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Applicant: **Silvestri, Attilio**
Via Allende, 58/C
I-41032 Cavezzo (Prov. of Modena)(IT)

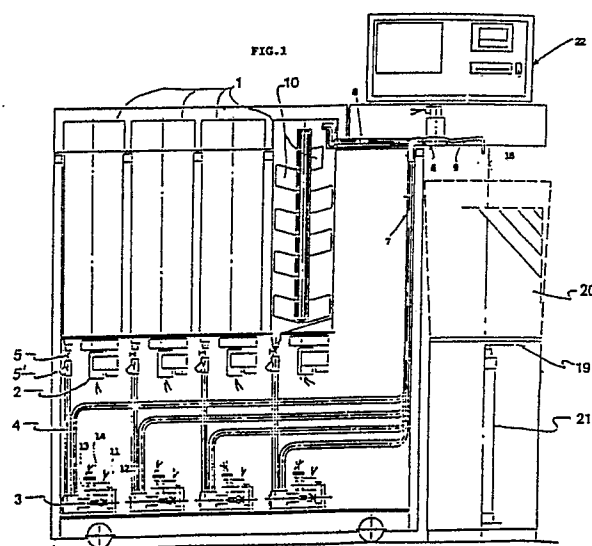
Inventor: **Silvestri, Attilio**
Via Allende, 58/C
I-41032 Cavezzo (Prov. of Modena)(IT)

Representative: **Gervasi, Gemma et al**
NOTARBARTOLO & GERVASI Srl Viale
Bianca Maria 33
I-20122 Milan(IT)

Apparatus for controlling the simultaneous feed of several pigmented liquids in a plant for preparing paint products.

An apparatus for controlling the simultaneous feed of several pigmented liquids of different colour in a plant for preparing paint products.

Said plant comprises a series of tanks (1), each of which contains a pigmented liquid of different colour which is fed by positive displacement metering pumps (3) through solenoid valves (6) into the container (20), said apparatus for controlling the feed of the pigmented liquids comprising a motor-reduction gear unit (11, 12) which transmits its stepped-down motion to a pump (3) and a counting module (13, 14) which transmits the number of revolutions through which the motor (11) has rotated to a computer (22) which starts and stops the motor (11) and switches the solenoid valve (6) such as to deliver into the container (20) the liquid quantity keyed into the computer.



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APPARATUS FOR CONTROLLING THE SIMULTANEOUS FEED OF SEVERAL PIGMENTED LIQUIDS IN A PLANT FOR PREPARING PAINT PRODUCTS

Field of the invention

This invention relates to a computerized automatic plant for the simultaneous feed of several pigmented liquids of different colour to obtain a paint product of the desired colour.

Prior art

To obtain a paint product, the various pigmented liquids are currently mixed together mainly by equipment which suffers from poor reproducibility of the paint product characteristics. In this respect, with the conventional syringe machine, which can be manual or semiautomatic, the error in the delivery of the individual liquids can range from 5 to 20%.

More accurate equipment has also been proposed, but its cost, owing to its complexity, is too high to enable it to be used for producing bulk-use paint products.

Summary of the invention

We have now discovered an apparatus for controlling the simultaneous feed of several pigmented liquids of different colour in a computerized automatic plant for producing a paint product of the desired colour, which obviates the drawbacks of the known art.

In particular, said apparatus enables the individual liquids to be metered with high accuracy and reproducibility, and is of low cost and simple and economical operation.

Said plant comprises a series of tanks 1, each of which contains a pigmented liquid of different colour and feeds a corresponding series of metering pumps 3, each of which delivers the respective liquid to the corresponding solenoid valve 6 which, according to the command which it receives, either feeds the liquid into the collection container 20 in which the liquids originating from the various tanks 1 are mixed, or recycles the liquid to its tank 1 of origin through the pipe 8.

Said apparatus for controlling the simultaneous feed of the various liquids is characterised by comprising:

- a motor-reduction gear unit 11, 12 which transmits its stepped-down motion to a positive displacement metering pump 3 which transfers the liquid from a tank 1 to a solenoid valve 6;
- a fan

13 coaxial with the motor 11, and to which the motor 11 directly transmits its motion without step-down;

- a proximity switch 14 installed in correspondence with said fan and arranged to determine the number of revolutions through which the motor has rotated, to convert this into electrical signals and to feed these signals to the computer 22;

- a computer 22 into which the quantity of liquid to be fed to the container 20 is keyed and which controls the operations required for this feed.

Detailed description of the invention

The characteristics and advantages of the present invention will be more apparent from the detailed description given hereinafter and the relative accompanying figures.

Figure 1 shows a computerized automatic plant for the simultaneous delivery of several pigmented liquids of different colour to obtain a paint product of the desired colour, and to which the liquid feed control apparatus of the present invention is applied.

Figure 2 shows in detail the liquid feed control apparatus.

The plant consists of several modules, each of which comprises a tank 1 containing one of the liquids to be delivered, and connected to a positive displacement metering pump 3 by a suction pipe 4.

In the suction pipe 4 there is connected a shut-off valve 5 and a fine mesh filter 5' for removing from the liquid any foreign matter which could damage the circuit.

The liquid is pumped by the pump 3 in the direction of a 3-way, 2-position solenoid valve 6 connected to the same pump by a discharge pipe 7 of smaller cross-section than the suction pipe 4.

If the valve 6 is unenergized and therefore not switched over, the liquid reaching it is recycled to its tank 1 of origin through the recycle pipe 8, which is of equal cross-section to the discharge pipe 7.

If on the other hand the valve is energized with the result that it has been switched over, the liquid is delivered into a collection container 20 through a delivery nozzle 9 of small cross-section.

The apparatus for controlling the feed of the various liquids consists of the motor 11, the reduction gear 12, the fan 13, the proximity switch 14 and the computer 22.

The motor-reduction gear unit 11, 12 transmits

its stepped-down motion to the pump 3, whereas the motor 11 directly transmits its motion without step-down to the fan 13 coaxial with it.

The fan 13 is composed of twelve equidistant radial blades .

The step-down ratio between the motor and the reduction gear is 62, so that a complete revolution of the pump can be divided into 744 (= 62 x 12) equal parts, thus determining the minimum quantity of liquid which can be delivered.

The proximity switch 14 is fixed in correspondence with said fan 13. It determines the number of revolutions through which the motor 11 has rotated by counting the number of blades which have passed by, then translates this data into electrical pulses and feeds these pulses to the computer 22.

The computer 22, into which the quantity of liquid to be delivered is keyed, starts the motor-reduction gear-pump unit, receives and memorizes the number of fan blades which have passed by, switches the solenoid valves 6 to allow delivery of liquid to the container 20, counts the number of pulses corresponding to the quantity of liquid to be delivered and then reswitches the solenoid valve 6 and halts the motor 11.

As also shown in Figure 1, the plant consists of a number of unit modules of the described type equal to the number of different liquids which can be used, and these liquids do not come into mutual contact other than in the container 20 in which they are mixed.

Said plant can consist for example of 30 modules of the described type, each of which is designed to deliver a different coloured liquid to the container 20. Obviously, the number of said modules is chosen on the basis of production requirements.

The various coloured liquids are delivered in the proportions necessary to obtain the desired colour of the final mixture which constitutes the paint product.

Because of the liquid characteristics, the tanks 1 are constructed preferably of thermoplastic polymer or copolymer such as polyformaldehyde, but they can also be constructed of metal such as stainless steel. They are provided with stirrers 10 driven by motors 2, which are powered at predetermined time intervals to prevent pigment deposition. The tanks have an asymmetric funnel-shaped base to prevent pigment sedimentation.

The pump 3 used for metering the liquid is of the positive displacement type.

The solenoid valve 6 is of the fast response type able to reduce errors to a minimum. The response time is 10 msec.

It has a deviating armature which is coated with a material resistant to the passing liquids.

The valve 6 operates with alternating current. An electrical pulse fed to the magnetic energizing solenoid attracts the deviator armature which remains in this position until the solenoid is de-energized.

Return to its initial position is by a spring which has undergone compression during the previous stage.

The containers 20 are supplied in different sizes because the quantity of paint product required or any given delivery differs. Said containers are raised to a height representing a minimum distance from the nozzles 9 by a mobile platform 19 able to be moved up and down vertically by an electrical actuator 21.

The mixture formed from the liquids delivered into the container 20 is homogenized during this operation for example by a mechanical stirrer or vibrator.

All the plant operations are controlled by a computerized central unit.

Said unit comprises: peripheral hardware, control and implementation hardware, central control unit (computer), data acquisition and user dialogue software, and execution software for the acquired input.

The peripheral hardware is represented by all the equipment the user uses for dialogue with the computer and consists of the alphanumerical keyboard, monitor, printer and floppy disks.

The control and implementation hardware is represented by a data acquisition system based on individual digital input and output modules which, without any configuration restriction, can be connected together and to the computer to form a complete system according to the individual application requirements.

The central control unit comprises a number of cards equal to the number of peripherals used plus the required functions.

The data acquisition and user dialogue software consists of the automatic coded formula schedules, manually compiled schedules for new formulas, delivery test schedules, personalized check-control publicity schedules and menu schedules for the use and ordinary maintenance of the plant.

In this manner it is possible to completely utilize the computer so as to eliminate idle times in the preparation of paint products.

The acquired input execution software is represented by a connection program for enabling the apparatus to operate in the production of the paint product. It is a specific program created on the basis of the data keyed in by the user, the physical characteristics of the liquids used, and the characteristics of the apparatus itself.

The following example of the operation of the

described plant is given for the purpose of non-limiting illustration.

Using the alphanumerical keyboard, the automatic coded formula schedule or manually compiled schedule is displayed on the monitor screen. By pressing specific keys, the various unit quantities of liquids to be dispensed are set by the alphanumerical keyboard. The capacity of the required container 20 is then keyed in, with the result that the mobile platform 19 is automatically and directly moved into the correct position and the unit quantities are multiplied if the required quantity exceeds the set quantity. The container is placed on the platform and the signal to start the feed is then fed by means of the displayed keyboard. The operations to be carried out in sequence are at the most five in number and the simultaneous delivery time for all the liquids does not exceed 45 seconds even in the case of complicated formulas. Thus the machine working cycle takes a maximum time of about 60 seconds.

The apparatus is preset to deliver a minimum liquid quantity of 0.1 mm with an accuracy of 2.5%.

The control of the liquid feed to the container 20 is effected in the following manner.

On receiving a start command from the computer, the motor-reduction gear 11, 12 begins to transfer liquid from the tank 1 to the solenoid valve 6 which, as it is not energized by the electric current, causes the liquid to recycle back to its tank 1 of origin.

The motor 11 also transmits its rotation directly without step-down to the fan 13 which besides cooling the motor also enables the proximity switch 14 to determine the number of revolutions through which the motor rotates, in that one revolution of the motor corresponds to the passing of twelve blades of the fan 13. The proximity switch 14 converts the number of blades of the fan 13 which have passed by into electrical pulses which it feeds to the computer for memorizing.

When the motor has come up to working speed, the computer takes the first subsequent blade signal as the switching signal for the solenoid valve 6, which then deviates the liquid into the container 20. When the number of pulses corresponding to the liquid quantity to be delivered has been counted, the computer feeds signals for reswitching the solenoid valve 6 and halting the motor 11.

The described plant can be used by either a producer or seller of paint products, with considerable economical and commercial advantages.

By combining several pigmented liquids the producer is able to obtain a wide range of colours and to reproduce others in a repeatable and proportional manner.

In this manner, the producer is able to com-

pletely satisfy the special requirements which the consumer places on his supplier without any slow down in production rate and without any increase in labour, which would substantially increase the cost of the final product.

The retailer using said plant is able to considerably reduce the amount of stock as he needs only to stock the main colours sold, the others then being made up by the apparatus itself.

This allows a considerable reduction in fixed capital and the advantage of not holding stock which remains unsold for a considerable time due to the limited demand either for the particular colour or for the type of product.

Finally, the consumer is able to choose from a wide range of colours divided into innumerable shades, or indeed opt for shades between one colour and another, with the guarantee of reproducibility of the paint product characteristics.

Using said plant, paint products can be prepared for numerous fields of application such as the building sector, the industrial and marine sector, vehicle bodywork, domestic electrical appliances and wood, as can inks, and also dyes for the textile and other industries.

Claims

1. An apparatus for controlling the simultaneous feed of several pigmented liquids in a plant for preparing paint products, characterised by comprising: a) a motor-reduction gear unit (11, 12) which transmits its stepped-down motion to a positive displacement metering pump (3) which transfers liquid from a tank (1) to a solenoid valve (6); b) a fan (13) coaxial with the motor (11), and to which the motor (11) directly transmits its motion without step-down; c) a proximity switch 14 installed in correspondence with said fan (13) and arranged to determine the number of revolutions through which the motor has rotated, to convert this into electrical signals and to feed these signals to the computer (22); d) a computer (22) into which the quantity of liquid to be fed to the container (20) is keyed and which controls the operations required for this feed.

2. An apparatus as claimed in claim 1, characterised in that said fan (13) is composed of twelve equidistant radial blades, the step-down ratio between said motor (11) and said reduction gear (12) being equal to 62 so that one complete revolution of the pump can be divided into 744 equal parts, thus determining the minimum quantity of liquid which can be delivered.

3. An apparatus as claimed in claim 1, characterised in that said proximity switch (14) measures the number of revolutions undergone by the motor (11) by counting the number of blades of the fan

(13) which have passed by.

4. An apparatus as claimed in claim 1, characterised in that said computer (22) starts the motor-reduction gear-pump unit, receives and memorizes the number of blades of the fan (13) which have passed by, switches the solenoid valves (6) to allow liquid to be fed to the container (20), counts the number of pulses corresponding to the quantity of liquid to be fed, re-switches the solenoid valves (6) and halts the motors (11).

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5. An apparatus as claimed in claim 1, characterised in that when said solenoid valve (6) is not energized by the electric current it allows the liquid arriving from the pump (3) to recycle back to its tank 1 of origin, whereas when it is energized it deviates said liquid into the container (20).

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6. An apparatus as claimed in claim 1, applied to a plant comprising a series of tanks (1), each of which contains a pigmented liquid of different colour and feeds a corresponding series of metering pumps (3), each of which delivers the respective liquid to the corresponding solenoid valve (6) which, according to the command which it receives, either feeds the liquid into the collection container (20) in which the liquids originating from the various tanks (1) are mixed, or recycles the liquid to its tank (1) of origin through the pipe (8).

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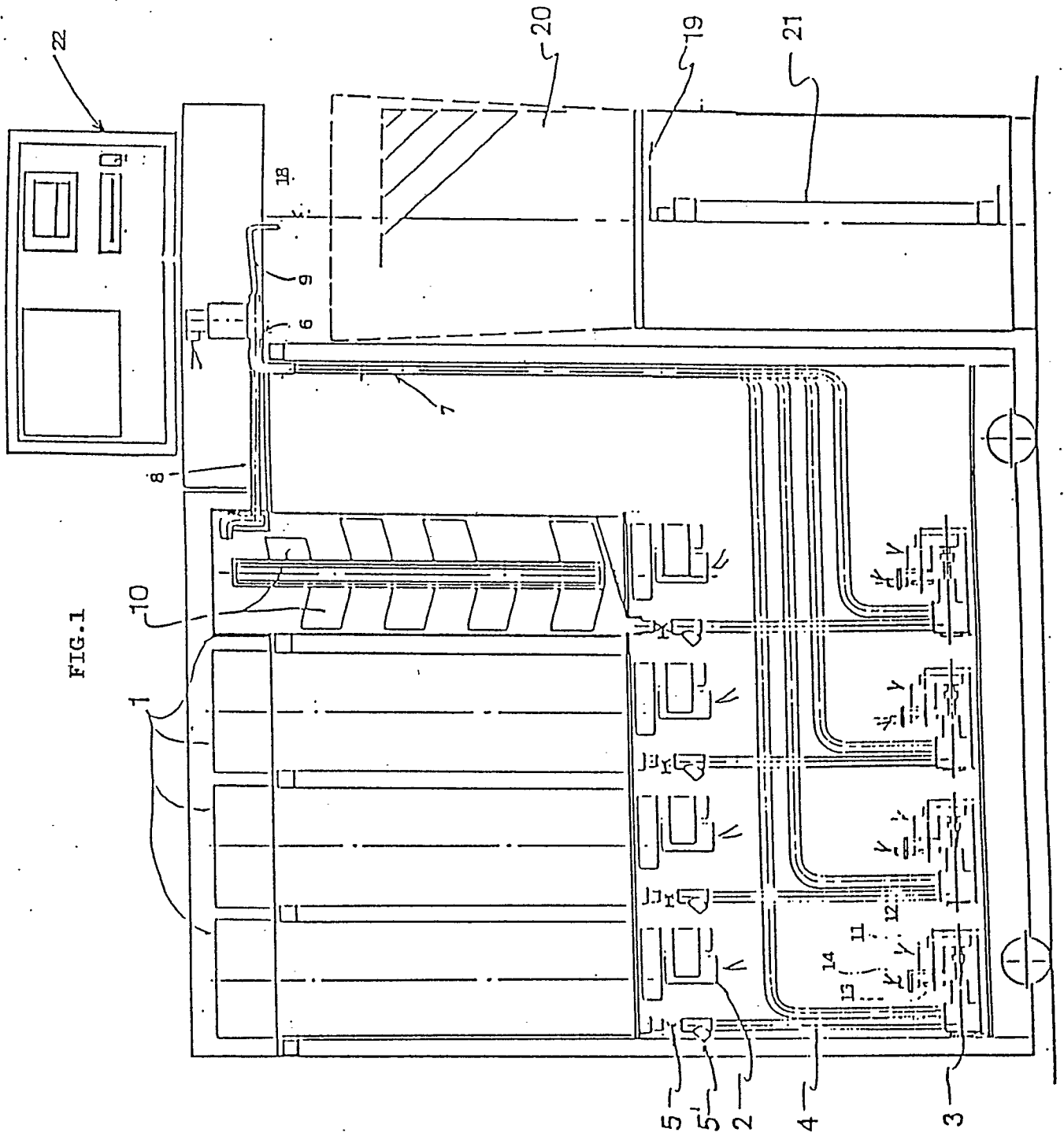
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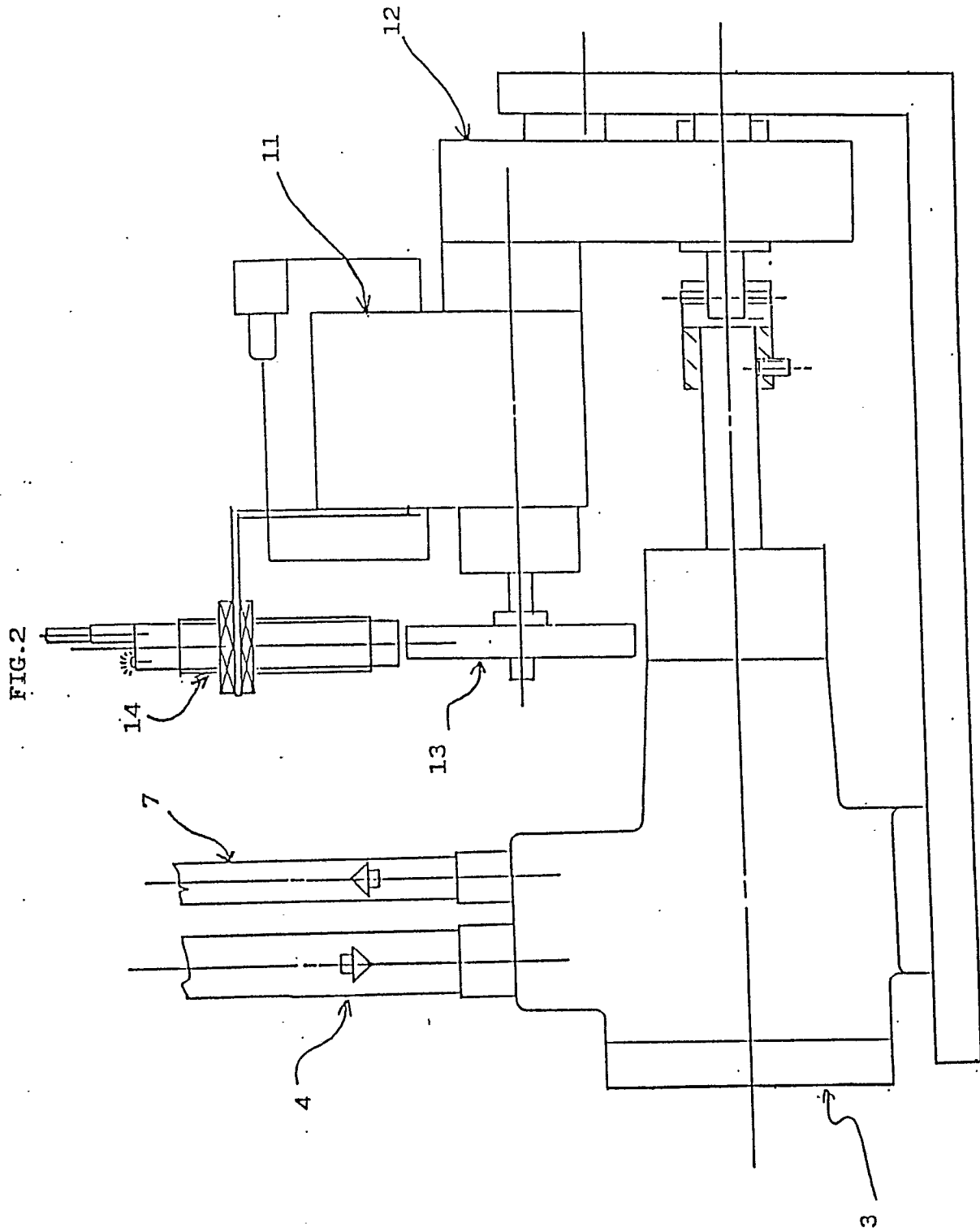
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DOCUMENTS CONSIDERED TO BE RELEVANT					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)		
Y	US-A-4 046 287 (HOEKSTRA) * Abstract; column 5, line 64 - column 7, line 40; fig. * ---	1-6	B 01 F 3/10 B 44 D 3/00		
Y	WO-A-8 602 320 (COROB) * Abstract; fig. * ---	1-6			
A	US-A-2 923 438 (LOGAN) ---				
A	DE-A-3 201 221 (RIBIC) ---				
A	GB-A-2 133 775 (APPLIED COLOR) -----				
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)		
			B 01 F B 44 D		
The present search report has been drawn up for all claims					
Place of search THE HAGUE		Date of completion of the search 09-03-1990	Examiner PEETERS S.		
<table border="0"><tr><td>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</td><td>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</td></tr></table>				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
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