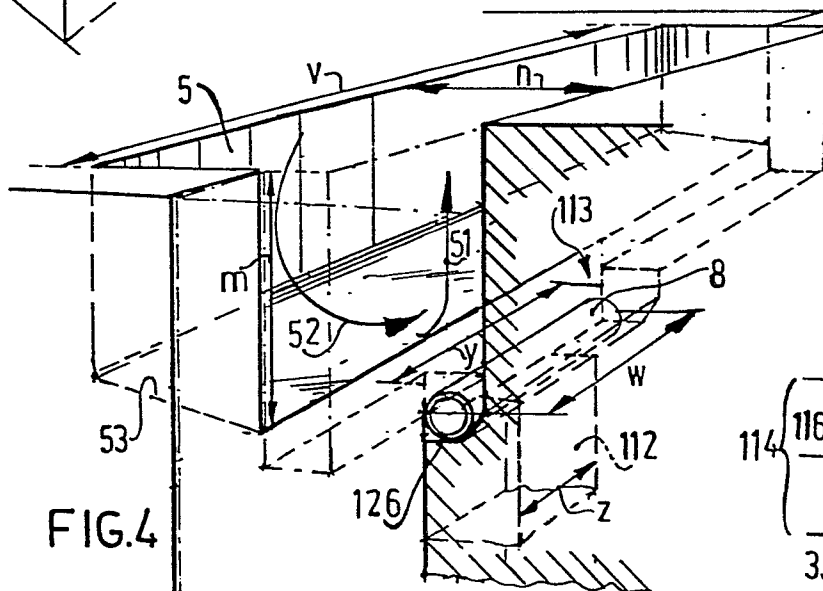
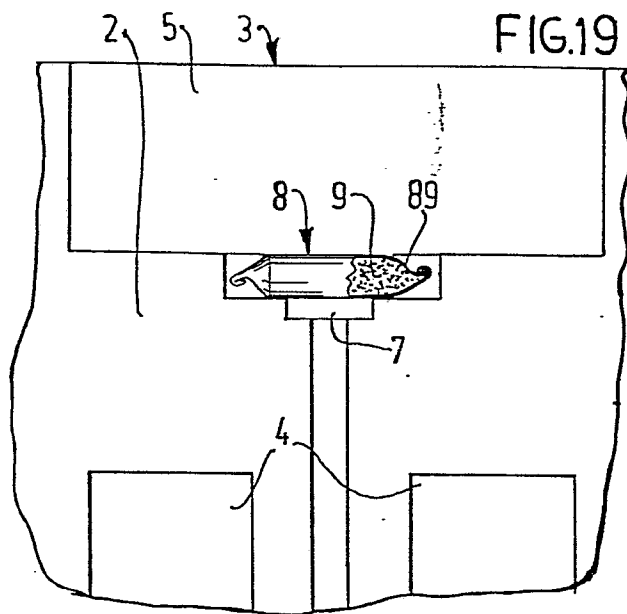
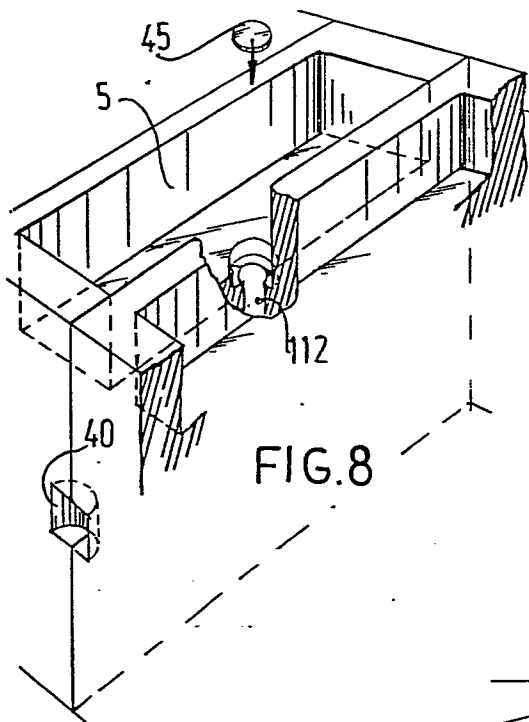
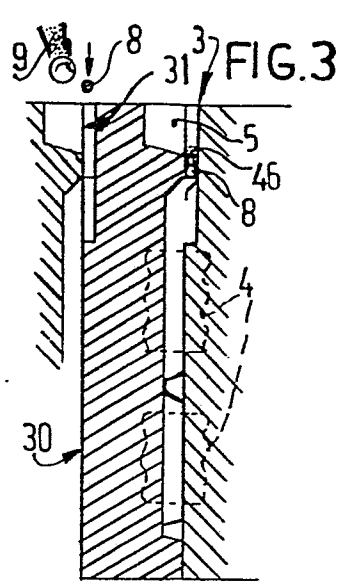
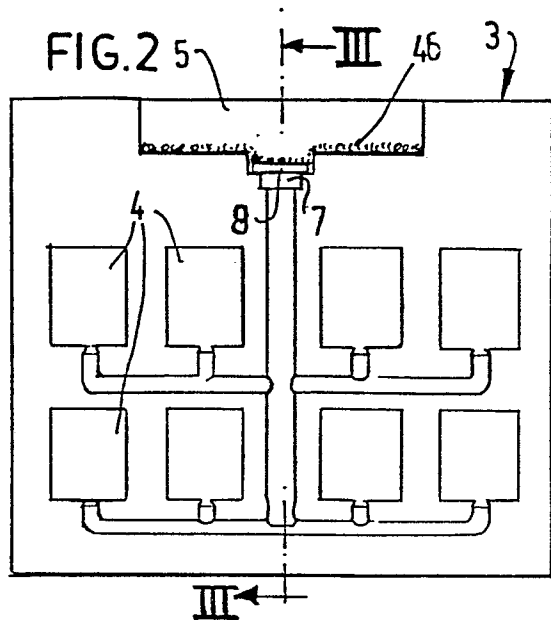
5 23. A fusible plug inserting device as claimed in claim 21, characterized in that it is provided with an additive dosing device.

24. A dosed amount of additive provided in a form suitable for administration to a mould.

10 25. A mould for carrying out the method as claimed in any one of claims 1 to 6, said mould having at least one mould cavity and at least one preparatory chamber with at least one outlet giving access to the mould cavity, characterized in that the outlet is provided on the bottom side of
15 the preparatory chamber and in that the outlet can be opened during the preparation stage and during the leading-in stage.

26. A mould as claimed in claim 25, characterized in that the preparatory chamber has substantially the same capacity as the mould cavity communicating therewith.





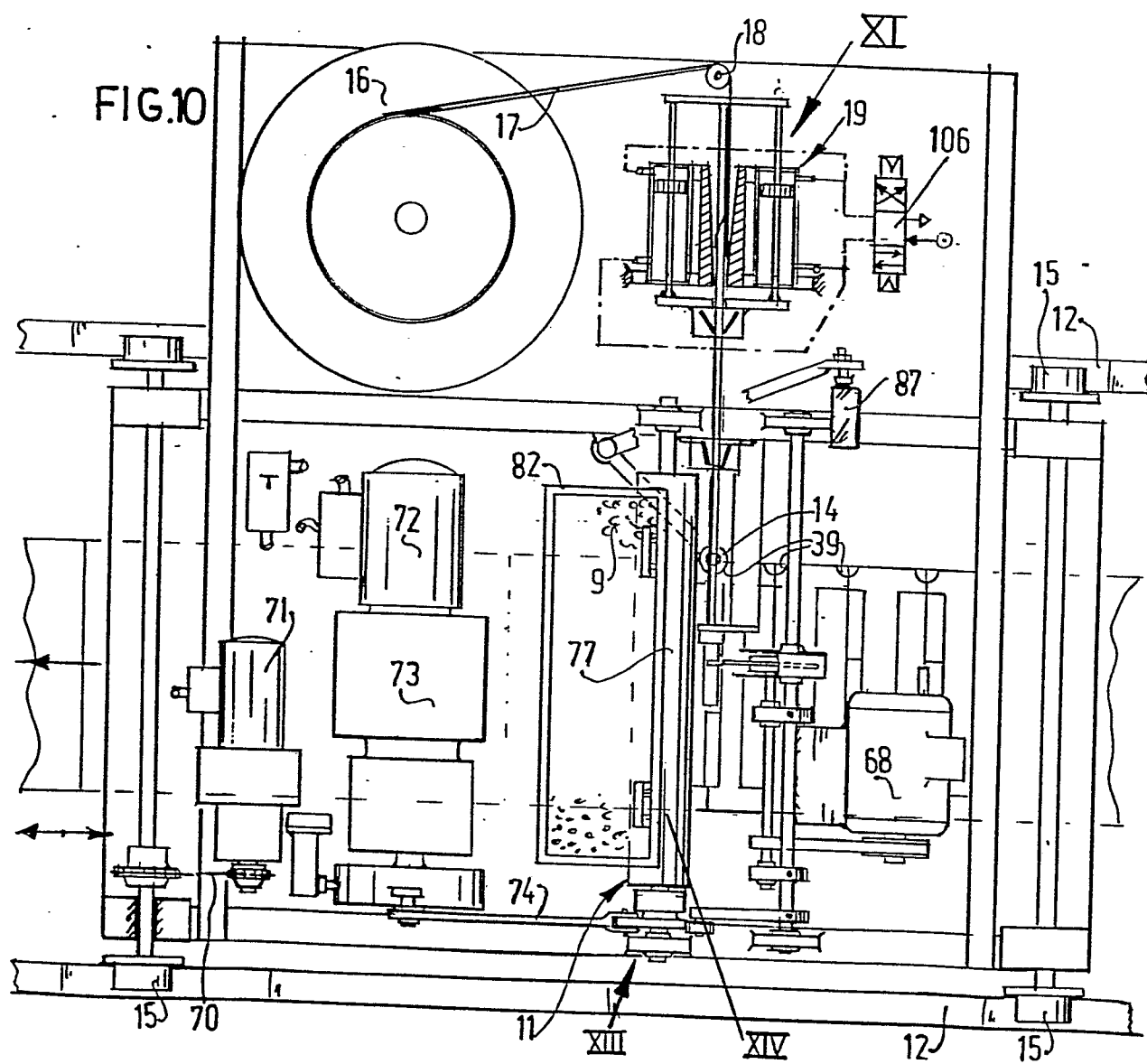
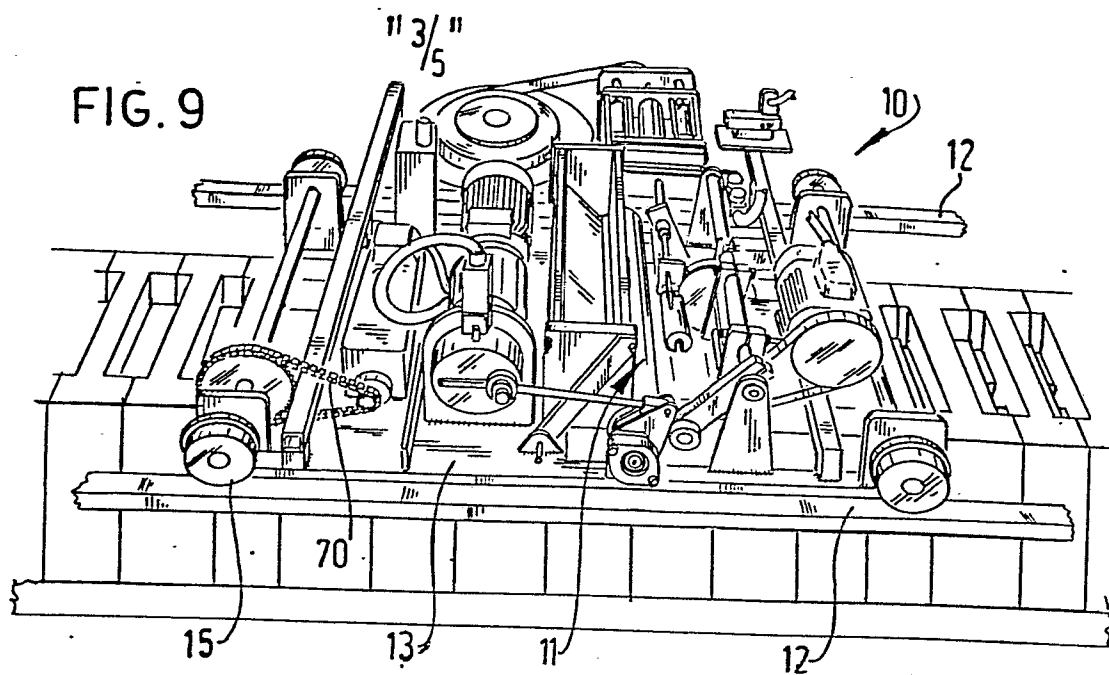
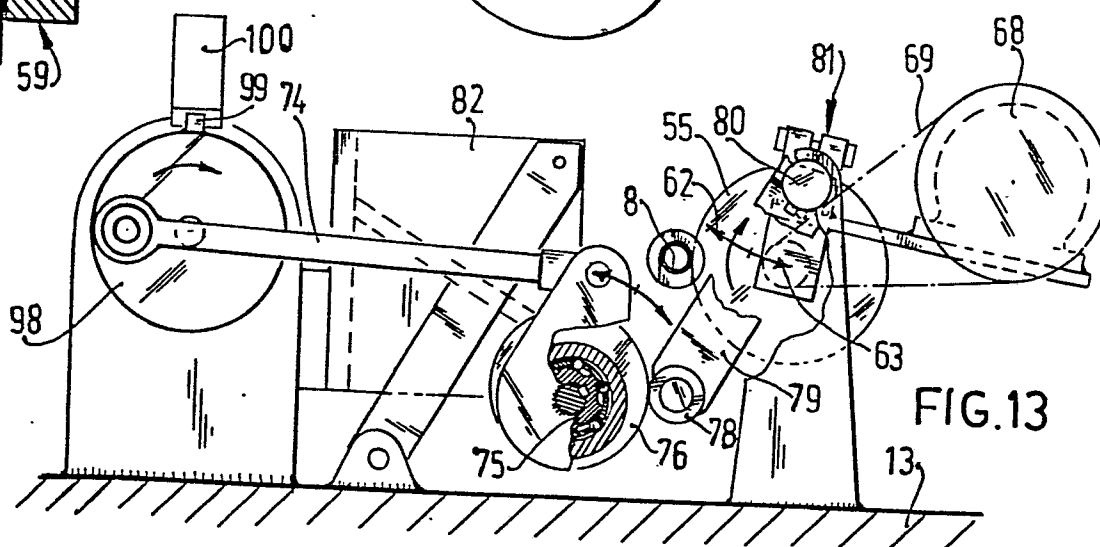
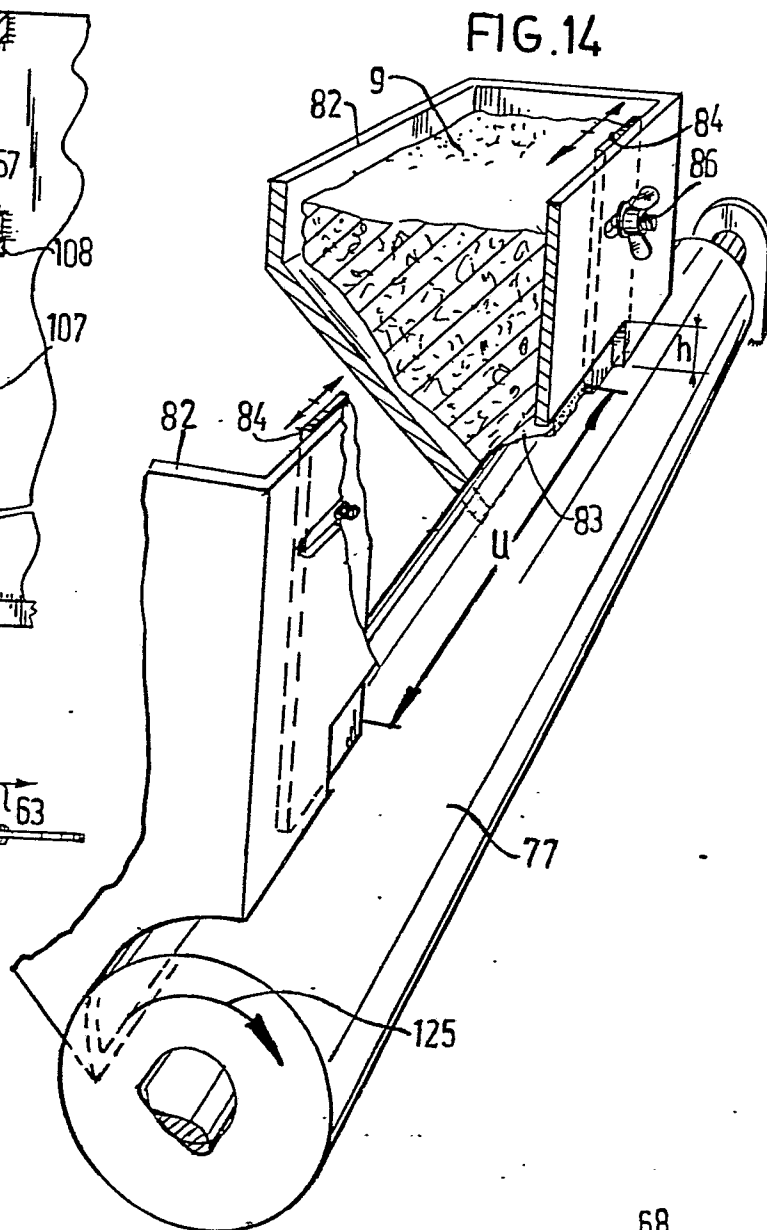
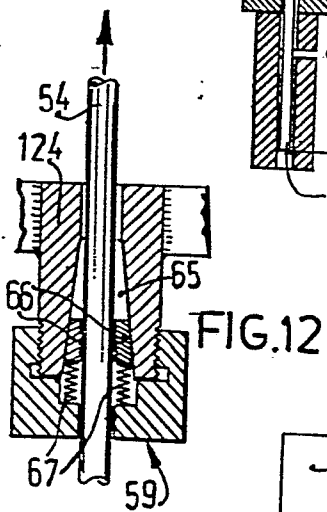
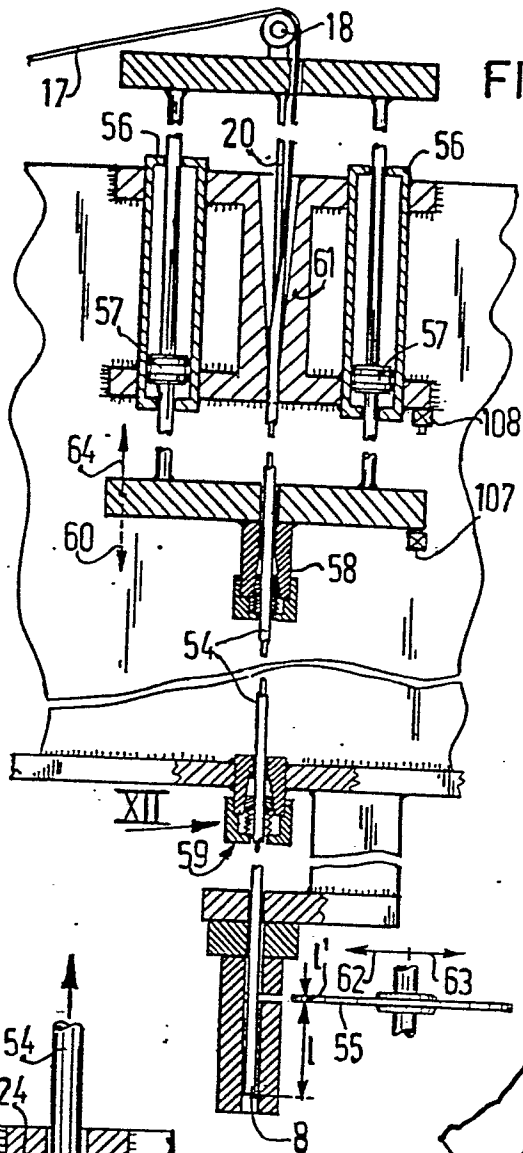
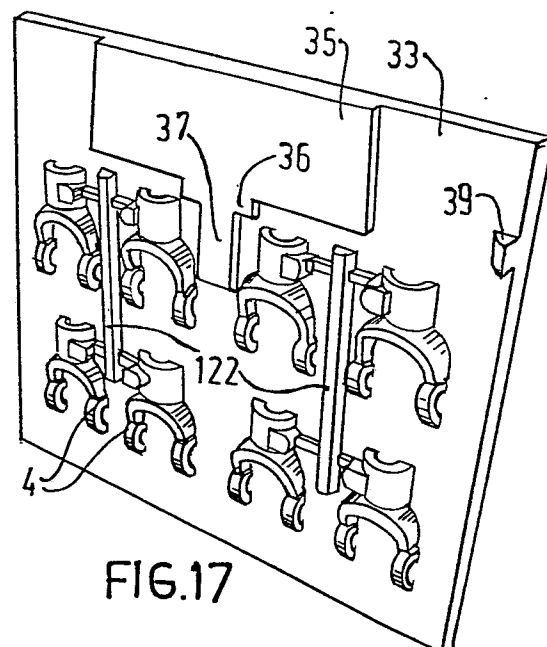
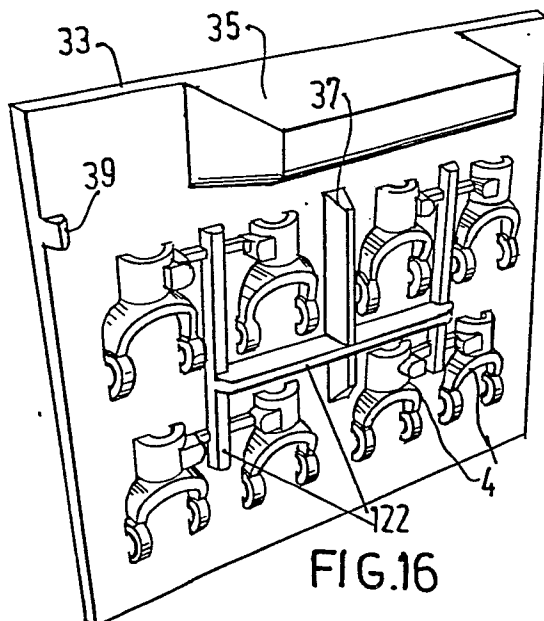
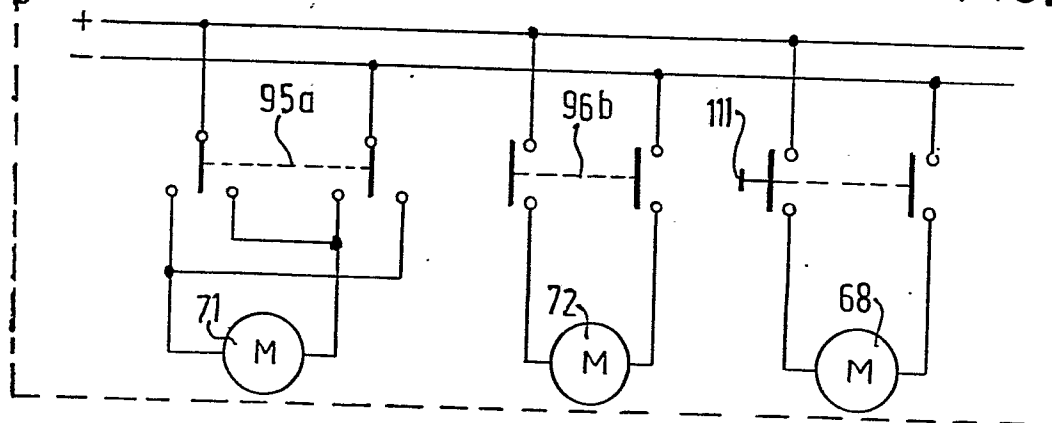
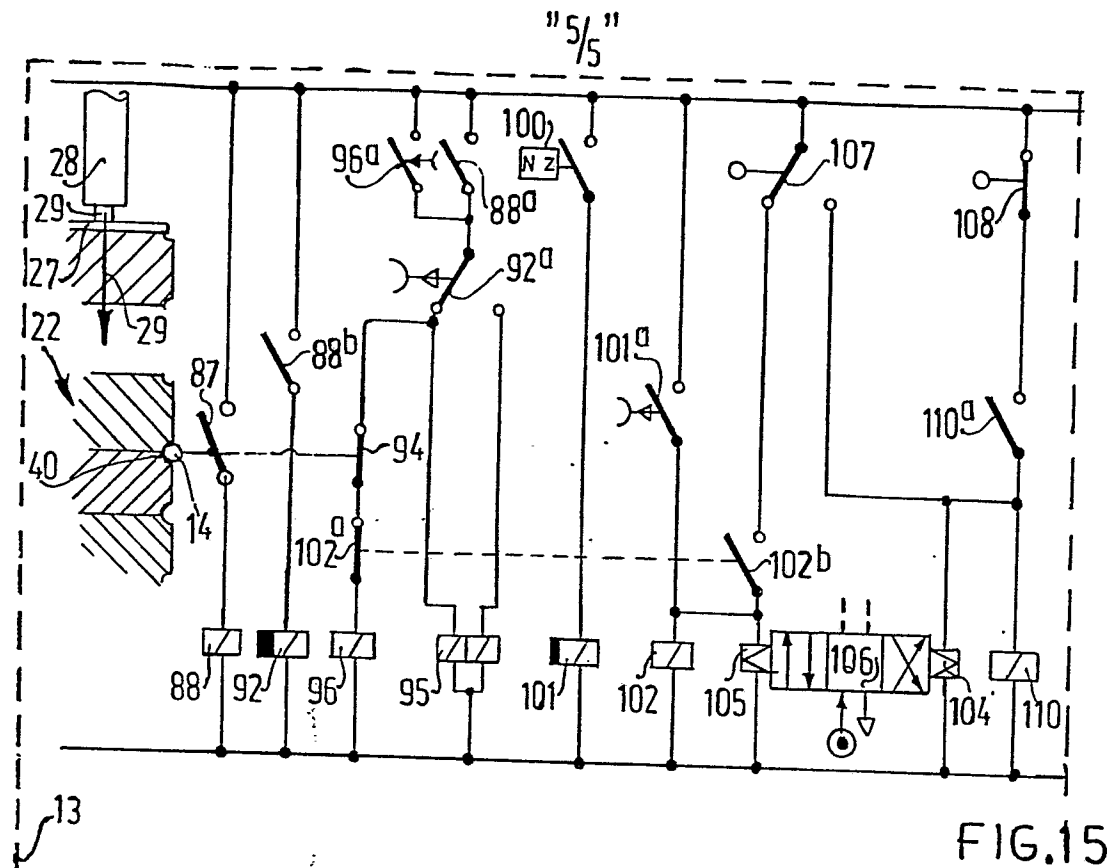


FIG.11 $\frac{11}{4}$





EP 81 20 1051

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 3 851 700</u> (GENERAL MOTORS)		B 22 D 1/00 C 21 C 1/10 B 22 D 47/02
A	<u>FR. - A - 2 094 191</u> (BERNOTTI)		
A	<u>DE - A - 2 006 704</u> (PASSAVAN)		
A	<u>DE. - A - 1 195 912</u> (RHEINSTAHL)		
A	<u>DE. - A - 2 325 720</u> (SULZER.)		
A	<u>US. - A - 3 965. 966.</u> (DANSK INDUSTRI)		
A	<u>NL. - A. - 74. 04556</u> (OTAKI)		
A	<u>FR - A - 2. 329. 391</u> (FISCHER)		TECHNICAL FIELDS SEARCHED (Int.Cl. 3) B 22 D 1/00 27/20 C 21 C 1/10 C 22 C 33/10 33/08 B 22 C 11/10 B 22 D 47/02
A	<u>FR - A - 2 393 746</u> (IRSID)		

			CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	28-12-1981	SCHIMBERG	