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(71) Applicant: **T.I. Domestic Appliances Limited**
Radiation House North Circular Road
London NW10 0JP(GB)

(72) Inventor: **Dow, Alexander Brian Roderick**
The Longhouse Park Row
Frampton Cotterell Bristol, BS17 2BS(GB)

(74) Representative: **Pike, Harold John et al,**
Abel & Imray Northumberland House 303-306 High Holborn
London, WC1V 7LH(GB)

(54) Improvements in or relating to washing machines.

(57) A washing machine has its drum/drive mechanism and tub assembly mounted upon transducers which provide an indication of the weight of the mechanism and assembly and of the weight of articles loaded into the drum for washing. The transducers input (26) to a microprocessor (27) which determines the weight of the clothes and also the weight of water required to wash that weight of clothes under program conditions some at least of which are selected by the user. The microprocessor may also control a display (29) which indicates the amount of detergent required.

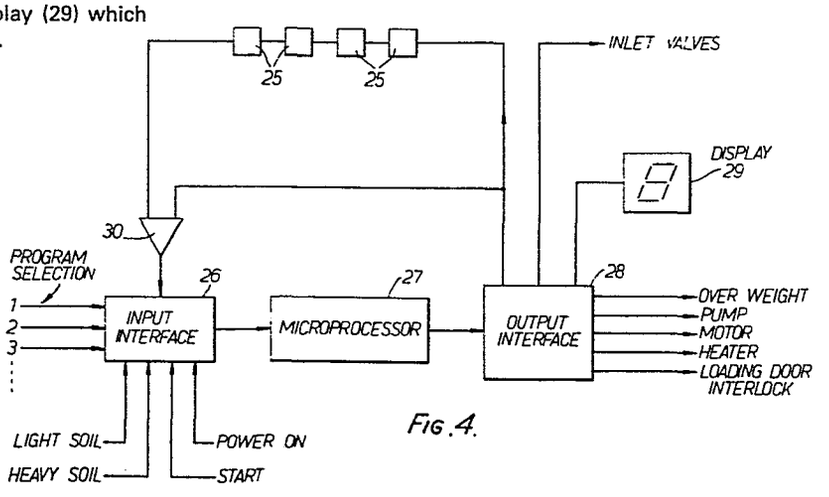

Fig.4.

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"Improvements in or relating to Washing Machines"

This invention relates to washing machines and has particular reference to automatic washing machines that are preset by a user to cycle through pre-arranged programs.

Such machines usually draw in a volume of water sufficient to wash a maximum permissible full load, although some machines give the user the option of selecting a program suitable for a smaller load - the so-called "half-load". When this option is selected, the machine draws in a preset volume of water that is smaller than the permissible full load volume.

The maximum permissible load also depends upon the type of material that the articles to be washed are made from. Articles of synthetic materials can, in general, be loaded to half the capacity allowed for articles made of cotton, and articles of wool materials can, in general, be loaded to approximately one quarter the capacity allowed for articles made of cotton. The volume of water normally drawn for a full load of cottons is not necessarily the same as that drawn for a full load of synthetic materials or for wool, the latter normally requiring much more water in order to impart a more gentle washing action.

It is a matter of considerable difficulty for the user to be certain of the weight of a load of clothes to washed. Although it is possible to weigh each load of articles before loading it into the machine, if the user finds that the load is greater than the "half-load", the

latter program cannot be used, and the full load program must be selected even though the load to be washed may not be a full load.

This is wasteful of water and of energy to heat the unnecessarily large volume of water and also of detergent. In practice, because of this difficulty, the half-load program is seldom used and many washes are carried out at 2/3 the maximum load using the full amount of water and detergent and the maximum consumption of energy.

It would be possible to have an infinitely-adjustable water level control device operable by the user to draw water into the machine in a quantity required for a weighed load of clothes of a particular type - but this would require very skilled judgement which the average user does not possess.

Accordingly, it is an object of the present invention to provide a washing machine in which the problems just referred to are reduced.

According to the present invention, a washing machine has a water flow control device operable to control the admission of water to the machine, a weight responsive device responsive to the weight of articles to be washed when loaded into the machine and to the weight of water admitted to the machine for a program cycle or a part thereof, and a control system adapted to respond to an output from the weight responsive device and being adapted to assess the weight of water required by the weight of articles and to actuate the water flow control device to terminate the admission of water when the required weight of water has been admitted.

Automatic variation of the weight of water to be admitted will occur in those machines having special selectable programs for washing articles of specified types of material. Thus, in the case of woollen articles, selection of a "wool" program would determine the weight of water to

be admitted to a value appropriate to woollen articles and to the weight of such articles in the machine.

The machine may incorporate a control system that is preset to respond to different outputs from the weight responsive device which characterise load and water weights appropriate to the program selected by the user.

In one embodiment of the invention, the control system is adapted to indicate to the user when the weight of articles loaded into the machine exceeds the maximum weight appropriate to a selected program. The maximum weight will be different for articles of different types of material. The indication may be audible or visual or both.

The weight responsive device may be fitted to the support system supporting the washing machine drum/drive mechanism and tub assembly and the control system may be such as to respond to an increase in weight of the assembly above a particular value or values.

After manufacture, the weight of the washing machine drum/drive mechanism and tub assembly may be measured and the value thereof entered into the control system, such value being hereinafter referred to as the datum weight. For practical purposes, the datum weight will be slightly in excess of the precise weight of the washing machine drum/drive mechanism and tub assembly alone to cater for conditions existing after the first use of the machine when, in many cases, a small weight of water is retained in the tub from the previous use. The slight excess represents a predetermined maximum weight of water that can be allowed to be retained in the tub at the commencement of a washing program.

The datum weight can thus be used to check, at the commencement of a washing program, that the weight of water retained in the tub does not exceed the predetermined maximum. If it is found that an excessive weight of water

has been retained, the control system is preferably adapted to take steps to cause the excess water to be pumped out of the machine.

Because the weight of water retained in the tub may vary somewhat, an accurate assessment may now be made of the actual weight of the machine drum/drive mechanism and tub assembly combined with the weight of the retained water and used to assess the weight of articles loaded into the drum at the commencement of a washing program. The actual weight of the machine drum/drive mechanism and tub assembly combined with the weight of the retained water (after pumping out if this has taken place) is herein referred to as the first assessed weight and is stored temporarily in the control system for use in assessing the weight of articles loaded into the drum.

It will usually be required to allow the entry of a measured weight of water at the commencement of a program involving a "wash" stage. Although such programs also include one or more "rinse" stages, it is not essential to assess the weight of the water to be drawn in at the commencement of each rinse stage because it can be assumed that the weight of "rinse" water bears a fixed relationship to the weight of water drawn in for the "wash" stage. Each "rinse" stage may require the same weight of water as the "wash" stage or a proportion only of that weight. Alternatively, where a small load of articles is to be dealt with, the control system may be adapted to reduce the number of "rinse" stages or it is also sometimes arranged that all rinses be carried out with a preset maximum weight of water in order to achieve the best rinse possible irrespective of the weight of the load of articles or the type of material of the articles.

Thus, the weight responsive device and control system would, in most cases, require the calculation of the required weight of water only at the initial part of a

program involving a "wash" stage on selection of such a program by the user or as described above. During the "rinse" stages, an already calculated weight of required water would be used to control the inflow of "rinse" water.

For some programs, the washing machine will draw in both hot and cold water and, in this case, the control system preferably incorporates means for sensing the temperature of water in the tub of the machine and for regulating the inputs of hot and cold water according to the sensed temperature. In order to be accurate, in some embodiments, weighing must be effected with the drum stationary, i.e. not revolving, and as water in the tub has to be agitated to mix incoming hot and cold supplies and ensure a homogeneous mix for temperature sensing, incoming water is taken first from one supply and then the other depending upon the sensed temperature, the drum being slowly rotated briefly after each intake. The sequencing of the temperature sensing means, the valves controlling the inflow of hot and cold water and the monitoring of the weight of water admitted is determined by the control system. In some cases, it may be preferable to effect weight measurements in the intervals between the intake of water and when the drum is at a standstill.

Where the washing machine has washing programs requiring an amount of water different from that determined simply in accordance with the weight of articles, the control system is adapted to ensure that the different amount of water is admitted. The selection by the user of a program requiring the different amount of water provides the appropriate input to the control system to indicate the different amount of water is required. In addition to varying the amount of water to be admitted as required by the selected program, the control system determines that a further variation is required if the weight of the contents of the drum to be processed according to the selected

program so requires.

Another variable that the user is required to control is the amount of detergent to be used for a specified program. The amount of detergent required for a wash is related to the hardness of the water and to the weight of water admitted and also depends on a number of other factors, for example, the degree of soiling of the articles and this the user can determine fairly easily, and the weight of the load. Conventionally, the user is told to add an amount of detergent appropriate to a full load and, of course, when the load is not a full one, detergent is wasted.

In one embodiment of the invention, the control means also indicates the amount of detergent required, or, if the machine incorporates an automatic detergent feed, the control means regulates the automatic feed to ensure the required amount of detergent is admitted. The detergent indicator may indicate the required amount on a 1-8 scale of required measures, one measure being 25 gm for example.

The control system may comprise a microprocessor programmed to provide other control features as well, for example speed control of the driving motor, monitoring of program variables including incoming water temperature to determine heating time when water temperatures above that of the water supply are required.

The weight responsive device may be a transducer for example a load cell or a strain gauge and may be associated with the resilient support system supporting the machine drum/drive mechanism and tub assembly.

By way of example only, an embodiment of the invention will now be described in greater detail with reference to the accompanying drawings of which:-

Fig. 1 is a schematic end view of part only of the embodiment,

Fig. 2 is a perspective view showing in more detail, and partly in exploded form, a support system,

Fig. 3 is a vertical section of a component of the support system of Fig. 2,

Fig. 4 is a block schematic of a control circuit,

Fig. 5 is a perspective view showing schematically part of a modified form of support system,

Fig. 6 is a vertical section through a component of the support structure shown in Fig. 5, and,

Fig. 7 is a vertical section through an alternative form of the component shown in Fig. 6.

The embodiment is a domestic automatic washing machine of generally conventional construction having a tub 1 inside which is a washing drum (not shown) rotatable about a horizontal axis by a driving motor 2 via driving pulleys 3 and 5 and a driving belt 4.

The tub 1, washing drum motor 2, driving pulleys 3, 5 and belt 4 comprise the drum/drive mechanism and tub assembly which is mounted upon two spring supports 6 upstanding from the base 7 of the machine. The spring supports are, as is conventional, suitably damped to prevent, as far as is possible, resonance in the support system during the acceleration of the drum to its maximum spin speed and at that speed. Although Fig. 1 shows only two supports 6, more, for example, four may be employed.

Weights 8 are attached to the tub to minimise the amplitude of any orbital movement of the tub. Such movement, about the horizontal axis of the drum, tends to occur with out-of-balance loads in the drum as the latter accelerates during "spin".

Associated with the support system for the drum/drive mechanism and tub assembly is a weighing system comprising one or more transducers. The weighing system inputs over a lead 9 to a control unit indicated schemati-

cally by block 10 which controls the operation of the washing machine. Also inputting to the control unit is a user control indicated schematically by block 11 having controls 12 operable by a user to select a required program and to enter other information into the control unit 10.

Water is fed into the tub 1 via water flow control means 13, which may be electro-magnetically operated flow control valves, and a detergent dispenser 14. Operation of the water flow control means 13 is controlled by the control unit 10 as indicated in Fig. 1. The control unit 10 has other outputs, for example, to a detergent quantity indicator referred to below, or to an automatic detergent dispenser when fitted.

Fig. 2 shows in more detail part of the support system of the washing machine shown in Fig. 1.

The base 7 of the machine has lateral flanges 15 to which side panels of the machine are secured. The base 7 is supported upon feet 16 adjustable to level the machine. Alternatively, the base 7 may be supported upon rubber-tyred wheels which may or may not include adjusters to level the machine.

Extending fore and aft along the sides of the base 7 are inverted channel-shaped members 17. The spring supports 6 are each secured centrally to the base of one of the members 17 via resilient mounting blocks 18 clamping plates 18a, 18b and locking nut 18c. Holes 19 beneath the points of attachment of the springs 6 to the members 17 provide clearance to ensure that there can be no contact between the support 6 and the base 7.

The ends of the members 17 rest on and are secured to transducers indicated schematically at 21 and located in recesses in the base 7. Straps 20 secured to the base 7 extend, as shown, over the ends of the members 17 at the locations of the transducers 21. The straps 20 prevent any

upward movement relative to the base 7 of the members 17 and thereby ensure that the transducers 21 cannot be dislodged from the recesses in which they are located. Dislodgement might otherwise occur, for example, when the machine is in transit.

Each transducer comprises, as is shown in Fig. 3, a cup-like container 21a closed by a flexible diaphragm 22 rigidly secured by a stud 23 to the base of the member 17. The centre of the diaphragm is strengthened by discs 23a held in place by the stud 23. The diaphragm 22 permits vertical movement of the member 17 but prevents lateral movement.

The container 21a locates in a recess 7a in the base 7, the recess 7a being apertured to accommodate a pressure-responsive transducer element 25 fitted to the container 21a as shown. The transducer element 25 is of the piezo-resistive type, i.e. of the type whose electrical resistance varies with applied pressure. The containers 21 are each fitted with a suitable liquid, for example a "thin oil" or a silicone liquid.

The transducer elements 25 are connected electrically in series and their aggregated outputs thus provide an indication of the total load imposed on them irrespective of the distribution of that load between the elements.

The arrangement just described overcomes the major problem associated with the derivation of an accurate indication of total weight of a load of articles in the drum, that of obtaining the indication in all conditions of distribution of the load within the drum.

If the load is supported equally by the supports 6, each transducer element 25 will experience an equal increase in the pressure in the container and the aggregated output of the elements accurately indicates the weight of the load.

If the load is not evenly distributed and one

support 6 is more heavily loaded than the other, the elements 25 supporting the more heavily loaded support will experience a greater pressure and the elements 25 supporting the less heavily loaded support will experience a lesser pressure than would be the case with equally loaded supports. However, the aggregated output of all the elements 25 will indicate accurately the weight of the load.

In the cases just described, it has been assumed that the load is centred with regard tc the front and back of the drum. If the load is located towards the back of the drum, the tub assembly tends to lean backwards with the result that the elements 25 at the rear ends of the members 17 are more heavily loaded and those at the front ends less heavily loaded than would be the case if the load was accurately centred. Again, however, the aggregate outputs of the elements 25 gives an accurate weight indication.

In similar manner, a load located towards the front of the drum causes the elements 25 at the front end of the members 17 to be more heavily loaded and those at the rear ends less heavily loaded. The aggretate output, again, provides an accurate weight indication.

The support system described above with reference to Figs. 1 and 2 is, preferably, used with an automatic washing machine controlled by a control system including a microprocessor. Such a control system is readily adapted to receive output signals from the elements 25 via a suitable input interface, to react to such signals and to transmit, via suitable output interfacing, control signals to operate water flow control valves, pumps, visual displays as required by a selected program.

A suitable control system is shown schematically in Fig. 4. An input interface 26 is joined to a program selector operable by a user to select a desired program,

to an input from a control operable by the user to indicate the degree of soiling of the articles to be washed if different from a "standard" degree of soiling programmed into the system, a "start" control and a "power on" control.

Interface 26 converts those inputs to a form acceptable to a control microprocessor indicated by block 27 whose output is converted by an output interface unit indicated by block 28 to output signals for operating the water flow control valves, a detergent display 29, the pump motor 2 and water heater of the washing machine, a loading door interlock and an "overweight" display. The loading door interlock is a locking mechanism which locks the drum loading door in its closed position so preventing a user opening the door until the lock is released. An example of a suitable loading door interlock is described in U.K. Patent Specification No. 2,031,053A.

The amount of detergent required depends upon the weight of clothes to be washed, the extent of soiling of the clothes, the amount of water used for the wash and the hardness of the water used. The extent of soiling of the clothes, if different from the standard, is programmed into the microprocessor by the user by means of the control referred to above. The hardness of the water in the locality in which the machine is being used is also programmed into the microprocessor by the user as a semi-permanent input and requires alteration only if the user moves to a different locality where the water hardness is different. The other two variables are sensed automatically as will be described later.

Having assessed the amount of detergent required, the microprocessor will activate the display 29 to indicate the required amount on, for example, a 1-8 scale of required measures, one measure being 25 gm. Thus, if the display 29 shows 2, the user is required to insert 2 measures, i.e. 50 gm of detergent into the dispenser 14.

The microprocessor 27 has a further output which, when energised, applies, via output interface 28, an energising voltage to the elements 25 and to a comparator 30 which acts to compare the voltage output from the elements 25 with the energising voltage and transmits to the input interface 26 a signal indicating the difference.

The transducer elements 25 are, for example, of the gauge pressure type, i.e. the type using atmospheric pressure as a reference. The output voltage from an element 25 is given by the equation

$$V_o = V_i + S(P)$$ where V_o = output voltage
V_i = input voltage
S = element sensitivity
P = pressure.

Before loading the drum with articles to be washed, and with the drum loading door closed, the power on control is operated. The resultant signal fed to the microprocessor causes the latter to output and via the output interface an energising voltage is applied to the elements 25. The door interlock is also actuated to lock the drum loading door.

Depending upon the load to which they are exposed, the elements 25 will transmit an output voltage to the comparator 30, the difference signal transmitted by the latter indicating the load. That difference signal is compared, in the microprocessor, with the stored datum weight. In the normal course of events, the difference signal will equate with the stored datum weight or be less than that datum weight and the microprocessor will then output to release the loading door lock and allow a user to open the door and commence loading articles to be washed into the drum. The microprocessor will also store temporarily the sensed weight of the machine drum/drive mechanism and tub assembly and any water retained therein from a previous use of the machine provided that the weight

of retained water does not exceed a predetermined maximum weight - this sensed weight being referred to herein as the first assessed weight.

The datum weight as has been explained above is in excess of the actual weight of the machine drum/drive mechanism and tub assembly alone, the excess representing the maximum weight of water that can be allowed to be retained in the tub at the commencement of a washing program.

However, it may be that the tub contains an excessive amount of water from a previous use of the machine and which, for some reason, was not pumped away during that use. Should that be the case, as will be indicated by the comparison between the difference signal and the stored datum weight, the microprocessor will command the pump to operate to pump away the excess water. At the same time, the microprocessor will maintain the drum loading door in its locked condition. As the excess water is pumped away, the difference signal will gradually approach the stored datum weight and, in due course, the microprocessor will stop the pump and release the loading door lock when the difference signal equates with the datum weight whereupon the user can then open the door and commence to load the articles to be washed into the drum. The microprocessor will also store temporarily the sensed weight of the machine drum/drive mechanism and tub assembly and retained water - the first assessed weight - referred to above.

During the loading of the clothes, the energising voltage is maintained so that the elements 25 will monitor continuously the weight of the loaded articles.

When the loading is finished, the user closes the loading door. At this stage, the elements 25 will be transmitting an output voltage indicating the combined weight of the machine drum/drive assembly and tub mechanism and

the weight of the articles loaded into the drum. That combined weight is compared, in the microprocessor, with the temporarily stored first assessed weight to give the weight of the articles loaded into the drum.

The user now selects a required program and any other required options e.g. degree of soiling if different from the standard. Should the weight of loaded articles exceed that appropriate to the selected program an indication is given over the "overweight" output and the user then removes articles from the drum until the indication ceases. The loading door must be closed after articles have been removed from the drum.

The microprocessor will now calculate the weight of water required, will output the display 29 to indicate the amount of detergent required and will disable the "start" control. The user then loads the required amount of detergent into the dispenser 14. The dispenser 14 is accessed in some suitable manner to permit it to be loaded with the detergent after which means associated with the access indicates to the microprocessor that "start" control can be enabled. The user then operates the "start" control to indicate to the microprocessor that the machine is now to be cycled through the selected program.

The microprocessor then permits the entry of water to the tub. The energising voltage to the elements 25 has been maintained by the microprocessor so that the admission of water is continuously monitored and when a weight of water appropriate to the loaded weight of articles, selected program, extent of soiling, as calculated by the microprocessor, has been admitted, the microprocessor signals the water flow control means 13 to terminate the inflow of water.

The washing machine is then sequenced by the microprocessor through the remaining stages of the selected

program. At the end of the program, the temporarily stored first assessed weight is deleted from the microprocessor.

It will usually be required to monitor the weight of water admitted at the commencement of a program involving a "wash" stage. Although such programs also include one or more "rinse" stages, it is not essential to assess the weight of water admitted to the machine at the commencement of each rinse stage because it can be assumed that the weight of the "rinse" water bears a fixed relationship to the weight of water admitted for the "wash" stage. Each "rinse" stage may require the same weight of water as the "wash" stage or a proportion only of that weight. In either case, the microprocessor is programmed to permit the entry of the predetermined weight of water. Alternatively, the microprocessor may be programmed to allow the rinse water to flow in for a predetermined time calculated to give the required rinse water weight.

Alternatively, where a small load of articles is to be dealt with, the microprocessor may be programmed to reduce the number of "rinse" stages.

For some programs, the washing machine will draw in both hot and cold water during the initial part of a program involving a "wash" stage. In that case, the control system will incorporate means for sensing the temperature of water in the tub. Such sensors will input to the microprocessor via the input interface 26 and the microprocessor will be programmed to regulate the admission of hot and cold water according to the sensed temperature. The total weight of water is, of course, controlled in the manner described above.

If both hot and cold water is admitted, it is usually necessary to rotate the drum slowing during admission to "mix" the water in the tub during admission to ensure a homogeneous mix for temperature sensing. In this case, the microprocessor is programmed to allow the

admission of water first from one supply and then from the other depending upon the sensed temperature, and to allow slow rotation of the drum briefly after each intake. Weight measurements are then taken by energising the elements 25 during the intervals between the intake of water and when the drum is stationary.

Where the washing machine has washing programs requiring an amount of water different from that determined simply in accordance with the weight of articles, the control system is adapted to ensure that the different amount of water is admitted. The selection by the user of a program requiring the different amount of water provides the appropriate input to the control system to indicate the different amount of water is required. In addition to varying the amount of water to be admitted as required by the selected program, the control system determines that a further variation is required if the weight of the contents of the drum to be processed according to the selected program so requires.

An alternative weight sensing configuration to that shown in Fig. 2 and using one sensor only is shown in Fig. 5. The configuration shown in Fig. 5 is generally similar to that shown in Fig. 2 except that the containers 21a do not each house an element 25 but instead are interconnected by ducting 31 joined by a branch pipe 32 to a fifth container 33 housing a single element 25. Included in the branch pipe 32 is a restrictor 34 whose function is to damp out transient changes in pressure in the liquid in the containers such as occur during rotation of the drum.

The single element 25 of the Fig. 5 configuration is energised and operates in the manner described above with reference to Fig. 4, except that, with the Fig. 5 configuration, it is not necessary periodically to stop the drum during admission of water in order to sense the

weight of admitted water. The restrictor 34 will damp out any transient pressure changes due to vertical oscillations of the drum due to rotation thereof for water mixing. This has the advantage of reducing the time required to admit water at the commencement of a program involving a "wash" stage.

It is, of course, also possible to house the single element 25 in one of the four containers 21a but not in a separate container as is the case in the configuration of Fig. 5. In that case, although restrictors can be included they are not as effective in damping out all transient responses.

In both configurations, however, it is necessary to ensure that there is no possibility of upward movement of the members 17 because such movement would permit liquid to flow from one container to another in response to differing pressures therein. Thus, the straps 20 must be so dimensioned and fitted as to prevent such upward movement.

Fig. 6 shows, in vertical section, a form of container suitable for the alternative configurations just referred to. A diaphragm unit 35 is located by a shallow recess 7a in the base 7 of the machine and is secured thereto by means of a bolt 36. The flexible upper surface 37 of the unit 35 is secured to the base of the associated member 17 by a fitment 38 with a threaded boss 39 with an internal branched bore 40. A branch pipe 41 with a coupling 42 fitted over the boss 39 communicates with the interior of the unit 35 via the bore 40. A closed end nut 44 screwed down on the boss 39 secures the fitment to the surface 37 of the unit 35.

Also secured to the base 7 adjacent the unit 35 is a bolt 45 that extends upwardly from the base 7 through an aperture 46 in the base of the member 17. The bolt 45 carries a washer 47 of a diameter larger than that of the

aperture 46.

After the units 35 have been fitted and the pipes 41 interconnected between the units and with the inclusion of an additional container as in Fig. 5 above or without it as in the alternative configuration, liquid is pumped into the system via a connector 48 (Fig. 5) until the bases of the members 17 contact the associated washers 47 or until a specified clearance is reached.

An alternative and simplified form of the container 21a is shown in Fig. 7. A cup-shaped vessel 49 whose curved wall is apertured as at 50, accommodates a bag 51 of a resilient material, for example rubber. The bag 51 is disc-shaped so as to fit easily within the vessel 49 and has a connector 52 that extends through the aperture 50. Seated upon the bag 51 and partly located within the upper part of the vessel 49 is a piston 53 with an integral central boss 54 that extends through the base of the member 17 and is secured thereto by a non-releasable fastener 55. The vessel 49 and the piston 53 may be made of a suitable plastics material.

The connectors 52 are used to interconnect the bags 51 with each other and with an additional container housing a pressure responsive element as in the configuration shown in Fig. 5.

Instead of incorporating the display 29 and the necessary controls, the machine may include an automatic detergent dispenser. In this case, the user simply fills the dispenser which thereafter dispenses, under the control of the microprocessor, a required weight of detergent.

In the event that the washing machine is not fitted with means for indicating to a user when the weight of articles loaded into the machine exceeds the maximum permitted weight, instructions will be provided that set out the maximum permitted weights for loads of articles of

the various materials that the machine will wash and the user must ensure that these maximum weights are not exceeded.

It will be appreciated that the tub may be supported by a spring suspension system from the top of the machine.

The construction just described has the advantage that the amount of water drawn into the machine is automatically set at the minimum required for the load in the drum thereby avoiding wasting water and energy in heating the water either before it enters the machine and/or in the machine itself.

1. A washing machine having a water flow control device operable to control the admission of water to the machine, a weight responsive device responsive to the weight of articles to be washed when loaded into the machine and to the weight of water admitted to the machine for a program cycle or a part thereof, and a control system adapted to respond to an output from the weight responsive device and being adapted to assess the weight of water to be admitted to the machine as determined by factors including the loaded weight of the articles and to actuate the water flow control device to terminate the admission of water to the machine when the required weight of water has been admitted.

2. A machine as claimed in claim 1 in which the control system is also adapted to indicate to a user when the weight of articles loaded into the machine exceeds the maximum weight appropriate to a selected program.

3. A machine as claimed in claim 2 in which the indication comprises an audible or visible warning or both.

4. A machine as claimed in any one of claims 1-3 in which the weight responsive device is associated with resilient means supporting the washing machine drum/drive mechanism and tub assembly and is adapted to respond to an increase of the assembly above a datum weight (as herein defined) and to transmit to the control system an indication of the sensed increase in weight to determine whether the tub assembly contains excessive water and to initiate the removal of any excess water present.

5. A machine as claimed in claim 4 in which the control system is adapted to store temporarily a first assessed weight (as herein defined) and to use that weight to assess the weight of articles loaded into the drum.

6. A machine as claimed in claim 5 in which the

first assessed weight is determined by the weight responsive device at the commencement of every washing cycle prior to articles being loaded into the drum.

7. A machine as claimed in claim 4, 5 or 6 in which the weight responsive device comprises a plurality of liquid filled containers each with a flexible wall which supports the resilient means.

8. A machine as claimed in claim 7 in which the resilient means comprises at least two upstanding resilient struts, each strut being mounted upon an elongate horizontal member lying parallel to the axis of the drum and supported at each end by the flexible wall of a liquid filled container.

9. A machine as claimed in claim 8 in which the means are provided for limiting upward movement of the elongate members.

10. A machine as claimed in any one of claims 7-9 in which each container has associated with it a transducer responsive to pressure changes in the liquid in the container.

11. A machine as claimed in any one of claims 7, 8 or 9 in which the containers are interconnected one with another and to a further container with which is associated the transducer responsive to pressure changes in the liquid in the further container.

12. A machine as claimed in any one of claims 4-11 in which the machine is adapted to take in both hot and cold water, in which rotation of the drum occurs periodically during admission of water, and in which the weight responsive device is controlled to sense the admitted water rate only when the drum is at a standstill.

13. A machine as claimed in accordance with any one of the preceding claims and further comprising a detergent supply means and in which the control system is adapted to control the detergent supply means to allow

the admission to the machine of a quantity of detergent determined in accordance with the required weight of water and the degree of soiling of articles to be washed.

14. A machine as claimed in any one of claims 1-12 in which there is an indicator for indicating to a user the amount of detergent to be added, the indicator being actuated by the control system to display an amount as determined by the required weight of water and the degree of soiling of the articles.

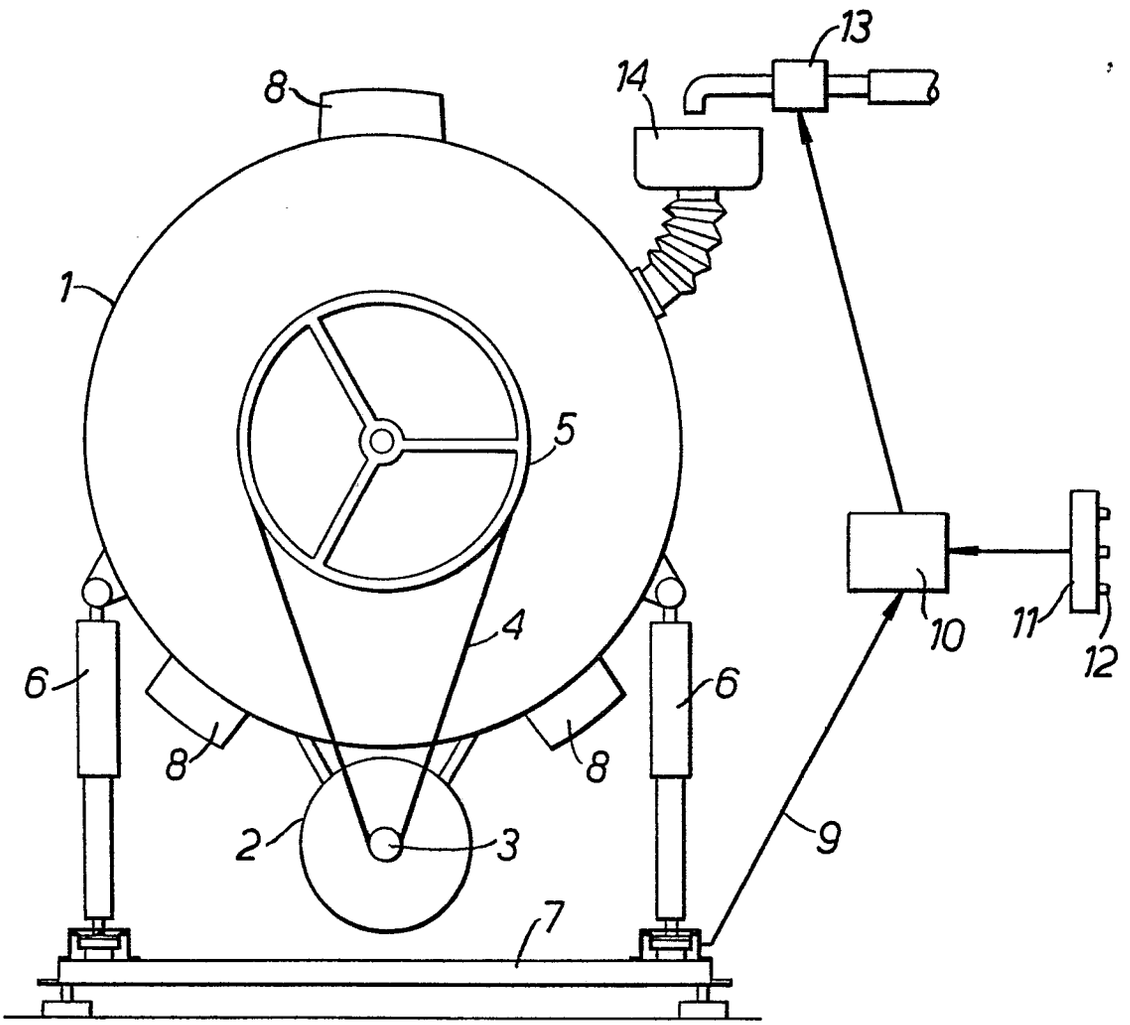

FIG. 1.

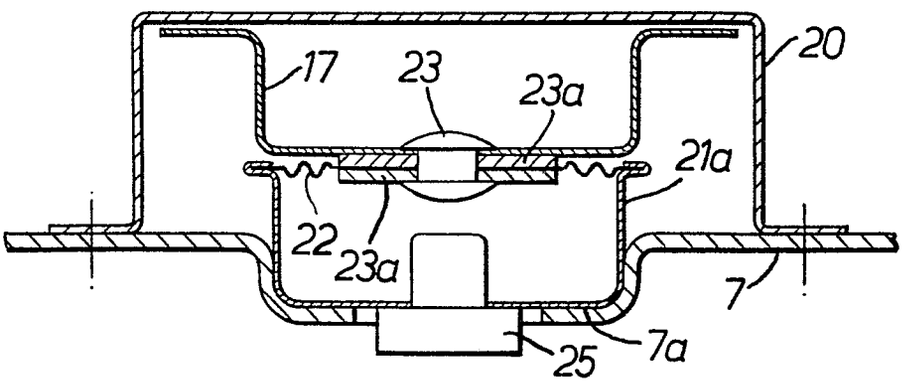

FIG. 3.

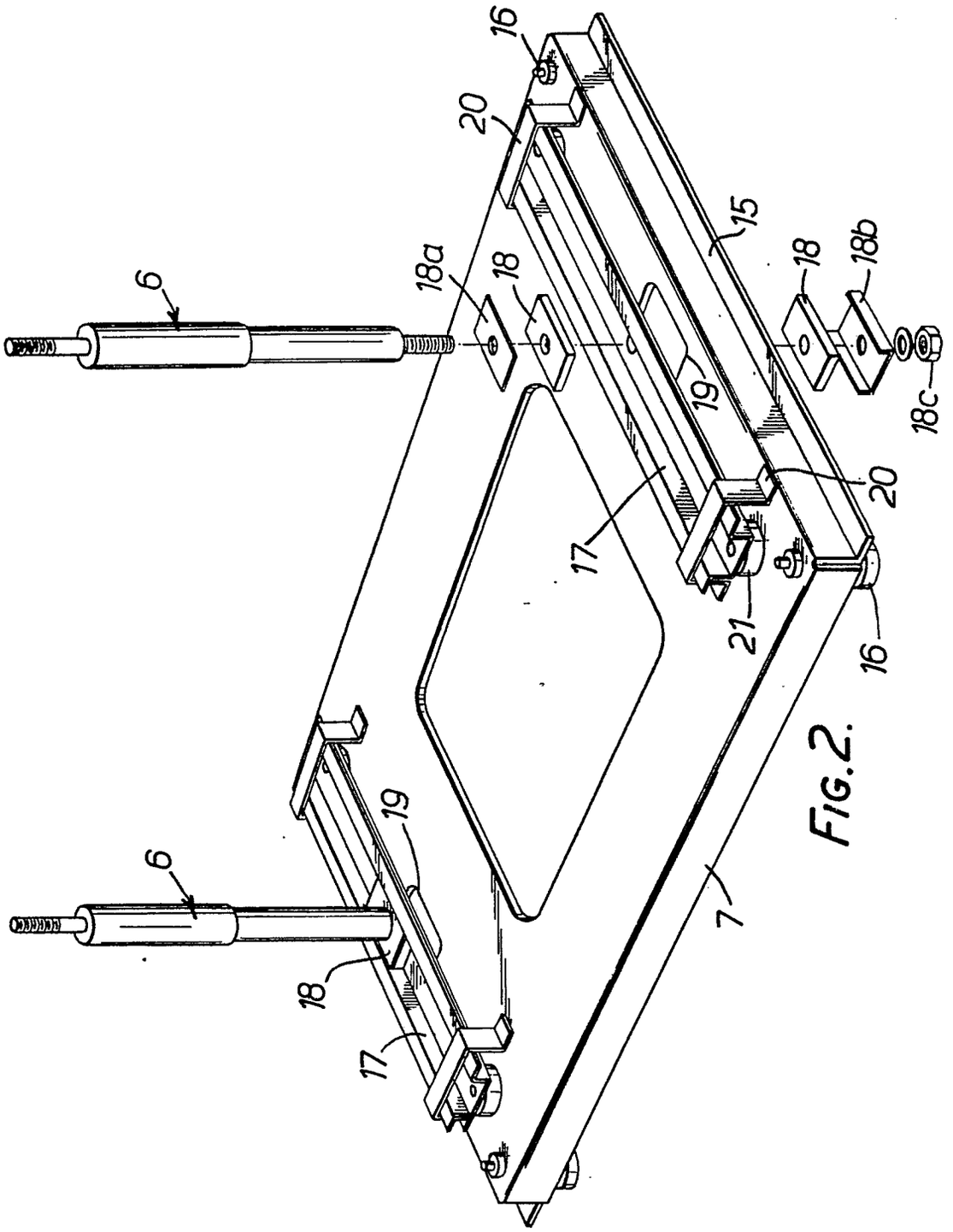

FIG.2.

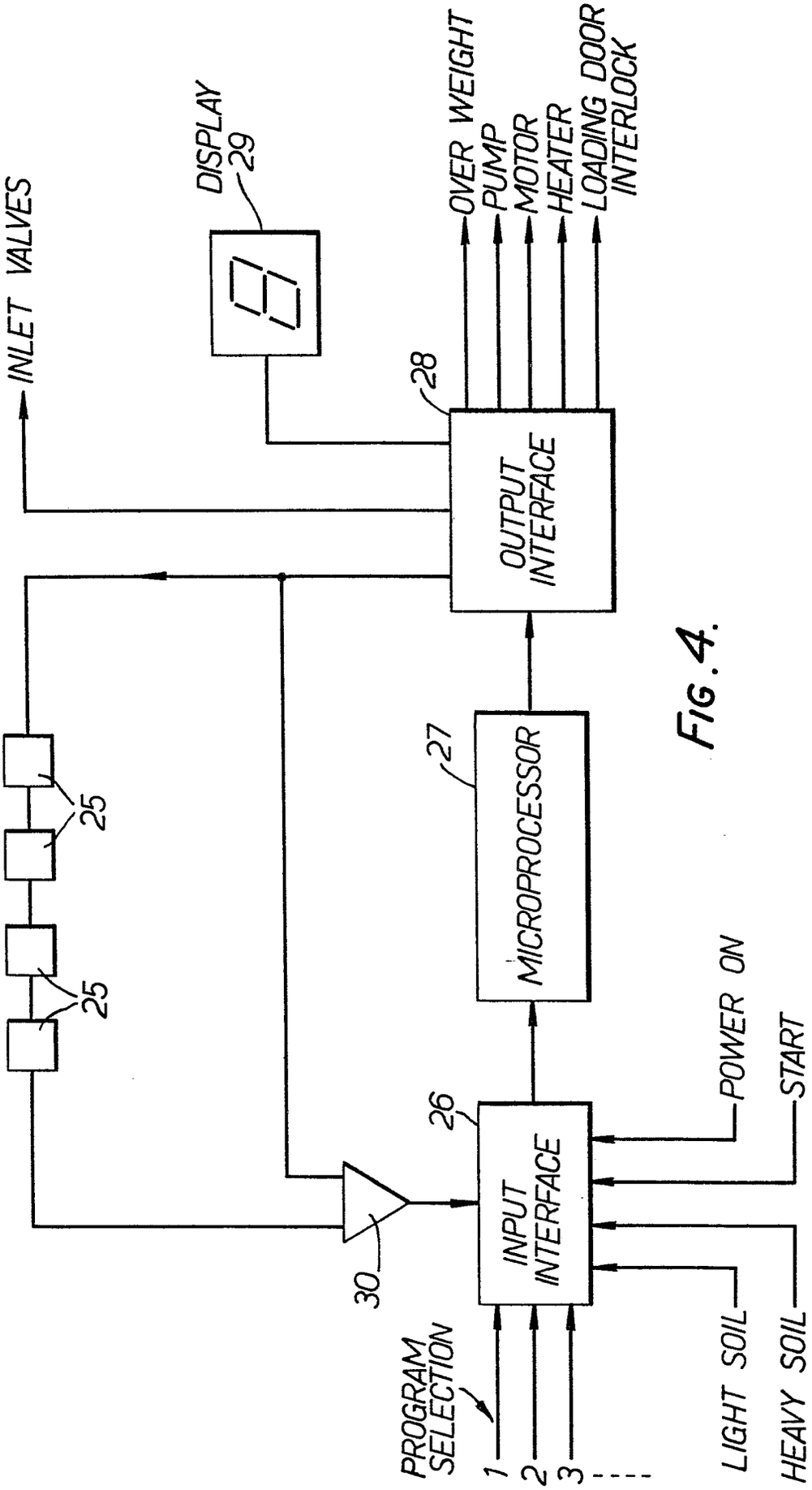
INLET VALVES
DISPLAY
29
OVER WEIGHT
PUMP
MOTOR
HEATER
LOADING DOOR INTERLOCK
28
OUTPUT INTERFACE
25
25
27
MICROPROCESSOR
26
INPUT INTERFACE
30
POWER ON
START
PROGRAM SELECTION
1
2
3
LIGHT SOIL
HEAVY SOIL

FIG. 4.

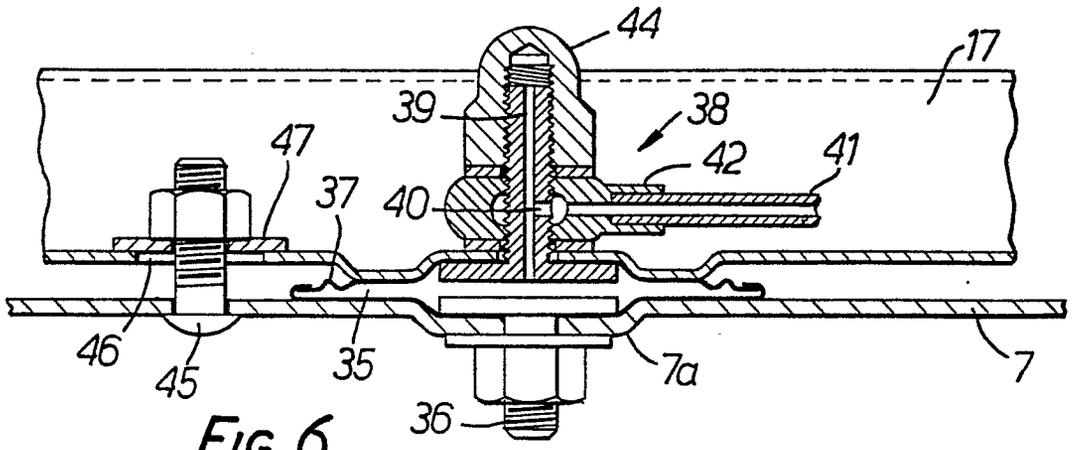

FIG. 6.

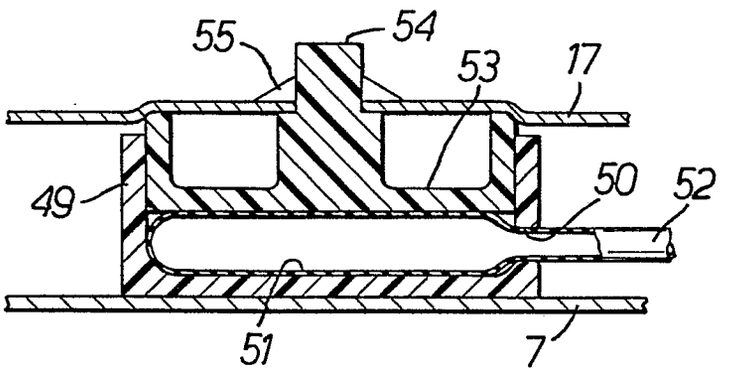

FIG. 7.

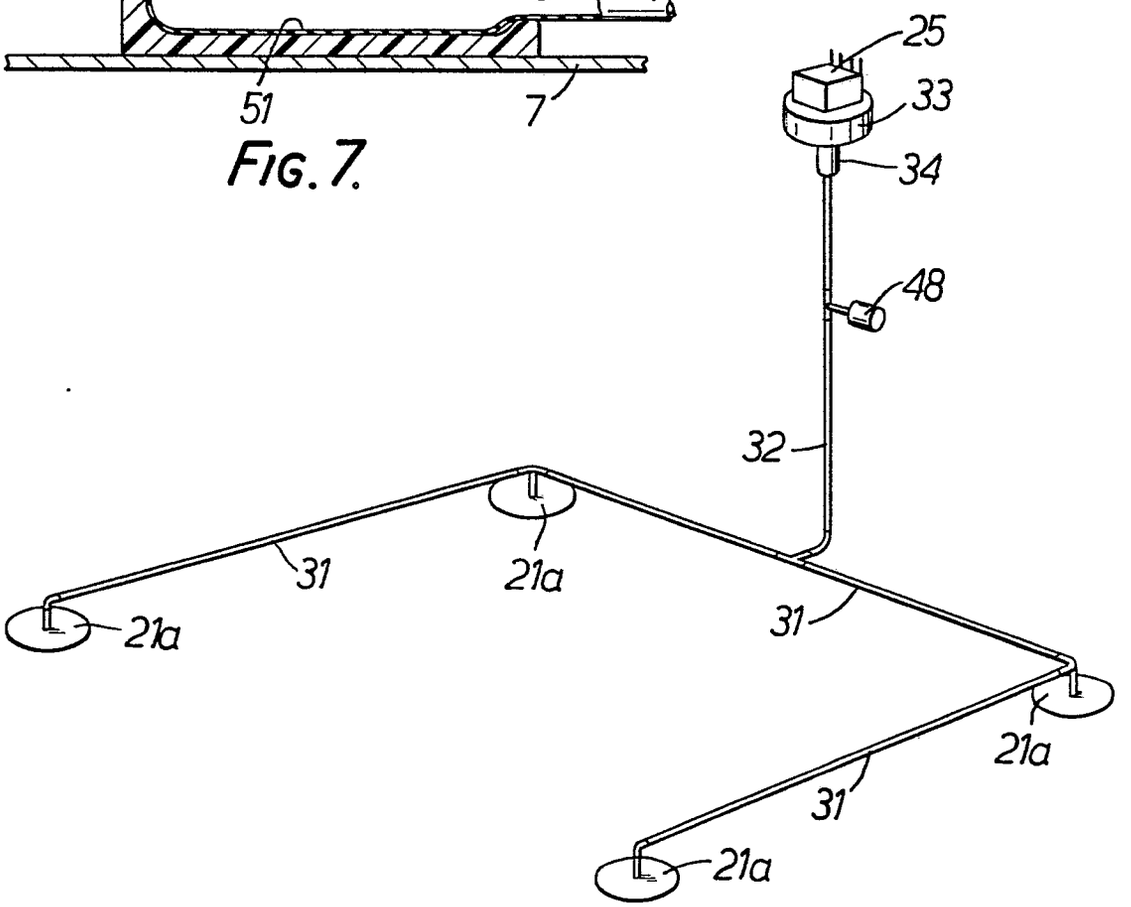

FIG. 5.

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 81 30 5223.0

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
Y	DE - A1 - 2 920 492 (VEB WASCHGERÄTE-WERK SCHWARZENBERG) * claim 1 *	1
Y	DE - A - 2 034 871 (BOSCH-SIEMENS) * claims 1,8 *	1,2
A	GB - A - 2 043 954 (TURNRIGHT CONTROLS LTD.)	
A	DE - A1 - 2 624 514 (LICENTIA PATENT-VERWALTUNGS-GMBH) * claim 1 *	1
A	DE - A1 - 2 854 148 (ASKO-UPO OY)	
A	DE - A1 - 2 822 077 (T.I. DOMESTIC APPLIANCES LTD.)	
A	US - A - 4 222 250 (TORITA)	

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

D 06 F 33/02

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

D 06 F 33/00
D 06 F 39/00
D 06 F 37/28

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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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
Berlin	22-01-1982	KLITSCH