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(54) **A tube filling machine.**

(57) A machine for simultaneous filling of a plurality of tubular electrical resistance elements comprises means (26) for holding of a plurality of element tubes (17) in a vertical position, support means (29) for supporting the lowermost ends of the element tubes (17) and simultaneously therewith holding the lowermost terminal end of the resistance wire spiral, hooking means for hooking up the uppermost terminal end of the resistance wire, means (14) for holding filling tubes (15) which surround one resistance wire spiral each.

An insulation powder magazine (19) is disposed laterally adjacent the filling tubes (15) and feeds the element tubes (17) with insulating powder through filling hoppers (21) which are vertically movable and are fed with predetermined amounts of insulating powder through longitudinally retractable and extendable obliquely downwardly directed tubular nozzles (20).

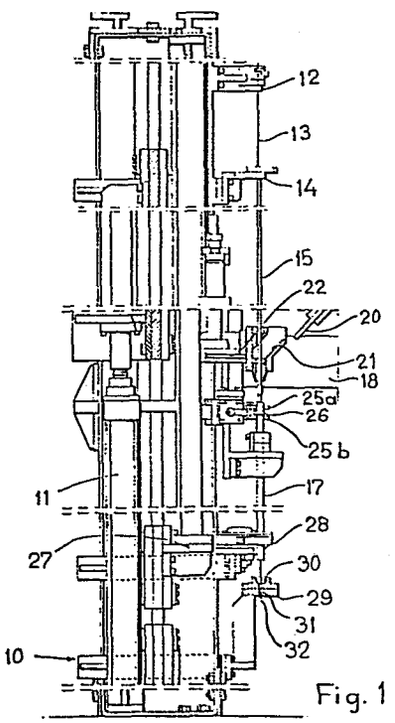

Fig. 1

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A tube filling machine

The present invention relates to a tube filling machine, i.e. a machine for feeding of electrically insulating powder into tubular electric heating elements.

Already previously a tube filling machine is known which machine is designed for feeding of a quantity of powder into a tubular electric heating element to embed therein a centrally disposed electric resistance element. The feeding of the powder takes place through one end of the element through a channel formed by the space between an outermost feeding tube adapted to be pushed into the tube element, and a concentric innermost feeding tube, which is inserted into the outermost feeding tube.

The previously known filling machine is provided with special powder valves in each one of the spaces between the outermost and innermost feeding tubes.

The previously known filling machine has found a wide spread marked, and it has been highly appreciated by the end users.

However, it has been found that certain improvements with respect to operational speed and ease in handling would still be possible, and simultaneously maintenance and servicing could be facilitated. Also some constructional details could be simplified so as to reduce the costs and make the filling machine less susceptible to operational disturbances.

The present invention has aimed at providing a filling machine that meets the just mentioned demands.

To that end, a tube filling machine according to the present invention constitutes a machine for simultaneous filling of a plurality of tubular electrical resistance elements comprising means for holding of a plurality of element tubes in a vertical position, support means for supporting the lowermost ends of the element tubes and simultaneously therewith holding the lowermost terminal end of the resistance wire spiral, hooking means for hooking up the uppermost terminal end of the resistance wire, means for holding filling tubes which surround one resistance wire spiral each, wherein an insulation powder

magazine is disposed laterally adjacent the filling tubes and feeds the element tubes with insulating powder through filling hoppers which are vertically movable and are fed with predetermined amounts of insulating powder through longitudinally retractable and extendable obliquely downwardly directed tubular nozzles.

The invention will be described in more details below with reference had to the accompanying drawings.

Fig. 1 is a side-view of one embodiment of a filling machine according to the invention with some portions of the machine left out to reduce the overall hight of the figure;

Fig. 2 is a front-view, partly in section, of a tube supporting portion of the machine in Fig. 1;

Fig. 3 is a side-view, partly in section, of a powder filling portion of the machine in Fig. 1.

The filling machine according to the invention has a frame 10 which carries equipment necessary for operation of the filling machine such as hydraulic cylinders 11 and valves, not shown, for control thereof. Further, the frame 10 carries fixed brackets and movable brackets for the element tubes, as well as the equipment necessary for the powder filling.

Thus, at the upper end of the filling machine there are disposed a plurality of fixed brackets 12, for instance twentysix, which brackets 12 are disposed side by side in a horizontal row. Each one of the brackets 12 is adapted to hold a vertically depending rod 13 which has, at the lowermost end thereof a hook, not shown, or a similar member to secure one terminal of the electric resistance wire spiral of a tube element under manufacture.

Below the row of brackets 12 there is disposed a horizontal row of holding brackets 14 for filling tubes 15, one for each one of the twentysix tube elements under manufacture in the instant case.

The filling tubes 15 are very thin-walled and have an inner diameter only slightly exceeding the outer diameter of the electrical resistance wire spiral of the tube element, so as to permit passage of the resistance wire

spiral through the filling tube 15. Near or at its lowermost end each one of the filling tubes 15 has a number of lateral fins 16 which protrude radially and are adapted to abut the inner surface of the respective element tubes 17 so as to position the filling tubes 15 centrally of the element tubes 17. It should be noted that the outermost ends of the fins 16 slide very easily against the inner surface of the respective element tube 17 due to the very restricted contact area.

A bracket 18 holds a container 19 which constitutes a magazine for the powder which is to form insulating and supporting material between the electrical resistance wire spiral and the outer sheathing of the electrical tube element, i.e. the element tube 17. Of course, the general purpose of the filling machine according to the present invention is to fill the tubular elements with insulating material from the magazine 19 in predetermined and correct doses.

At its lower end the magazine 19 has obliquely downwardly directed nozzles 20 which are at least in part longitudinally movable. The expression at least in part is used to denote that the nozzle 20 may be divided up into several smaller tubes, out of which only one or a few may be longitudinally movable.

The magazine 19 is adapted to cooperate with a vertically movable hopper 21 on a bracket 22. The lowermost portion 23 of the hopper 21 is conical and has outer dimensions so as to fit closely into the upper end of the element tubes 17.

The upper ends of the element tubes 17 are held in position during the filling by means of a holding mechanism, generally denoted 24. That mechanism comprises two support members 25a, 25b having recesses for the element tubes 17, and a horizontally movable clamping means 26, by means of which the element tubes are locked to the holding mechanism.

A further bracket 27 carries a vibrator 28 which is adapted to vibrate the element tubes 17 at a suitable frequency during the filling. The vibrator 28 is vertically movable and should, during the entire filling procedure,

take the best possible position with respect to the amount of powder that has already been admitted.

At their lowermost ends the element tubes 17 are supported by means of a support 29 which has a plurality of cup shaped recesses 30, viz. one recess 30 for each one of the element tubes 17. Each cup shaped recess 30 has a bore 31 in the bottom thereof to receive the terminal 32 of the resistance wire spiral. To seal off the space between the terminal and the element tube each element tube is provided with a sealing plug, not shown.

Normally, the filling machine according to the invention will be built for filling of a larger number of tube elements simultaneously. A suitable size of the machine could mean a simultaneous filling of 20-30 tube elements. By a suitable programming of the devices which control the movements of the machine it is possible to use the machine for tubular elements of different lengths, which thus may be filled in the machine without other steps than a simple shift ot the program. The machine may also be utilized for tubular elements of different diameters, but in such cases a few components have to be replaced by others with due respect paid to the tube diameter in each particular case.

The operational sequence at the filling of tubular elements may be as follows, whereby it is assumed all the time that the nozzles 20 which protrude downwardly from the magazine 19 are upwardly retracted, so that the magazine 19 and the hopper 21 may pass each other in a vertical path of movement. The nozzles 20 assume their downwardly protruding position only for the short period of time when the powder feeding takes place. In the starting position the support 29 for the guiding cup shaped recesses 30 should be in its lowermost position. The vertical stroke of the support 29 is comparatively short. The filling tube 15, the hopper 21 and the powder magazine 19 should be rized into a position wherein the lowermost edges thereof are disposed just about in level with the lowermost end of the rod 13 which holds the hook for connection of the resistance wire spiral. Then, the element tubes are inserted into the element tube holder

24. Before that the element tubes may advantageously be placed in a magazine which may hold the desired number of tubes. All of them may then be gripped by means of a simple device and be simultaneously inserted into the filling machine. In such a manner a time consuming insertion of individual element tubes is avoided. Then, the element tubes 17, the filling tubes 15 and the filling hoppers 21 are elevated to their uppermost position, so that the fastening hook for the resistance wire spiral is made accessible. Prior to that the filling tube 15 may be inserted into the element tube 17 by a short movement downwardly, and similarly may the hopper 21 or rather the conical end portion 23 thereof be introduced into the end of the element tube 17 by a short movement downwardly.

With the hooks for the resistance wire spirals made accessible the spirals may be hooked up thereon. At this moment the spirals are provided with terminals at both ends, and at the lower end the terminal is provided with a sealing plug which is adapted to make a seal between the terminal and the inner surface of the element tube. Then, the element tubes 17, the filling tubes 15 and the hoppers 21 are moved downwardly. As the tubes 17 are in their lowermost position the support 29 is moved a short distance upwardly so as to press the sealing plugs into the element tube ends. Simultaneously, the hoppers 21 move downwardly, similar to the movement of the element tubes 17. Also the filling tubes 15 move downwardly so as to reach the sealing plugs at the bottom end of the element tubes 17. Then, the resistance wire spiral assumes a stretched position within the filling tube 15. Now, the powder magazine 19 is moved vertically into a proper position, and the nozzles 20 are extended into the hoppers 21. In that moment a connection between each one of the nozzles 20 and the powder magazine 19 is opened and the flow of powder starts up.

Simultaneously with the start of the powder flow the vibrator starts, and as the filling of the tubes proceeds the vibrator and the filling tubes move vertically upwardly. When a suitable amount of powder has been given off

the nozzles 20 are retracted and the powder flow is interrupted. The speed of movement of the filling tubes and that of the vibrator need not be the same, but are in both cases adapted to the particular kind of powder, the element dimensions and other relevant factors.The moment when the powder flow should be interrupted may be controlled e.g. by controlling the actual filling time or by control in dependence of the position of the filling tube.

When the filling of the element tubes 17 has been completed a small additional movement upwardly of the filling tubes 15 takes place, and also the hopper 21 is moved upwardly. Simultaneously, the cup shaped guide recesses 30 are moved downwardly which permits withdrawal of the element tubes, advantageously by means of the same device as that which was once used for the insertion of the element tubes 17 into the filling machine.

Claims

1. A machine for simultaneous filling of a plurality of tubular electrical resistance elements comprising means (25) for holding of a plurality of element tubes (17) in a vertical position, support means (29) for supporting the lowermost ends of the element tubes (17) and simultaneously therewith holding the lowermost terminal end of the resistance wire spiral, hooking means for hooking up the uppermost terminal end of the resistance wire, means (14) for holding filling tubes (15) which surround one resistance wire spiral each, wherein an insulation powder magazine (19) is disposed laterally adjacent the filling tubes (15) and feeds the element tubes (17) with insulating powder through filling hoppers (21) which are vertically movable and are fed with predetermined amounts of insulating powder through longitudinally retractable and extendable obliquely downwardly directed tubular nozzles (20).

2. A machine as claimed in claim 1, wherein the filling tubes (15) at their lowermost ends are provided with radially protruding lateral fins (16) adapted to slidably bear against the inner surfaces of the element tubes (17) so at to position the resistance wire spiral centrally of the element tube.

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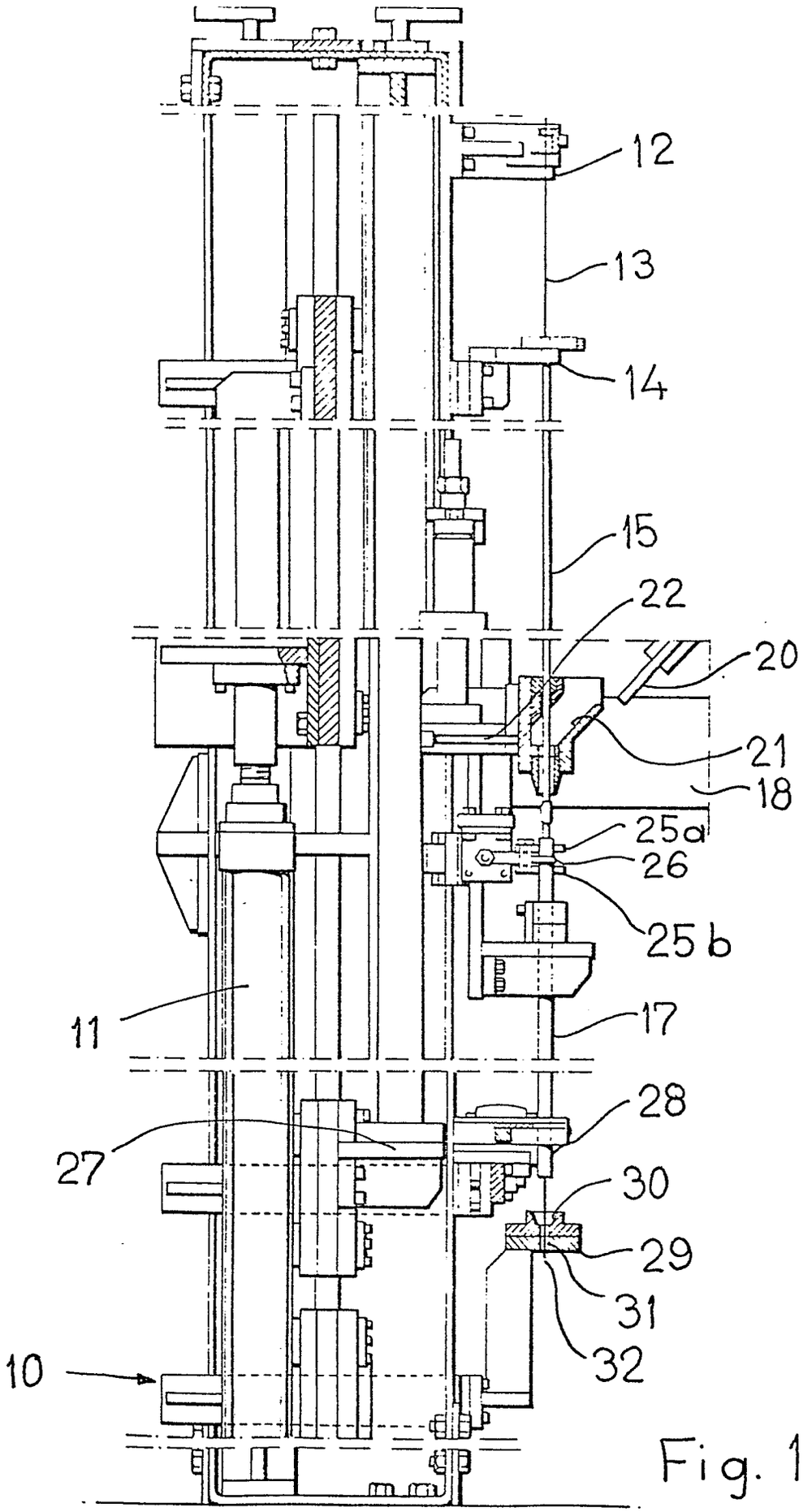

Fig. 1

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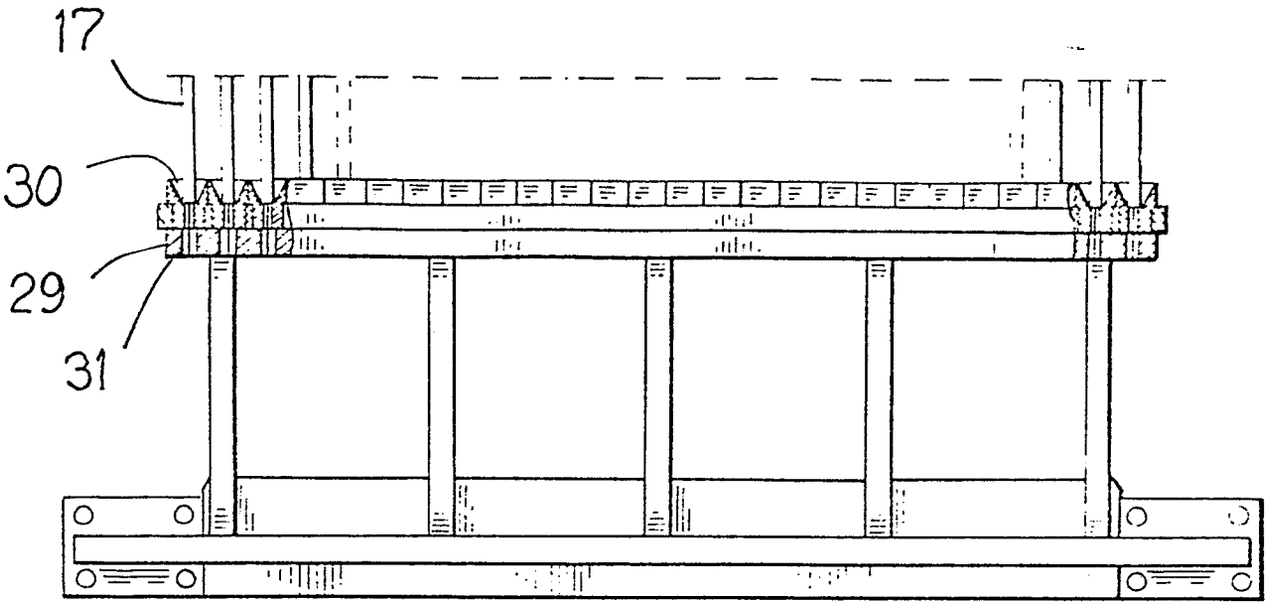

Fig. 2

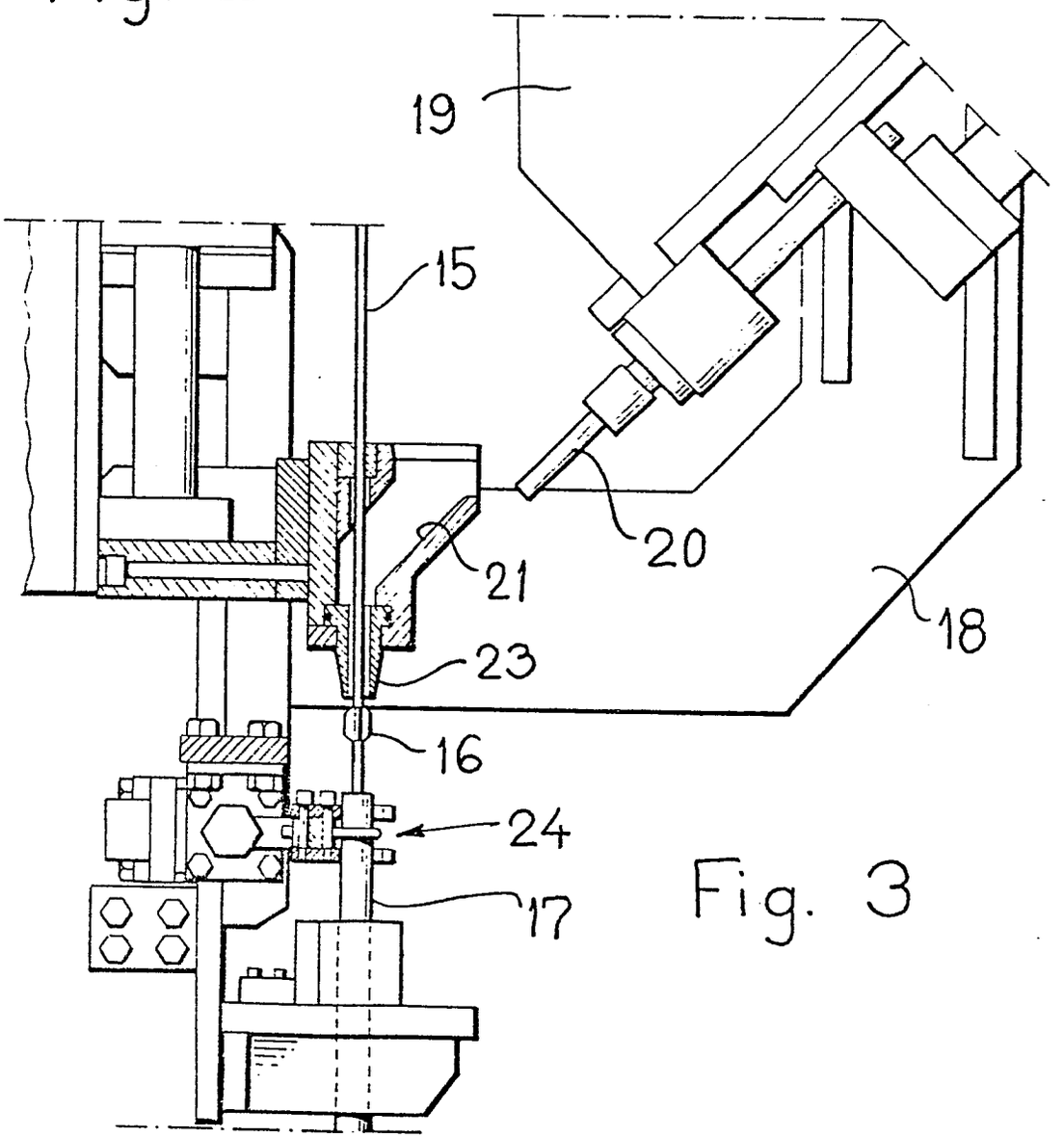

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

0147371
Application number

EP 84 85 0287

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 4)
A	US-A-4 190 407 (STEVEN L. STROUP) * Title, column 1, lines 58-64; column 2, lines 55-68; column 3; column 4, lines 1-18, 55-68; column 5, lines 1-5; column 9, lines 10-68; columns 10,11; column 12, lines 1-25; figures 1,7,14-20 *	1,2	H 05 B 3/52
A	FR-A- 535 018 (THE CUTLER-HAMMER) * Page 3, lines 72-93; page 4, lines 31-72; figures 22-24 *	1,2	
A	CA-A-1 035 125 (DRUGMAND LESTER D.) * Page 1, lines 1-7; page 3, lines 16-29; page 4, lines 1-17; figures 1-5 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			H 05 B 3/00 H 01 B 13/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21-03-1985	PIERRON P.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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