

METHOD OF WIRING/PIPING CONFIRMATION OF A MULTIPLE AIR CONDITIONER

The present invention relates, in general, to a method of confirming wiring and piping relationships of a multiple air conditioner whereby the correspondence between wiring and piping between a plurality of internal units and a controller in a multiple air conditioner is confirmed.

In general, a multiple air conditioner is a system in which air conditioning of locations, such as rooms, is performed by a plurality of internal units controlled by a single central controller. Since there are a plurality of internal units, control must be carried out appropriately, matching the plurality of wirings used for communication between the internal units and controller with the plurality of pipings used to carry refrigerant.

Specifically, the locations of wiring and piping are predetermined such that, the first wiring is arranged to be at a location specified as number 1 by the controller. The first piping also must be arranged to be at the location specified as number 1 by the controller. The wiring and piping are related at that location with the correct correspondence relationship. If the correspondence relationship between wiring and piping is incorrect, the internal units to which the controller sends an operating signal cannot be correctly controlled. Thus, the wiring and piping must be done all over again.

Confirmation of wiring and piping was conventionally performed by operating the internal units one by one, and so was time consuming. As an example, a method of wiring confirmation of a multiple air conditioner is described in Japanese Patent Disclosure (Kokai) No. 1-247938. The conventional technique discloses that an internal unit has a sensor which detects an operation of thermal media. The internal unit and external unit, which consist of a pair of heat cyclic engines, are respectively controlled by a controller. Each controller is connected by communications media. Thus, the correction of errors in connecting condition of the communication way is detected by means of the operation of thermal media.

Accordingly, the conventional technique does not teach both confirmation of wiring and piping in multiple air conditioning systems. Furthermore, when incorrect wiring is detected, the wiring must be done over again.

Summary of the Invention

Accordingly, it is an object of the present invention to provide a method of wiring/piping confirmation of a multiple air conditioner that enables

the correspondence relationship between wiring and piping in the multiple air conditioner to be verified accurately and efficiently.

It is a further object of the present invention to provide a method of wiring/piping confirmation of a multiple air conditioner that eliminates the occurrence of, and correction of errors in the correspondence relationship of wiring and piping.

In accordance with the present invention, the foregoing objects are achieved by providing a method for confirming a wiring of between a plurality of internal units and a controller provided in an external unit and a piping supplies a refrigerant to each internal unit in a multiple air conditioner system. The method includes the steps of actuating the plurality of internal units connected to the controller, supplying the refrigerant to any one internal unit by opening a refrigerant pipe connecting to any one internal unit and the external unit, detecting a change in temperature produced by the refrigerant in the internal unit to which the opened refrigerant pipe is connected, transmitting the changing data to the controller from the internal unit which has detected the change through the wiring and recognizing the correspondence relationship between the wiring that has received the change data and the opened refrigerant pipe.

Brief Description of the Drawings

These and other objects and advantages of this invention will become more apparent from the following detailed description of the presently preferred embodiment of the invention, taken in conjunction with the accompanying drawings of which:

Fig. 1 is a circuit diagram illustrating a multiple air conditioner in accordance with a first embodiment, to which the present invention has been applied;

Fig. 2 is a detailed block diagram of the controller shown in Fig. 1;

Fig. 3 is a flow chart showing the operation of the controller of Fig. 2.;

Fig. 4 is a flow chart showing the wiring/piping confirmation operation in the multiple air conditioner of Fig. 1;

Fig. 5 is a timing chart showing the wiring/piping confirmation operation in the multiple air conditioner of Fig. 1;

Fig. 6 is a flow chart showing the operation control of an internal unit after wiring/piping confirmation of the multiple air conditioner of Fig. 1;

Fig. 7 is a flow chart showing the operation in

the case where none of the wiring between the internal unit and a refrigerant has been connected in the multiple air conditioner of Fig. 1;

Fig. 8 is a circuit diagram illustrating a multiple air conditioner in accordance with a second embodiment, to which the present invention has been applied;

Fig. 9 is a detailed block diagram of the controller shown in Fig. 8;

Fig. 10 is a flow chart showing the wiring/piping confirmation operation in the multiple air conditioner of Fig. 8;

Fig. 11 is a timing chart showing the wiring/piping confirmation operation in the multiple air conditioner of Fig. 8;

Fig. 12 is a circuit diagram illustrating a multiple air conditioner in accordance with a third embodiment, to which the present invention has been applied;

Fig. 13 is a detailed block diagram of the controller shown in Fig. 12;

Fig. 14 is a flow chart showing the wiring/piping confirmation operation in the multiple air conditioner of Fig. 12;

Fig. 15 is a flow chart showing the operation control of an internal unit after wiring/piping confirmation of the multiple air conditioner of Fig. 12;

Fig. 16 is a circuit diagram illustrating a multiple air conditioner in accordance with a fourth embodiment, to which the present invention has been applied;

Fig. 17 is a detailed block diagram of the controller shown in Fig. 16;

Fig. 18 is a circuit diagram illustrating a multiple air conditioner in accordance with a fifth embodiment, to which the present invention has been applied;

Fig. 19 is a detailed block diagram of the controller shown in Fig. 18;

Fig. 20 is a flow chart showing the wiring/piping confirmation operation in the multiple air conditioner of Fig. 18; and

Fig. 21 is a timing chart showing the wiring/piping confirmation operation in the multiple air conditioner of Fig. 18.

Detailed Description of the Preferred Embodiment

The preferred embodiment of the present invention will now be described in more detail with reference to the accompanying drawings.

A multiple air conditioner system, as shown generally as 1 in Fig. 1, is provided with a plurality of internal units 11,13 separately arranged in a room or the like to affect air conditioning of the

room. The multiple air conditioner is provided with an external unit 21 which constitutes a central control device. The external unit 21 supplies a refrigerant to each internal unit so as to control the air conditioning of each internal unit 11,13. The external unit 21 controls said plurality of internal units 11,13 in common. The plurality of internal units 11,13 is connected to the external unit 21 respectively through a plurality of refrigerant pipes 41,43 and serial communication wirings 51,53. It should be noted that there is at least one refrigerant pipe and communications wiring for each internal unit. The internal units 11,13 are connected to the external unit 21 through a common refrigerant return pipe 45.

External unit 21 is provided with a heat exchanger 25 which is linked to respective refrigerant pipes 41,43 through flow control valves 31,33. The refrigerant is supplied to the internal units 11,13 respectively through these refrigerant pipes 41,43. The refrigerant that is supplied to each internal unit 11,13 is returned to the external unit 21 through the common return pipe 45. The refrigerant returned to the external unit 21 is supplied to a compressor 29 through a four way valve 35. The refrigerant is supplied from the compressor 29 through the four way valve 35 to a heat exchanger 25. The refrigerant is again supplied to the internal units 11,13 through the flow control valves 31,33 and the refrigerant pipes 41,43. The heat exchanger 25 is provided with a fan 27. The external unit 21 is provided with a controller 23 that performs overall electrical control. The serial communication wirings 51,53 are respectively connected to serial communication control units 71,73 provided in the controller 23. Data concerning the refrigerant in pipes 41,43 is sent from the controller 23 of the external unit 21 by serial communication control units 71,73 to the respective internal units 11,13 through the serial communication wirings 51,53. In the opposite direction, data from each internal unit 11,13 is sent to the respective serial communication control units 71,73 through the serial communication wirings 51,53.

The controller 23 is further provided with flow control valve control units 61,63, a compressor control unit 65, a four way valve control unit 69 and a fan control unit 67. The flow control valve control units 61,63 control the flow control valves 31,33 respectively. The compressor control unit 65 controls the compressor 29. The four way valve control unit 69 controls the four way valve 35. The fan control unit 67 controls the fan 27 for the heat exchanger 25. In addition, each internal unit 11,13 has a respective built-in temperature sensor 37,39 for monitoring the air conditioning temperature and a respective fan 15,17. Remote controllers 55,57 for effecting remote control of the internal units

11,13 are connected to the respective internal units 11,13 near the locations where they are arranged. The internal units 11,13 are also connected in common to an integrated control device 47.

As shown in Fig. 2, the controller 23 is provided with a central processing unit (CPU) 81, a data discriminating unit 83, a memory unit 85 and a timer 87. The central processing unit 81 consists of a microprocessor or other processing device that controls the overall operation. The data discriminating unit 83 discriminates the data received by the serial communication control units 71 to 73 from the internal units 11,13. The memory unit 85 stores the correspondence relationship between the piping and wiring between the internal units 11,13 and the controller 23, i.e., memory unit 85 stores the correspondence relationship between the refrigerant pipes 41,43 and the serial communication wiring 51,53.

The operation of the controller 23 will be described with reference to Fig. 3. In Fig. 3, in step 100, the controller 23 is actuated. In step 110, a check is made as to whether the correspondence relationship between the wiring and piping is recognized or not. If it is not recognized, the controller goes into the recognition mode of step 120, in which it actuates the compressor 29 of the external unit 21, the fan 27 and the four way valve 35. Next, in step 130, all the internal units 11,13 are operated manually. To operate all the internal units 11,13, for example the remote controllers 55,57 provided for the internal units 11,13 are sequentially operated, or the integrated control device 47 provided in common for the internal units 11,13 is operated. In step 140, after all the internal units 11,13 have been operated, the controller 23 opens the flow control valves corresponding to an arbitrary set of the plurality of the refrigerant pipes 41,43. The refrigerant is supplied to the internal units through the refrigerant pipes corresponding to the flow control valves which have been opened. As a result, a temperature change occurs due to the effect of the refrigerant in the internal units that are supplied with the refrigerant. This temperature change is detected by the temperature sensor, eg. 37,39, provided in the internal unit. The temperature change data for the internal unit is supplied to the controller 23 through the serial communication wiring of the internal unit detecting the temperature change.

In step 150, the controller 23 monitors whether or not a signal indicating temperature change is returned from the internal units 11,13 through the serial communication control units 71,73 that are connected to serial communication wirings 51,53. If there is a return signal from the internal unit, the controller 23 identifies, by means of the data discrimination unit 83, the number of the serial com-

munication wiring from the identification number of the serial communication control unit 71,73 that receives the signal. In step 160, the controller 23 thereby recognizes the serial communication wiring corresponding to the refrigerant pipe that has been opened, and stores the correspondence relationship between this recognized refrigerant pipe and the serial communication wiring in the memory unit 85. If there is no return signal from the internal unit, in step 170, it recognizes that there is no serial communication wiring corresponding to the piping of the refrigerant pipe that was opened as described above. In step 180, a check is performed as to whether recognition processing of the correspondence relationship between piping and wiring as described above has been performed for all of the internal units 11,13 (for example N units), or not. If the recognition processing has not been completed for all N units, the control returns to step 140. Thus, the operation described above is repeated until recognition processing of the correspondence relationship between piping and wiring of the internal unit has been completed for all N units. In step 190, after recognition of the correspondence relationship between piping and wiring has been completed for all the internal units, the control returns to step 110.

When recognition of the correspondence relationship between wiring and piping has been completed, the control advances from the check of step 110 to the normal mode beginning with step 200, in which a check is made as to whether there is a control signal from any of the internal units 11,13. If there is no control signal, the system returns to step 110. If there is a control signal, that is, if operation of an internal unit is required, the controller 23 identifies, through the data discrimination unit 83, the identification number of the serial communication wiring from the serial communication control unit 71,73 that has received this control signal. In step 210, the controller 23 gets the piping number of the refrigerant pipe corresponding to the serial communication wiring of this identification number from the memory unit 85. In step 220, controller 23 controls the opening of the flow control valve corresponding to the refrigerant pipe of this piping number. Thus, the refrigerant is supplied to the corresponding internal unit, which starts operation.

Next, the wiring/piping confirmation will be described with reference to Fig. 4 and Fig. 5.

In Fig. 4, the operation is effected as shown in (e), (h) and (k) of the timing diagram of Fig. 5 for all the N internal units 11-13, by operating the remote controllers 55-57 or the integrated control device 47 connected to the internal units 11-13 (step 310,320). In step 330, the compressor 29, the fan 27 and the four way valve 35 of the external unit 21

are actuated. In step 340, the controller 23 opens an arbitrary set, for example, the first flow control valve 31 of the plurality of flow control valves 31,33 corresponding to the plurality of refrigerant pipes 41,43. Thus, it supplies the refrigerant to the corresponding first internal unit 11 through any one corresponding pipe, for example, the first refrigerant pipe 41, as shown in Fig. 5a. After this, in step 350, as shown in Fig. 5b, the timer 87 is actuated. As a result, refrigerant is supplied to the first internal unit 11 connected to first refrigerant pipe 41. This results in the occurrence of a temperature change due to the effect of the refrigerant, as shown in Fig. 5f. In step 360, a check is made as to whether this temperature change has taken place or not. In step 370, this temperature change is detected by the temperature sensor 37 provided at the first internal unit 11. This detected temperature change data at the first internal unit 11 is sent to the controller 23 as shown in Fig. 5g through the first serial communication wiring 51, which is connected to the first internal unit 11. The data that is sent from the internal unit 11 through the serial communication wiring 51 is received through the serial communication control unit 71 by the controller 23, as shown in Fig. 5c. When the data is received from the internal unit 11 by the controller 23, the timer 87 that was actuated in step 350 as shown in Fig. 5b is stopped. The controller 23 identifies, by means of the data discrimination unit 83, the number of the serial communication wiring from the identification number of the first serial communication control unit 71 that is connected to the first serial communication wiring 51 which has received this data. It thereby recognizes the first serial communication wiring 51 corresponding to the first refrigerant pipe that was opened as described above.

In step 470, the controller stores the correspondence relationship between this recognized refrigerant pipe 41 and the serial communication wiring 51 in the memory unit 85. In step 480, a check is performed as to whether the recognition processing of the correspondence relationship of piping and wiring has been carried out for all the internal units (for example N units) or not. If the recognition processing has not been completed for all the N units, the control returns to step 340. Thus, the operation described above is repeated until recognition processing of the correspondence relationship between piping and wiring of all N internal units has been completed.

If a refrigerant pipe is opened by opening one flow control valve, it is unclear which internal unit is showing the temperature change until the correspondence relationship is recognized. That is, it is unclear which internal unit the opened refrigerant pipe has been connected to. Therefore, as shown

in steps 360 to 470, a check is made for the existence of temperature change in sequence in cascade fashion for the first to the n-th internal unit, as shown in step 370 to 420. The corresponding internal unit is thereby detected. Thus, if there is no temperature change in the first internal unit, a check is made as to whether there is a temperature change in the second internal unit. If there is no temperature change in the second internal unit, the next internal unit in sequence is checked. In this way, the internal units showing temperature change are detected. In step 450, the check for temperature change of all of the internal units from the first to the n-th is repeated until time-up of the timer 87 actuated in step 350. On time-up, if no temperature change has been detected from any internal unit, in step 460, it is recognized that there is no serial communication wiring corresponding to the aforementioned opened refrigerant pipe, and this fact is stored in the memory unit 85. Thus, the recognition processing of the correspondence relationship between piping and wiring is repeated for all the internal units (for example N units).

Next, the operation control of the internal unit after recognition of the correspondence relationship of wiring and piping will be described with reference to the flow chart shown in Fig. 6. In Fig. 6, to check whether or not there is an operation request from any internal unit, in steps 510 to 530 a check is performed as to whether there is a control signal or not from each internal unit. This check is performed in sequence for all of the internal units 11,13 connected to all of the serial communication wiring 51,53 from the first to the n-th. This process is carried out by checking in sequence whether or not a control signal is being sent to the serial communication control units 71,73 of the controller 23 from each of the serial communication wiring 51,53. If a control signal is identified from the internal unit that is connected to the i-th serial communication wiring, in steps 540 to 560, the piping number corresponding to this i-th serial communication wiring is read from the memory unit 85. In step 570, the opening control is performed of the flow control valve for the refrigerant pipe corresponding to this piping number, so that the operating control of the corresponding internal unit is accomplished.

Fig. 7 is a timing chart showing the operation when the serial communication wiring between the internal units and the controller 23 of the external unit 21 are completely unconnected. As can be understood by comparison with the timing chart of Fig. 5, in the operation shown in Fig. 7, the serial communication wirings are unconnected, in spite of the refrigerant being supplied in sequence to the internal units through the refrigerant pipes by the opening of each of the flow control valves cor-

responding to the refrigerant pipes after actuation of all the internal units. Temperature change data of the internal units is therefore not received by the controller 23 of the external unit 21. As a result, it can be seen that there is no connection of the serial communication wiring between the internal units 11,13 and the controller 23. In this case, the operation continues until time-up of the timer.

Fig. 8 shows a second embodiment of the present invention. In the multiple air conditioner shown in Fig. 8, the remote controllers 55,57 that were respectively connected to the internal units 11,13 in the multiple air conditioner of Fig. 1 and the integrated control device 47 that was connected in common are eliminated. Instead, all the various operations such as start of operation, stopping and temperature setting etc. of the internal units 11,13 are performed automatically and remotely from the controller 23 of the external unit 21. Apart from this difference, the rest of the layout and operation is the same as that of the multiple air conditioner of Fig. 1.

Fig. 9 shows the controller 23 and its peripheral units used in the multiple air conditioner of Fig. 8. The controller 23 shown in Fig. 9 controls the internal units 11-13 which do not have the aforesaid remote controllers 55-57 or the integrated control unit 47. Controller 23 therefore is arranged so as to control all the operations such as starting, stopping and temperature setting of the various internal units 11-13. Otherwise, its layout and operation is the same as the controller 23 of Fig. 2. The operation of the controller 23 in the multiple air conditioner of the second embodiment differs only in that, instead of processing to operate manually all of the internal units 11-13 in the operation of the controller of the first embodiment shown in Fig. 3, all of the internal units 11-13 are operated automatically from the controller 23.

Fig. 10 and Fig. 11 are, respectively, a flow chart and timing chart showing the wiring/piping recognition operation in the second embodiment. In the wiring/piping recognition operation shown in this Fig. 10 and Fig. 11, all of the internal units 11-13 are automatically operated by sending an operation signal to the internal units 11-13 from the controller 23. Thus, a step 308 in Fig. 10 replaces the steps 310 and 320 in Fig. 4. Also, in the timing chart of Fig. 11, as shown in Fig. 11a, all of internal units 11-13 are simultaneously automatically actuated by an operating signal from the controller 23. This is because in this second embodiment the operation of all the internal units 11-13 is controlled in common from the central controller 23. Therefore, there is no need to actuate internal units 11-13 one by one by remote controllers or the like. As a result, the control can be achieved in a simple manner from the controller 23 provided at a single

central location without going to individual locations of the internal units 11-13.

Fig. 12 shows a third embodiment of the present invention. In the multiple air conditioner shown in Fig. 12, the serial communication control units 71-73 and the serial communication wirings 51-53 of Fig. 1 are eliminated. Instead, a bus communication control unit 70 is provided in the controller 23. A bus communication wiring 50 is provided in common between the internal units 11,13 and the bus communication control unit 70. The internal units 11,13 are given identification numbers. These identification numbers are sent to the controller 23 from the internal units 11,13 through the bus communication wiring 50. Thus, the correspondence relationship between the identification numbers of the internal units 11,13 and the piping, i.e., the refrigerant pipes 41,43 is thereby recognized. The rest of the layout and operation are the same as that of the multiple air conditioner of Fig. 1.

Fig. 13 shows the controller 23 and its peripheral units used in the multiple air conditioner of Fig. 12. In the controller 23 shown in Fig. 13, there is provided a bus communication control unit 70. The connection is effected in common from the bus communication control unit 70 to the internal units 11,13 through the bus communication wiring 50. The internal units 11,13 are given distinguishing identification numbers which can be transmitted to the control unit 23 on bus 50. The correspondence relationship between the piping between the internal units 11,13 and the external unit 21 and the identification numbers of the internal units 11,13 is thereby recognized.

Fig. 14 is a flow chart showing the wiring/piping recognition operation in a third embodiment. In Fig. 14, when a temperature change of the internal unit that is supplied with refrigerant through the refrigerant pipe corresponding to an opened flow control valve is detected, both this temperature change data and the identification number of the internal unit are returned to the controller 23 via common bus communication wiring 50. The controller 23 then recognizes and stores the correspondence relationship between the identification number of the internal unit which it has received and the refrigerant pipe that was opened. The controller 23 then controls the internal units using the correspondence relationship between the identification number and the piping that have been stored.

Specifically, in steps 361, 381, 401 and 421 of Fig. 14, a check is made on the first to the n-th internal unit to establish which of the internal units showed a temperature change in response to the refrigerant supplied through an opened refrigerant pipe. The internal unit that experienced the temperature variation sends data concerning this tem-

perature variation together with its own identification number to the controller 23 through the common bus communication wiring 50 (steps 371, 391, 411, 431). The controller 23 receives this temperature variation data together with the identification number of the internal unit from the bus communication wiring 50 through the bus communication control unit 70. Thus, in step 471, the controller 23 recognizes, by means of data discrimination unit 83, the identification number of the internal unit corresponding to the refrigerant pipe that has been opened and stores this correspondence relationship in the memory unit 85. In step 461, if data is not returned from any internal unit within the prescribed time-up period, controller 23 recognizes that there is no internal unit corresponding to the aforementioned opened refrigerant pipe, and also stores this fact.

Next, with reference to the flow chart shown in Fig. 15, the operation control of the internal units of the third embodiment after the correspondence relationships between the opened refrigerant pipes and identification numbers of the internal units have been stored will be explained. In Fig. 15, in order to perform a check as to whether there is an operating request from any internal unit, in steps 511 to 531, the system checks as to whether or not a control signal constituting an operation request is being received through the bus communication wiring 50. This check is carried out in sequence for all of the internal units 11,13 from the first to the n-th. In such a case, each internal unit that sends a control signal also sends its own identification number together with this control signal. As a result, in steps 541, 551, 561, when the controller 23 receives a control signal from a i-th internal unit, together with its identification number, it reads from the memory unit the piping number of the refrigerant pipe corresponding to this received identification number of the i-th internal unit. In step 571, the controller 23 controls the opening of the flow control valve for the refrigerant pipe corresponding to this piping number, thereby controlling the operation of the corresponding internal unit.

In the third embodiment described above, since connection is made between internal unit 11,13 and the controller 23 through a common bus communication wiring 50, the amount of wiring between the internal units 11,13 and the controller 23 can be reduced. There is no need to perform separate wiring such as serial communication wiring 51-53 corresponding to each internal unit 11-13. Thus, the wiring operation can be carried out more simply.

Fig. 16 and Fig. 17 show a fourth embodiment of the present invention. The multiple air conditioner of the fourth embodiment incorporates both of the improvements to the first embodiment made

in the second and the third embodiments respectively. Specifically, in this fourth embodiment, (1) the operation of the internal units 11,13 is automatically controlled from the controller 23 and (2) a common bus communication wiring 50 is employed. In addition, the internal units 11,13 are given identification numbers and the correspondence relationship between the identification numbers of internal units 11,13 and the piping is recognized and stored. In the third embodiment, in the piping/wiring recognition operation, each of the internal units 11,13 was operated manually, one at a time, using a remote controller 55,57 or the integrated control device 47. In the fourth embodiment, all of the internal units 11,13 are operated simultaneously by control performed by sending an operating signal to each internal unit 11,13 from the controller 23. In the fourth embodiment, since the operation of the internal units 11,13 is controlled in common from the controller 23 that is centrally provided, it is not necessary to operate the internal devices 11,13 one by one by means of remote controllers, etc. They can be controlled in a simple manner from the controller 23 provided in a single central location, without going to the individual locations of the internal units 11,13. Also, since the connection between the internal units 11,13 and the controller 23 is effected through a common bus communication wiring 50, the wiring between the internal units 11,13 and the controller 23 can be reduced. The wiring operation can be carried out in a simpler manner, without needing to perform individual wiring corresponding to each internal unit 11,13, as was done in the case of serial communication wiring 51,53. The remaining operational aspects of the fourth embodiment are the same as those of the third embodiment discussed above.

Fig. 18 and Fig. 19 show a fifth embodiment of the present invention. The fifth embodiment differs from the first embodiment in that operation of the internal units 11,13 is controlled from a distance through a telephone circuit, and the fact that the system is in the wiring/piping recognition mode is transmitted to the controller 23, so that the operation of wiring/piping recognition can be performed by remote control. Specifically, the multiple air conditioner of the fifth embodiment differs from the first embodiment in that a telecontroller 44, which is connected to a telephone circuit 92 and adapters 46-48, is provided between the internal units 11-13 and the remote controllers 55-57. The telecontroller 44 is connected to the internal units through the adapters 46-48. The operation of the internal units 11-13 is controlled through the telecontroller 44 and the adapters 46-48 from the telephone circuit 92. The wiring/piping recognition mode data is transmitted to the controller 23 through the internal units 11-13. A telephone set 93 is connected to the

telecontroller 44 as shown in Fig. 19.

Fig. 20 and Fig. 21 are respectively a flow chart and timing chart of the wiring/piping recognition operation in a fifth embodiment. The wiring/piping recognition operation illustrated in Fig. 20 and Fig. 21 differs from the second embodiment described with reference to Fig. 10 and Fig. 11 only in that, all the internal units 11-13 are made to operate by the remote control from the telephone circuit 92 through the telecontroller 44 and the adapters 46-48. In step 305, the wiring/piping recognition mode is transmitted to the controller 23 from the internal units 11-13. Also, as shown by Fig. 21(a), all the internal units 11-13 are remotely controlled from the telephone circuit 92 through the telecontroller 44 and the adapters 46-48. Thus, the operation of all the internal units 11,13 is started as shown at (b) in the timing diagram of Fig. 21. Since, in the fifth embodiment, the operation of the internal units 11- 13 in wiring/piping recognition mode is remotely controlled through the telephone circuit 92, the control can be achieved from a distance in a simple manner without the need for going to the location where the multiple air conditioner and the internal units are located.

Numerous other modifications and variations of the present invention are possible in light of the above teachings. It is there to be understood that, within the scope of the appended claims, the present invention can be practiced in a manner other than as specifically described herein.

Claims

1. A method of confirming wiring between a plurality of internal units and a controller provided in an external unit and piping supplies of a refrigerant to each internal unit in a multiple air conditioner system, wherein said method comprises the steps of: actuating at least one of the plurality of internal units connected to the controller; supplying the refrigerant to an internal unit by opening a refrigerant pipe connecting said internal unit and said external unit; detecting a change in temperature produced by the refrigerant in said internal unit; transmitting data of said change in temperature to the controller from said internal unit through wiring; and detecting a correspondence relationship between said wiring transmitting said change in temperature data and said opened refrigerant pipe.

2. The method according to claim 1, wherein said actuating step is performed manually.

3. The method according to claim 1, wherein said actuating step is performed automatically.

4. The method according to one of claims 1 to 3,

wherein said actuating step is performed by remote control.

5. The method according to claim 4, wherein said actuating step by remote control is performed through a telephone circuit.

6. The method according to any preceding claim, wherein a flow control valve is utilized to perform said supplying step.

7. The method according to any preceding claim, wherein a temperature sensor is utilized to perform said detecting step.

8. The method according to any preceding claim, comprising limiting a time period for detecting said change in temperature.

9. The method according to any preceding claim, wherein a serial communication wiring is utilized to perform said transmitting step.

10. The method according to one of claims 1 to 8, wherein a bus communication is utilized to perform said transmitting step.

11. The method according to claim 10, wherein an identification number of the internal unit is transmitted together with the changing data to perform said transmitting step.

12. The method according to any preceding claim, comprising the additional step of storing the data of said correspondence relationship.

13. The method according to any preceding claim, comprising the step of supplying the refrigerant to a sequence of pipes and detecting corresponding temperature changes.

14. A method of controlling a multiple air conditioner system having a plurality of internal units and at least one external unit having a controller, wherein said method comprises the steps of:

actuating at least one of the plurality of internal units connected to the controller;

supplying refrigerant to an internal unit by opening a refrigerant pipe connecting said internal unit and said external unit;

detecting a change in temperature produced by the refrigerant in said internal unit;

transmitting data of said change in temperature to the controller from said internal unit through communications wiring;

detecting a correspondence relationship between said wiring transmitting said change in temperature data and said opened refrigerant pipe; and

monitoring said internal units for refrigerant requests and upon receipt of a refrigerant request from a particular internal unit opening the corresponding pipe determined by the correspondence relationships.

15. The method recited in claim 14, wherein the correspondence relationship is stored in a memory.

16. The method recited in claim 15, wherein upon receipt of a refrigerant request, the controller reads the memory to identify the corresponding pipe to

be opened.

17. The method recited in one of claims 14 to 16, wherein temperature change data is transmitted with an internal unit identification number over a bus.

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18. The method recited in one of claims 14 to 17, wherein each internal unit is supplied with refrigerant in a predetermined sequence.

19. A multiple air conditioner system, wherein said system comprises:

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a plurality of internal units and at least one external unit, the external unit having a controller;

means for actuating at least one of the plurality of internal units connected to the controller;

means for opening refrigerant pipes, each refrigerant pipe connecting an internal unit to said external unit to supply refrigerant to said internal unit;

15

a sensor for each internal unit for detecting changes in temperature produced by the refrigerant in said internal unit;

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means for transmitting data of said change in temperature to the controller from said internal unit through communications wiring;

means for detecting a correspondence relationship between said wiring transmitting said change in temperature data and said opened refrigerant pipe; and

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means for monitoring said internal units for refrigerant requests and upon receipt of a refrigerant request from a particular internal unit for opening the corresponding pipe determined by the correspondence relationships.

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20. The apparatus recited in claim 19 wherein the communications wiring comprises a data bus.

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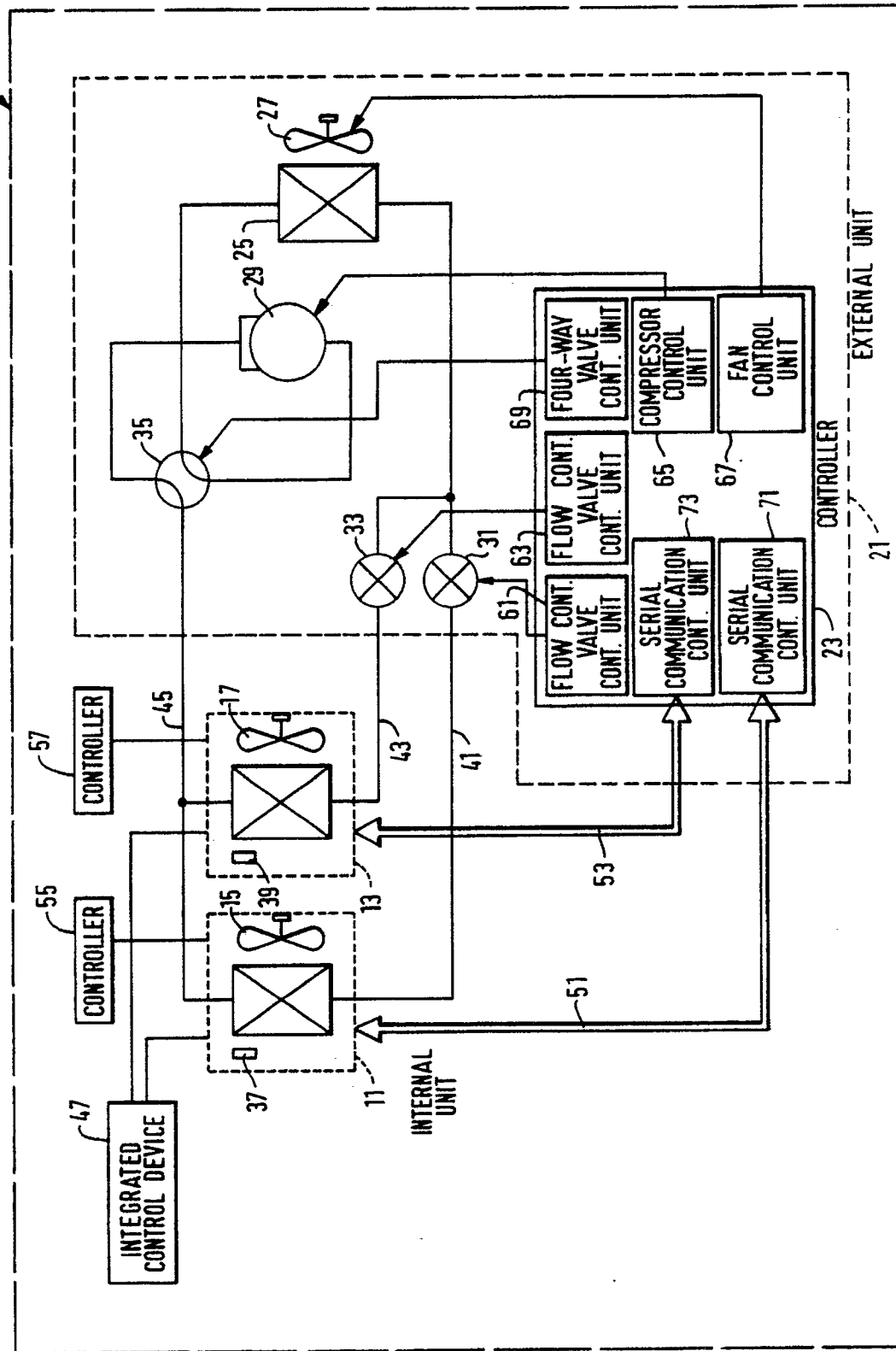
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50

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FIG.1



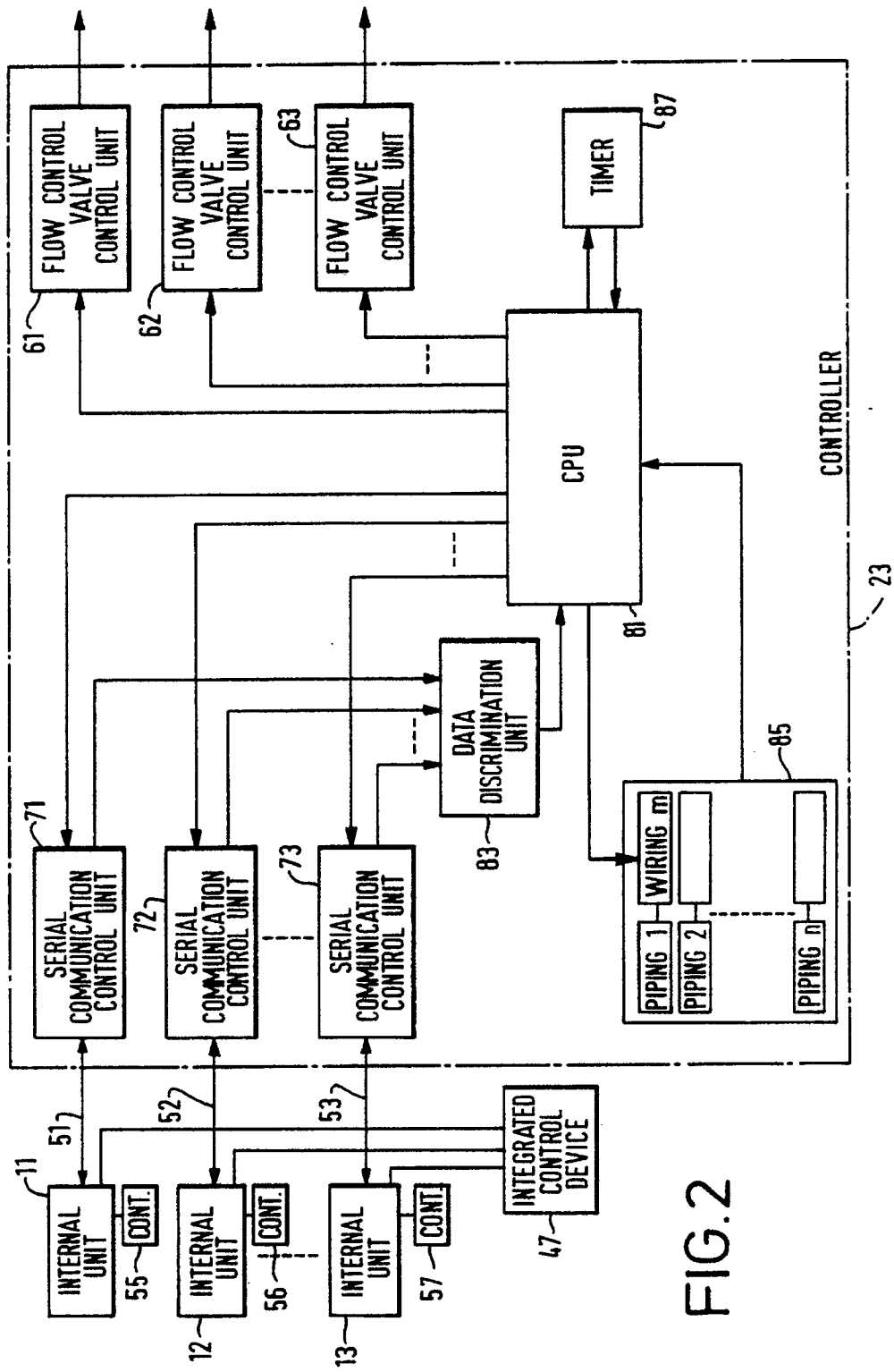


FIG. 2

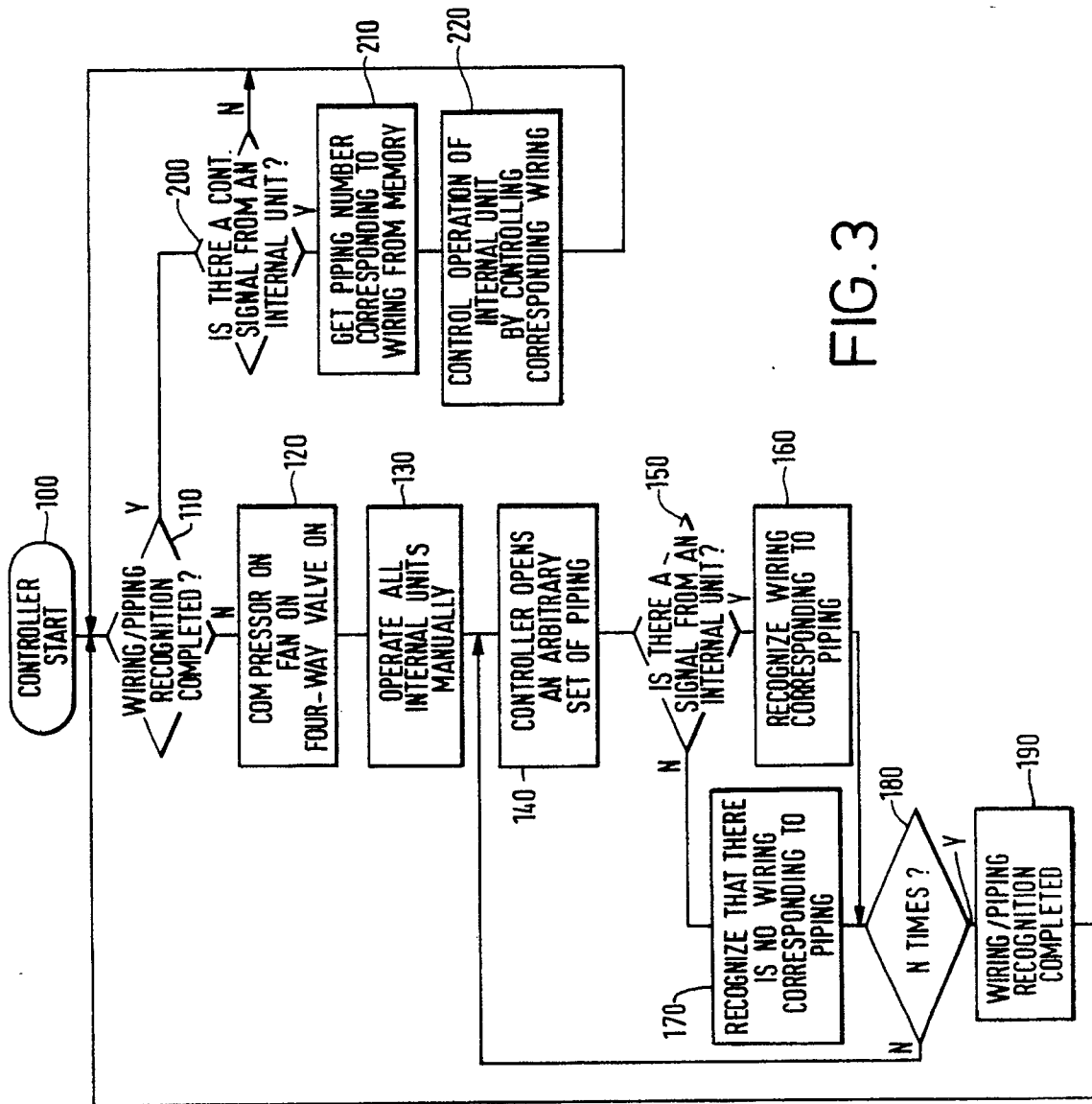


FIG. 3

FIG. 4

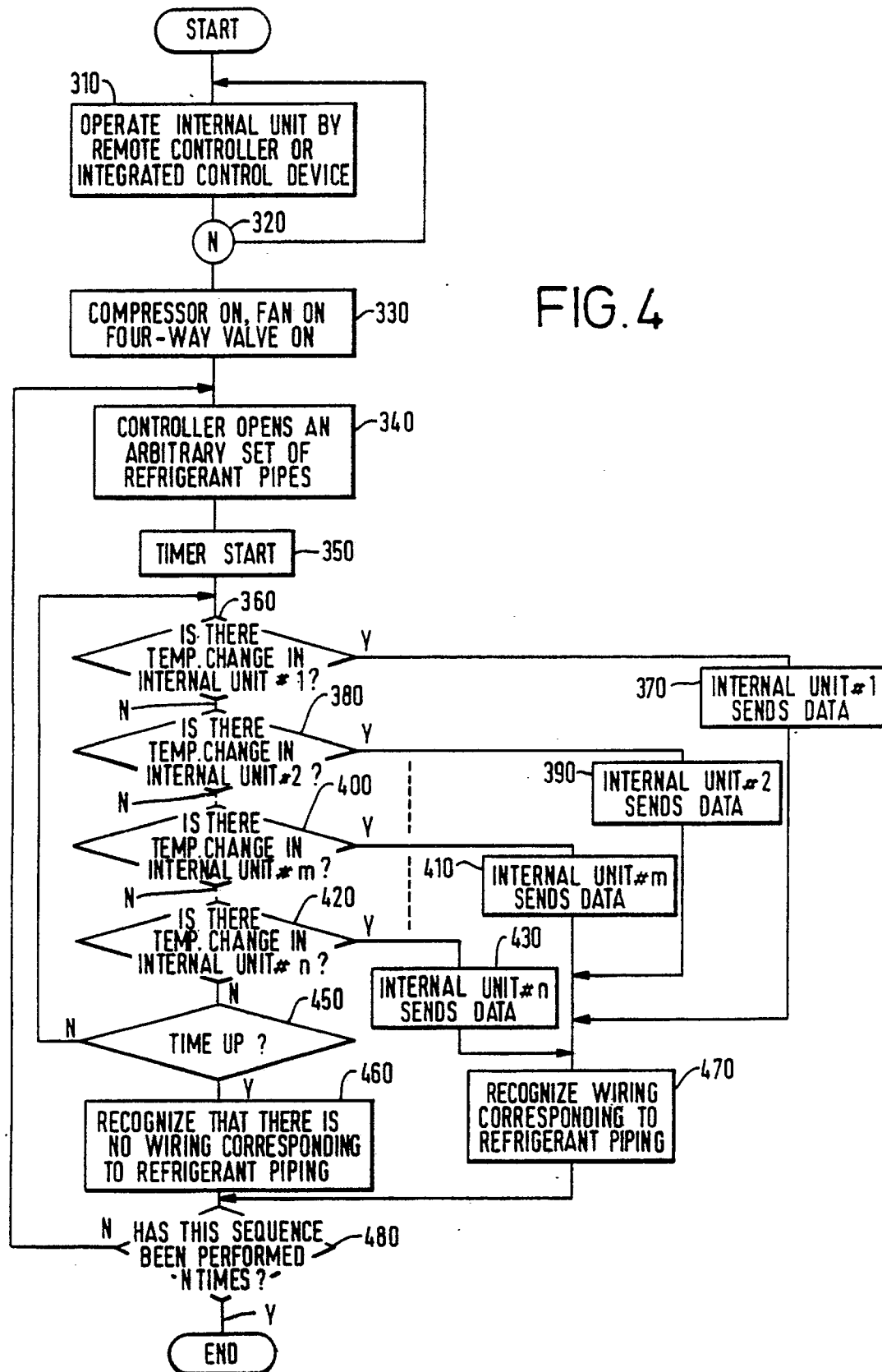


FIG.5

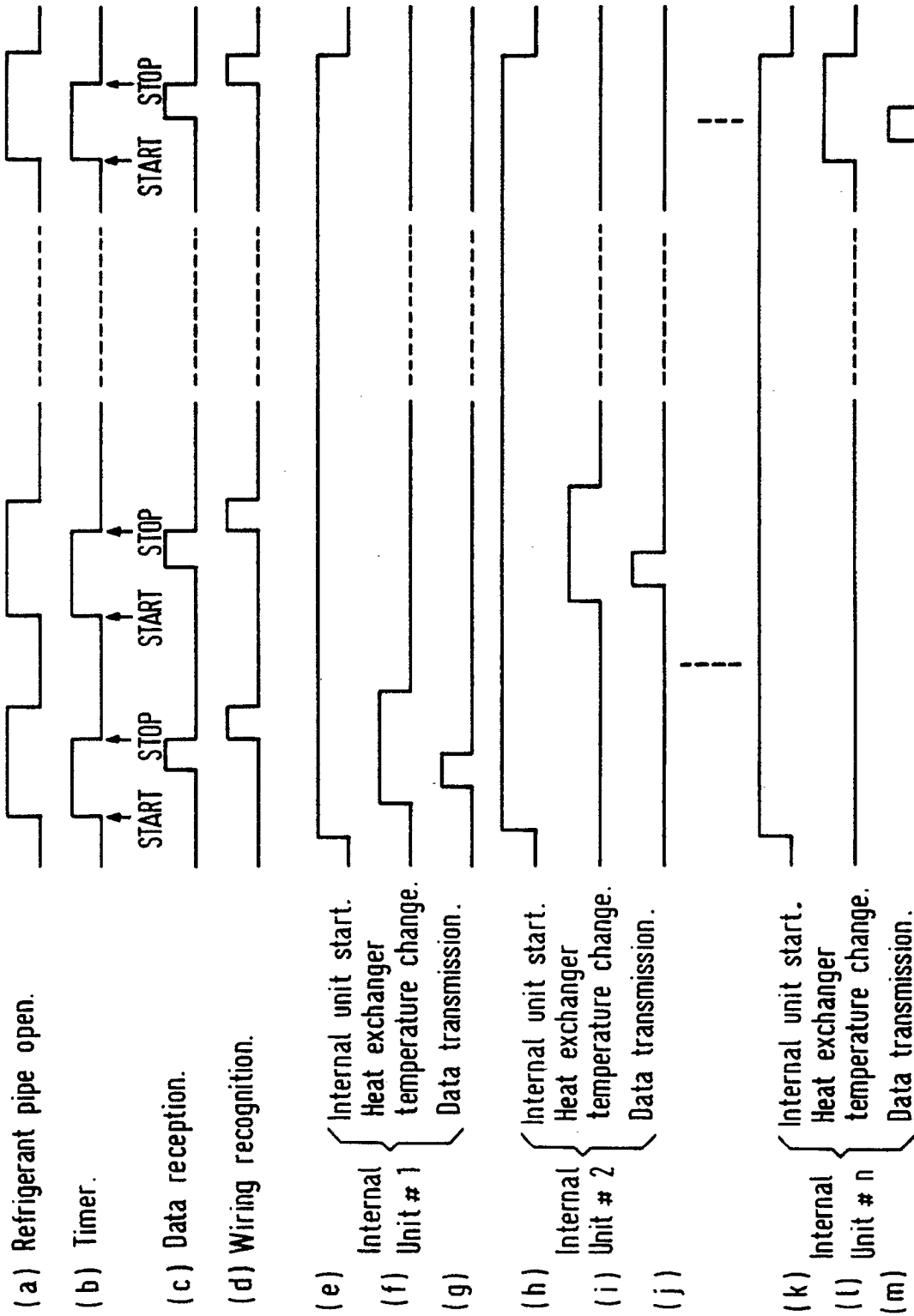


FIG. 6

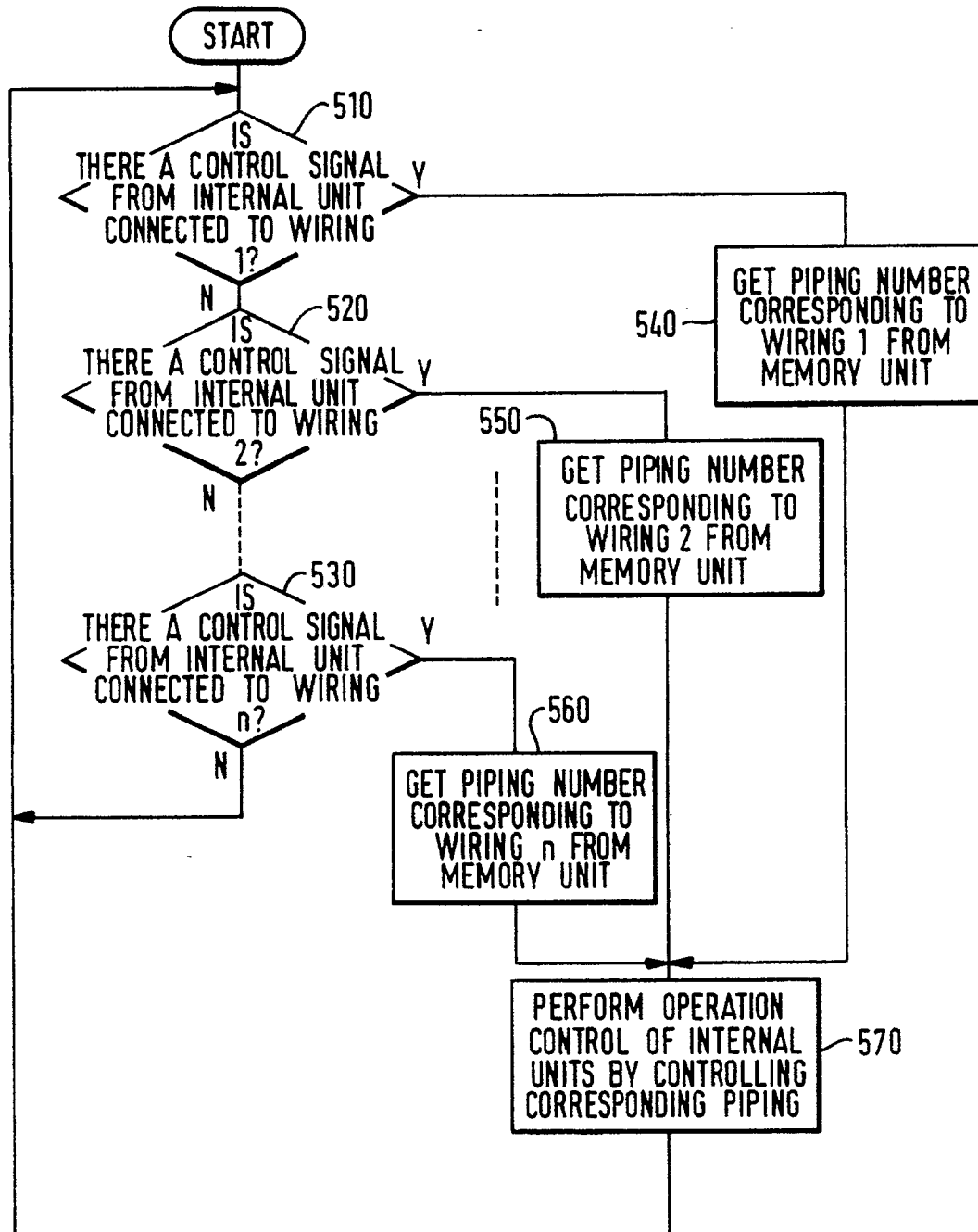


FIG. 7

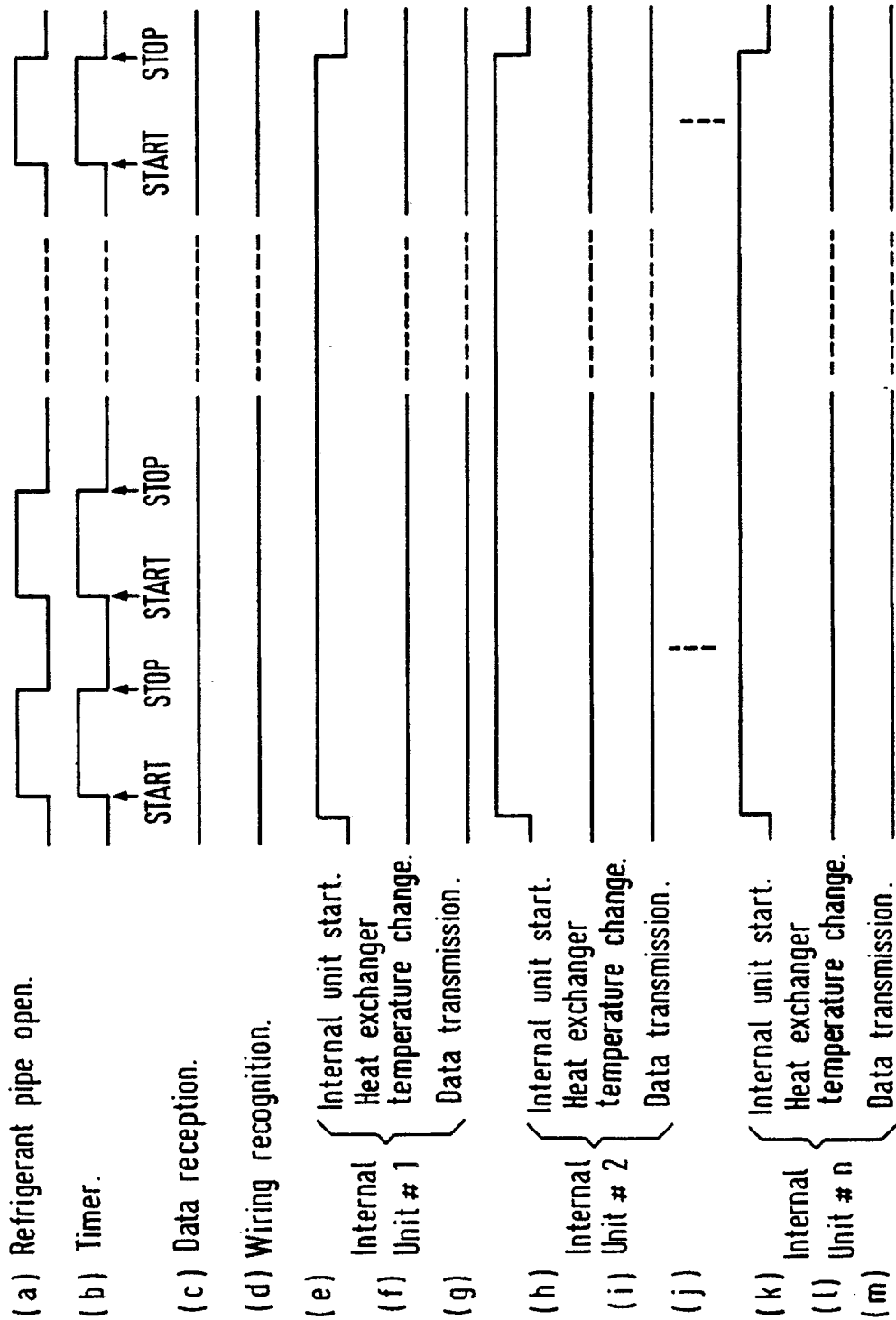
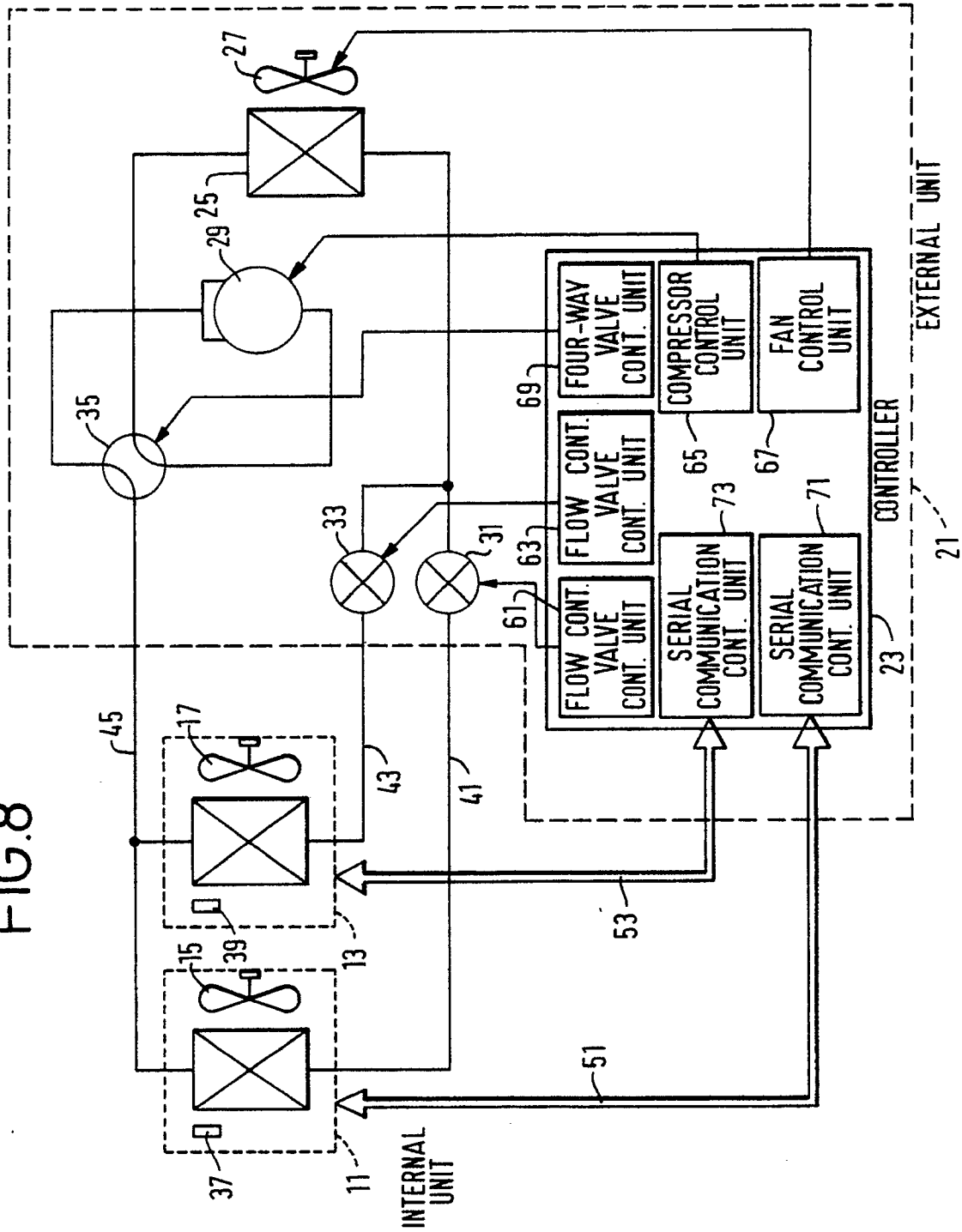


FIG. 8.



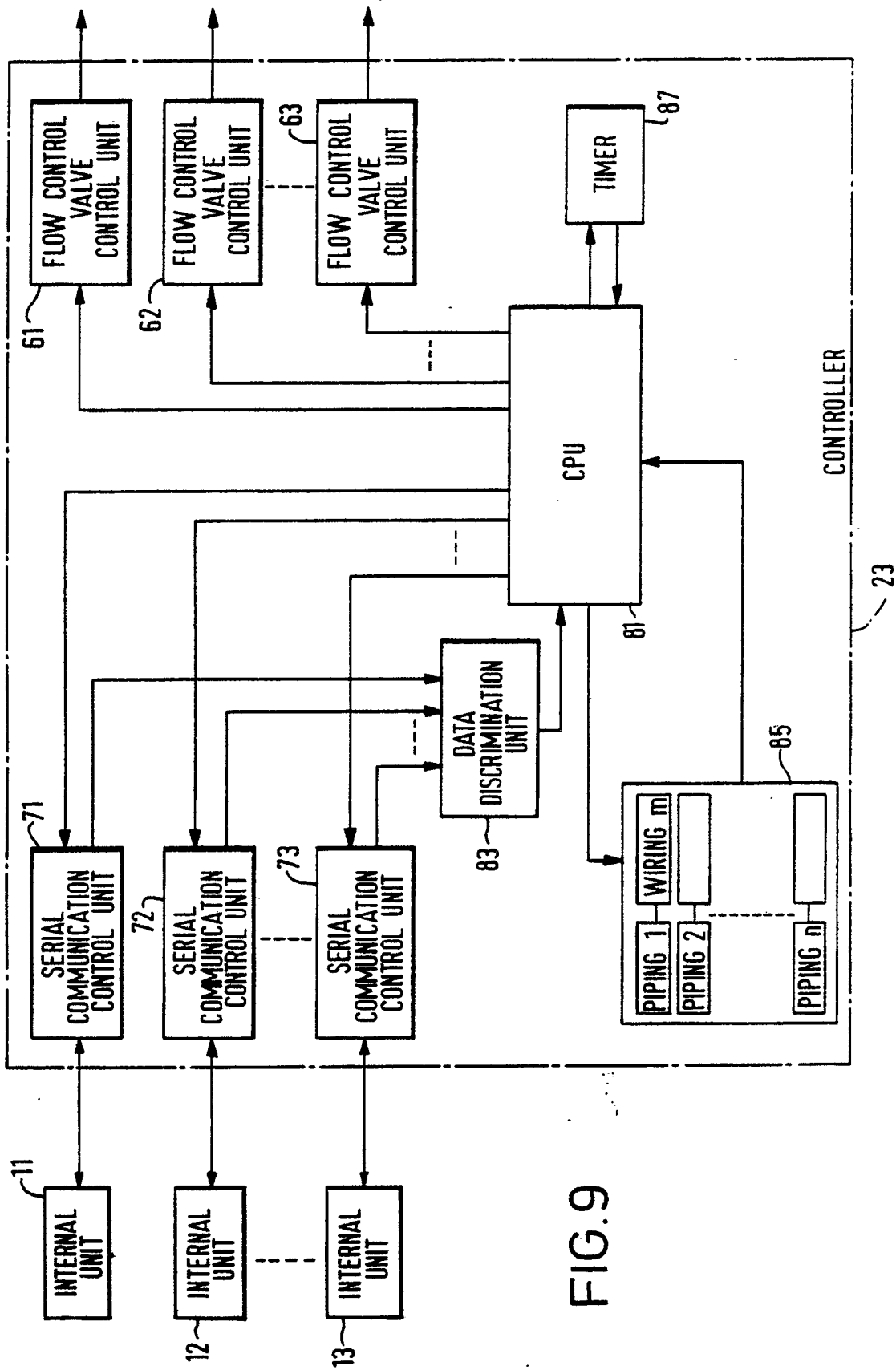


FIG.9

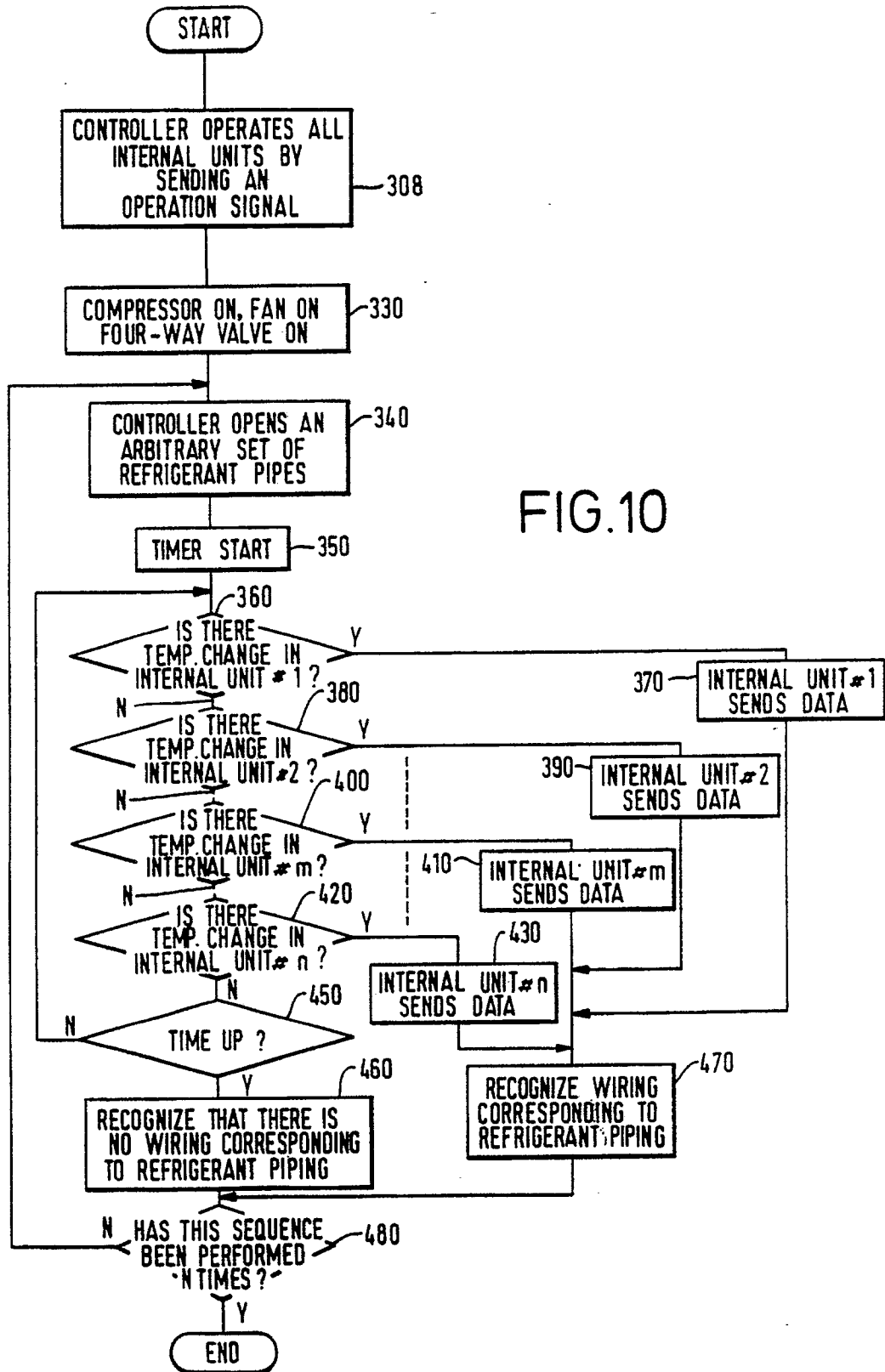
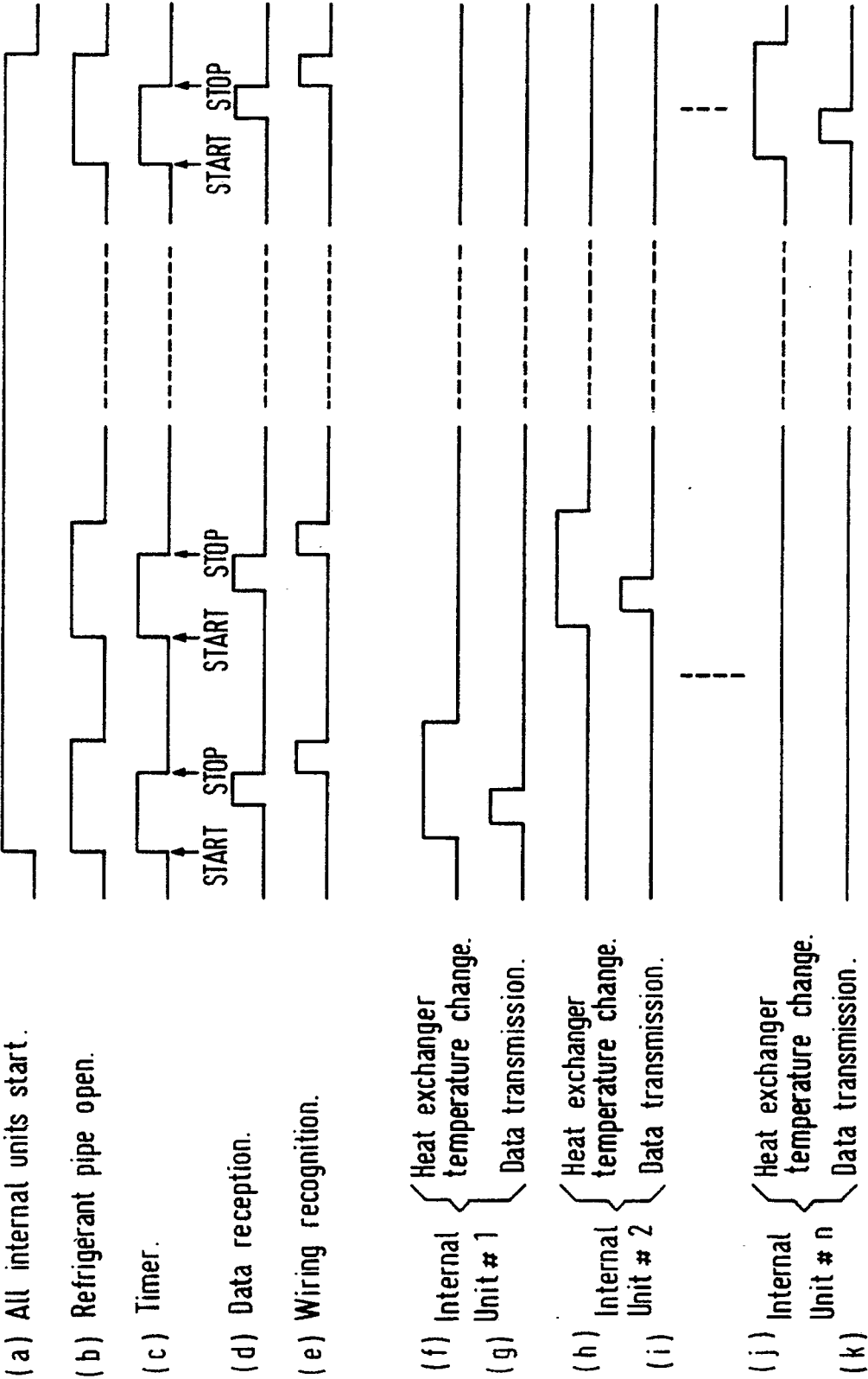


FIG.11



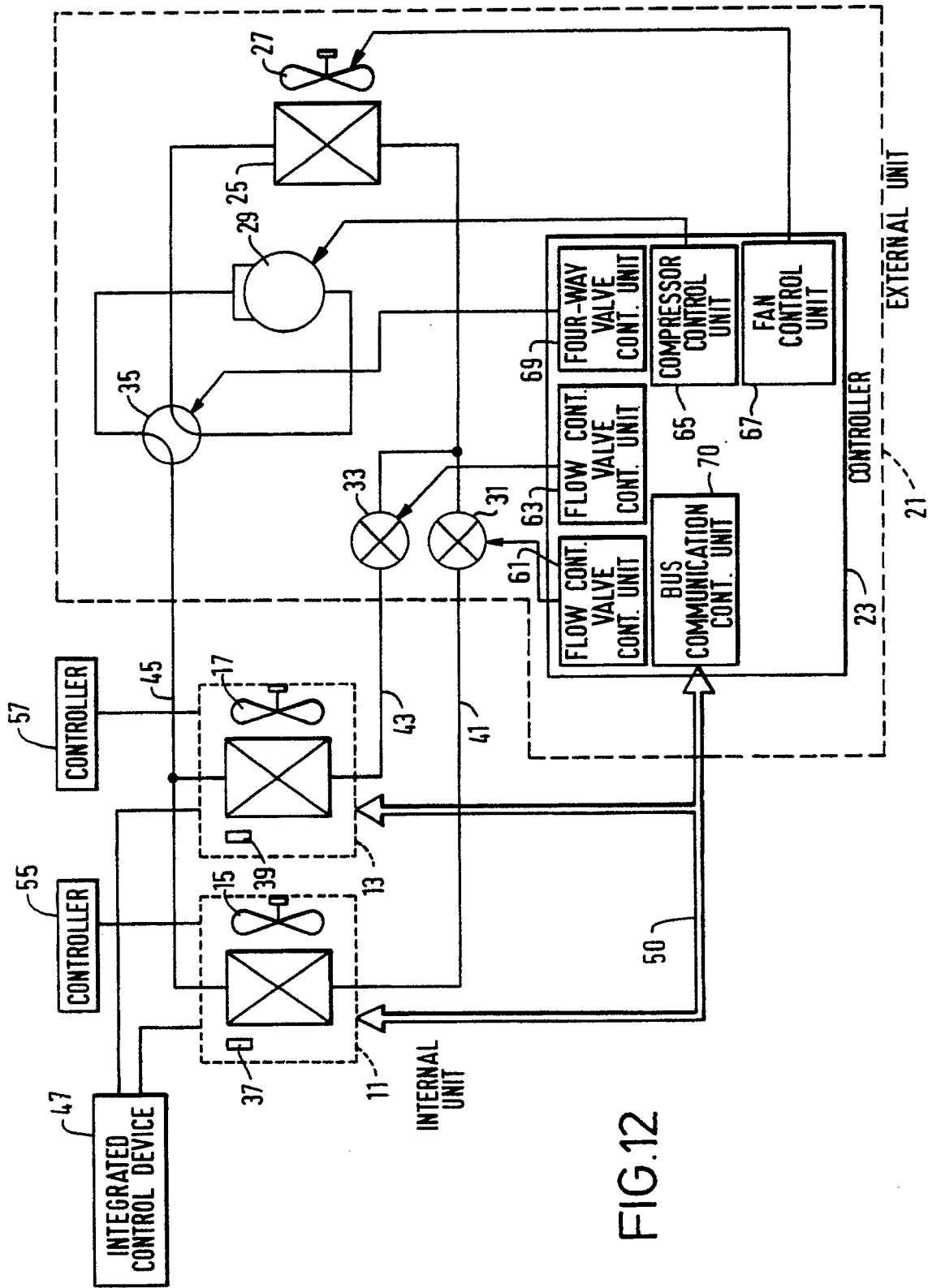


FIG.12

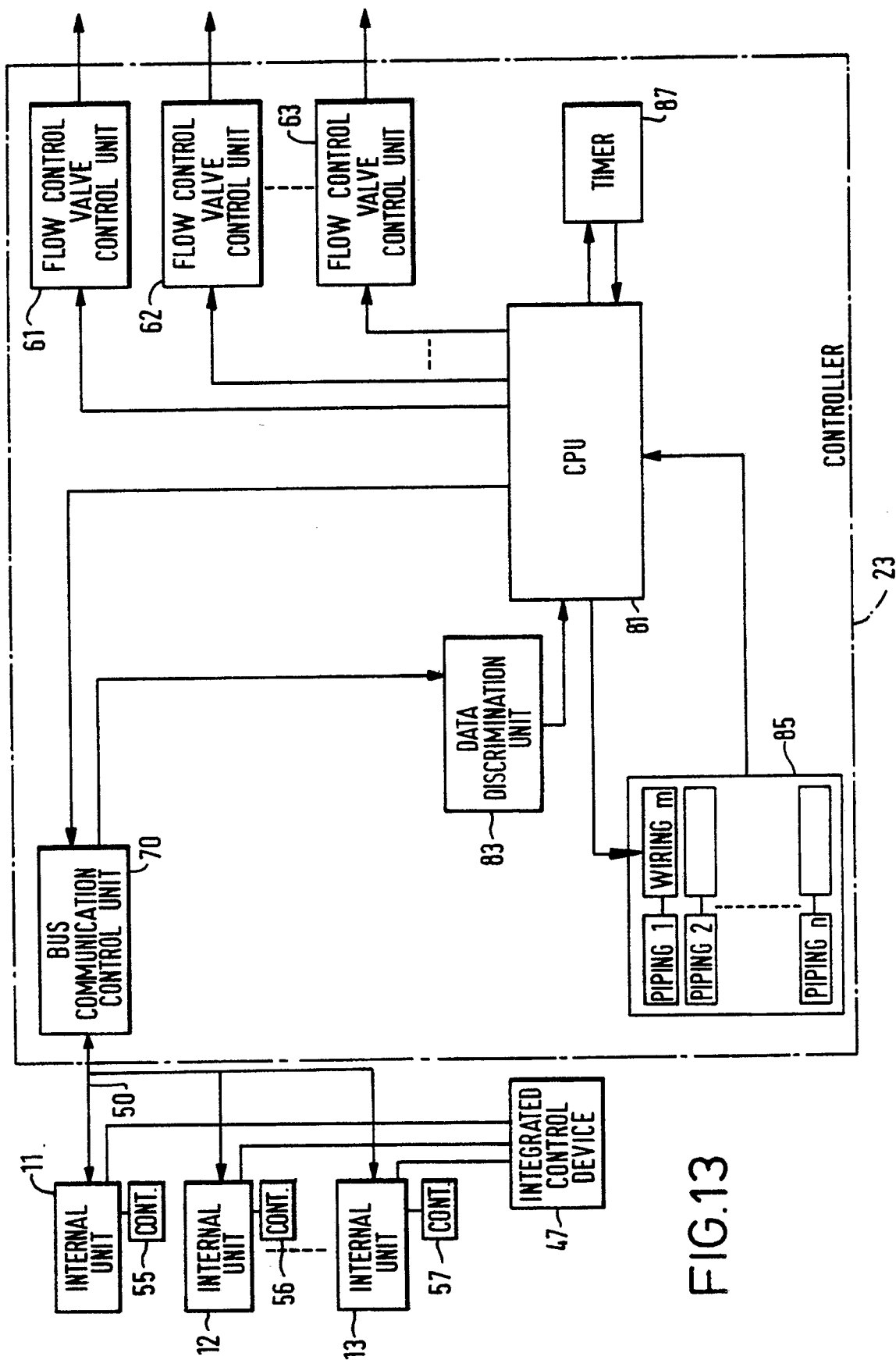


FIG. 13

FIG. 14

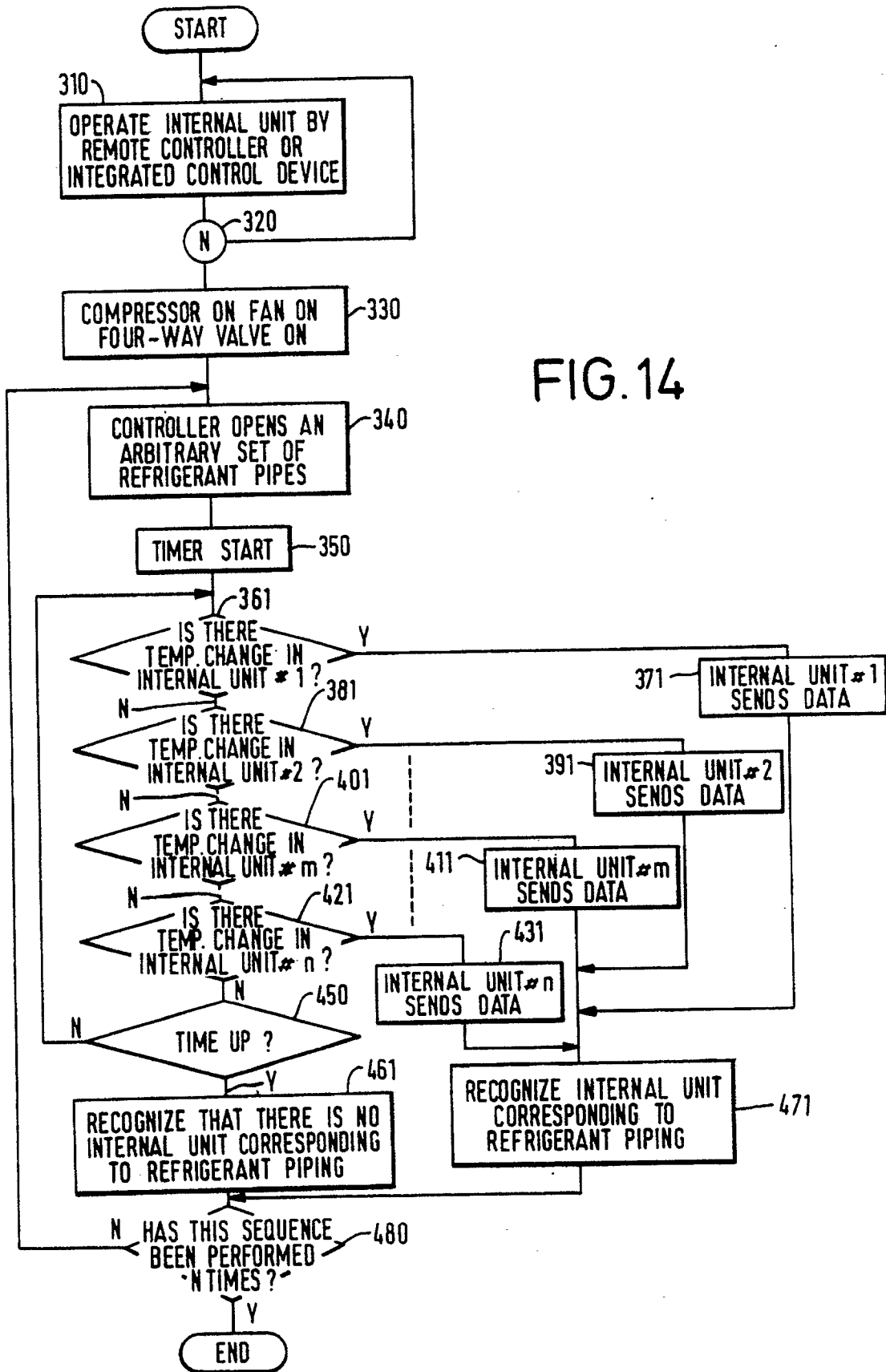
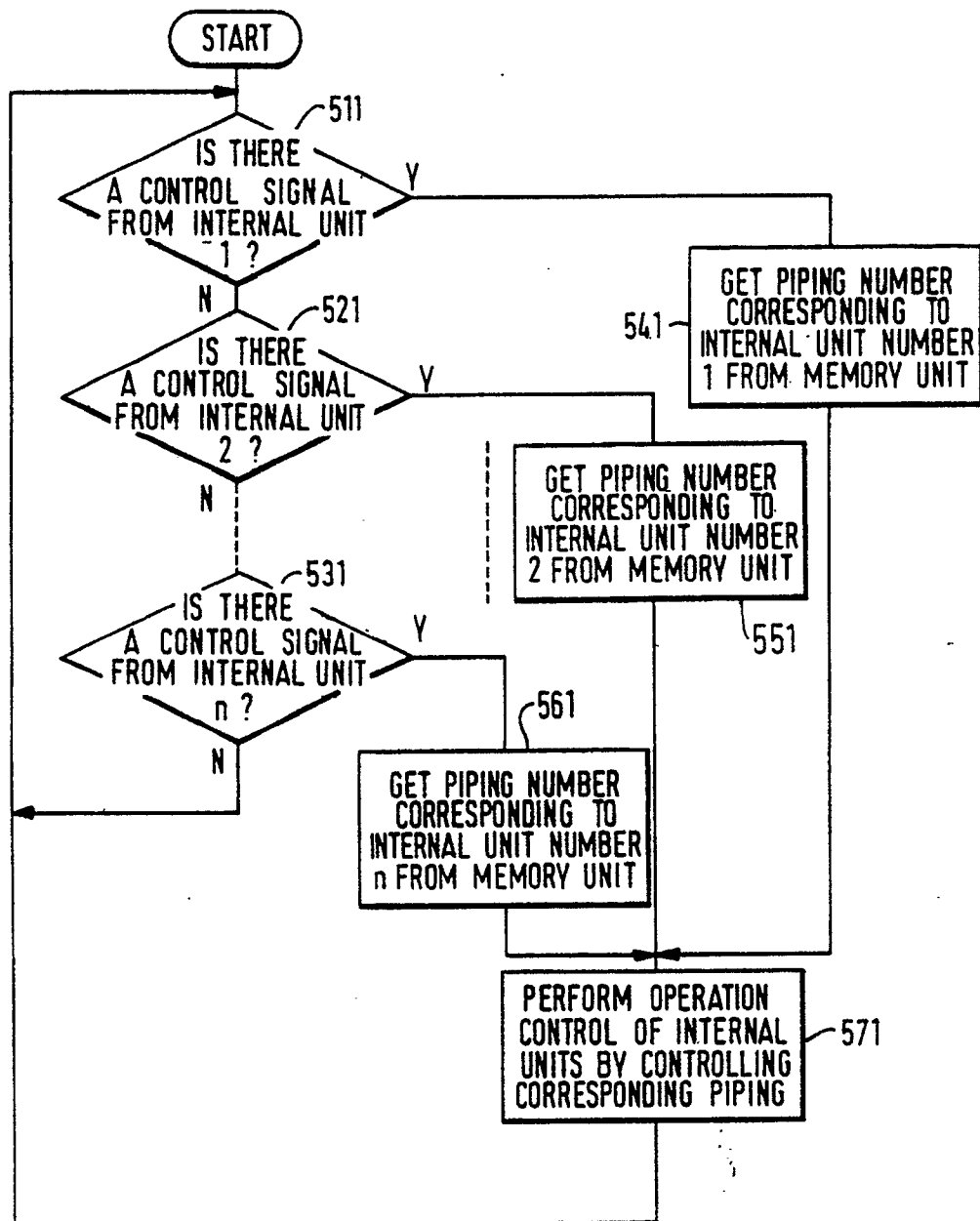


FIG. 15



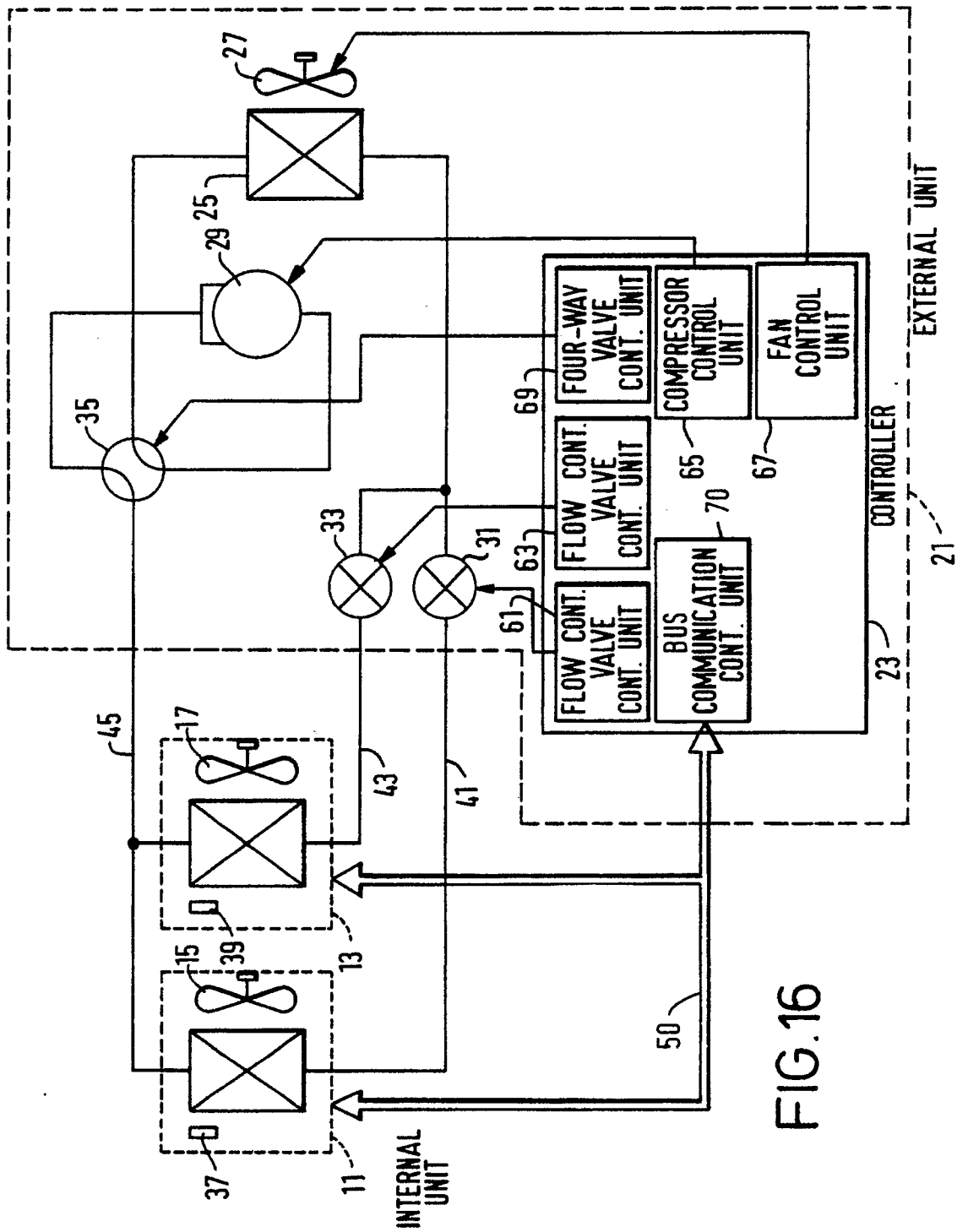


FIG.16

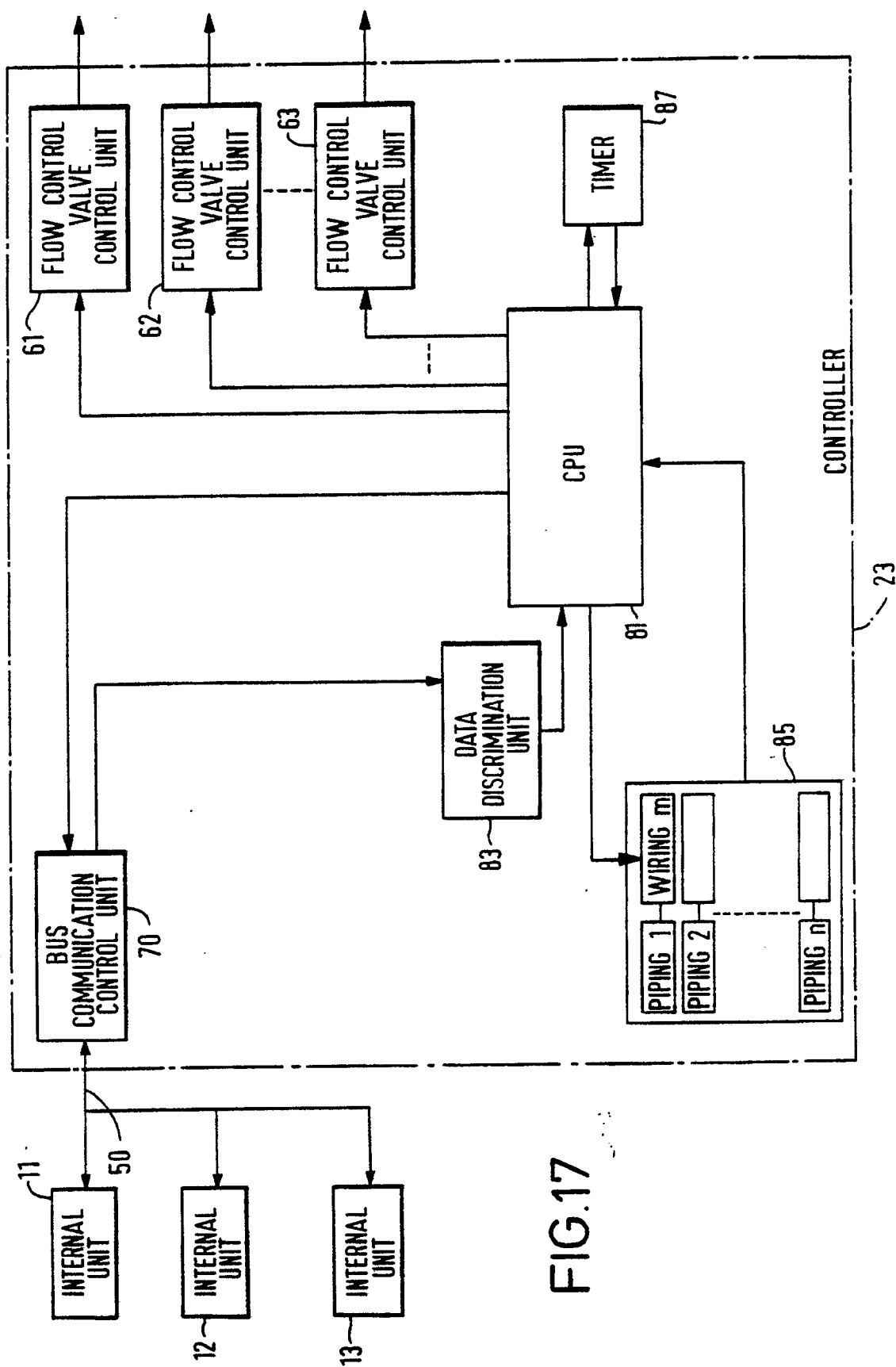


FIG.17

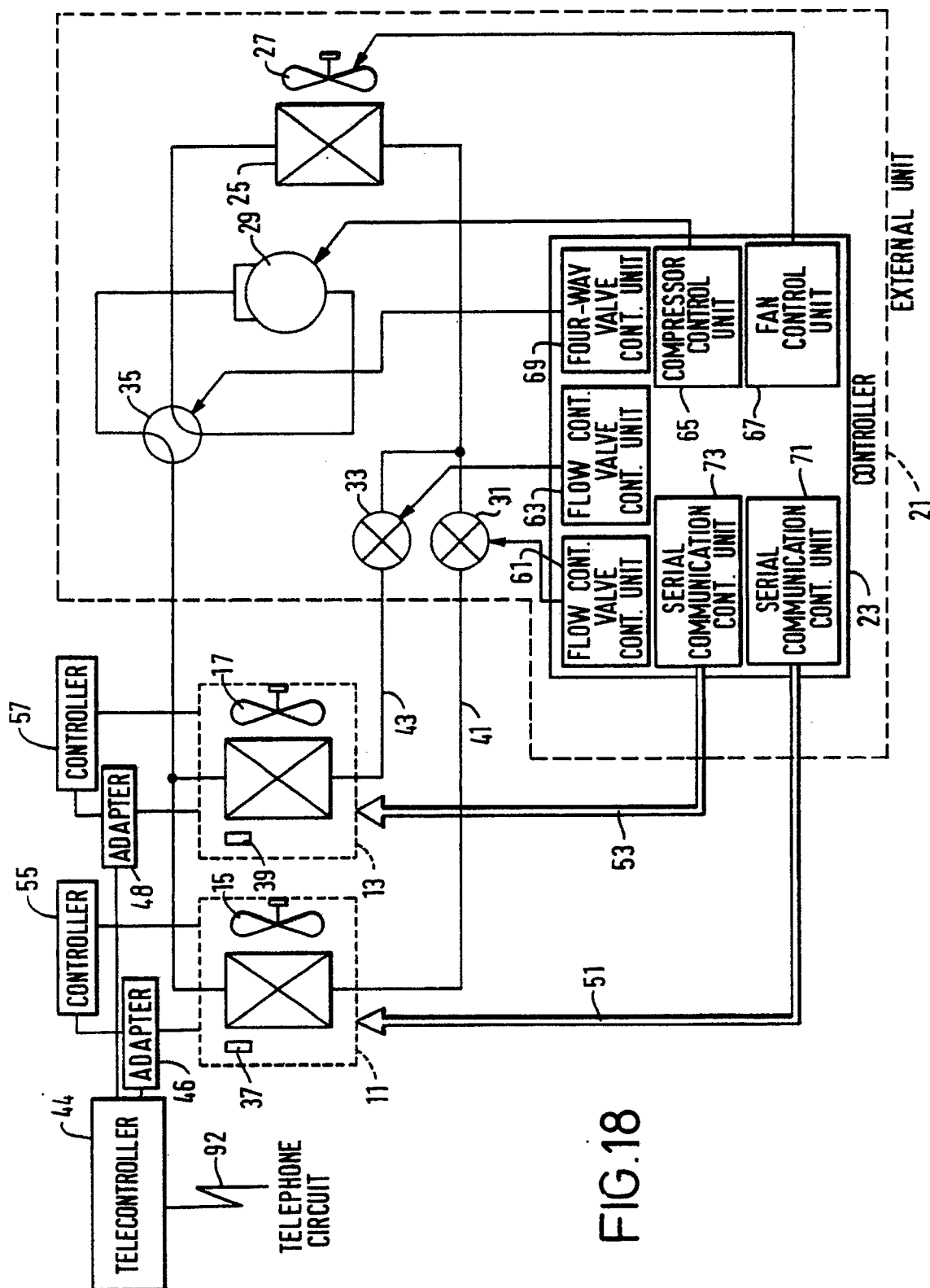


FIG. 18

FIG.19

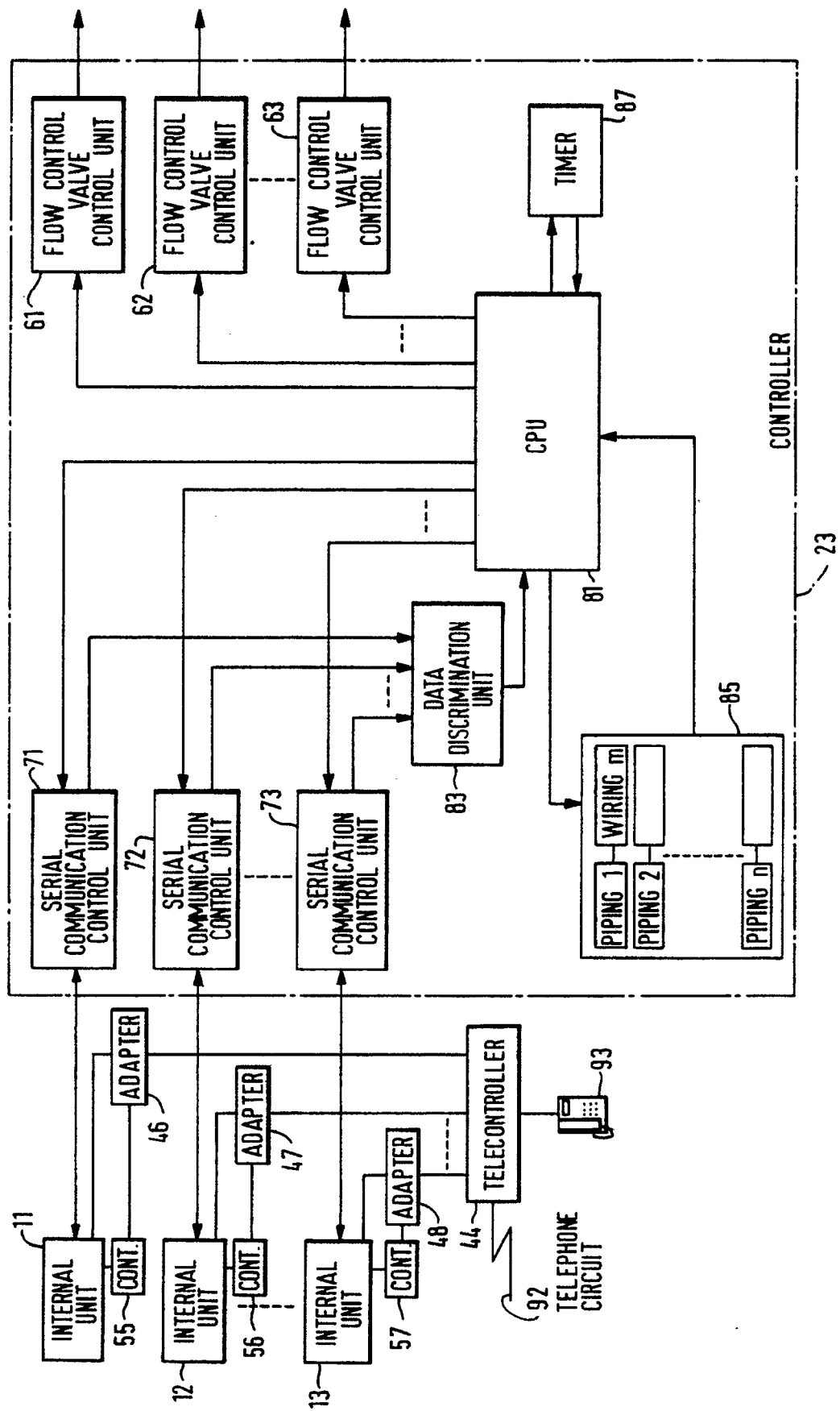


FIG. 20

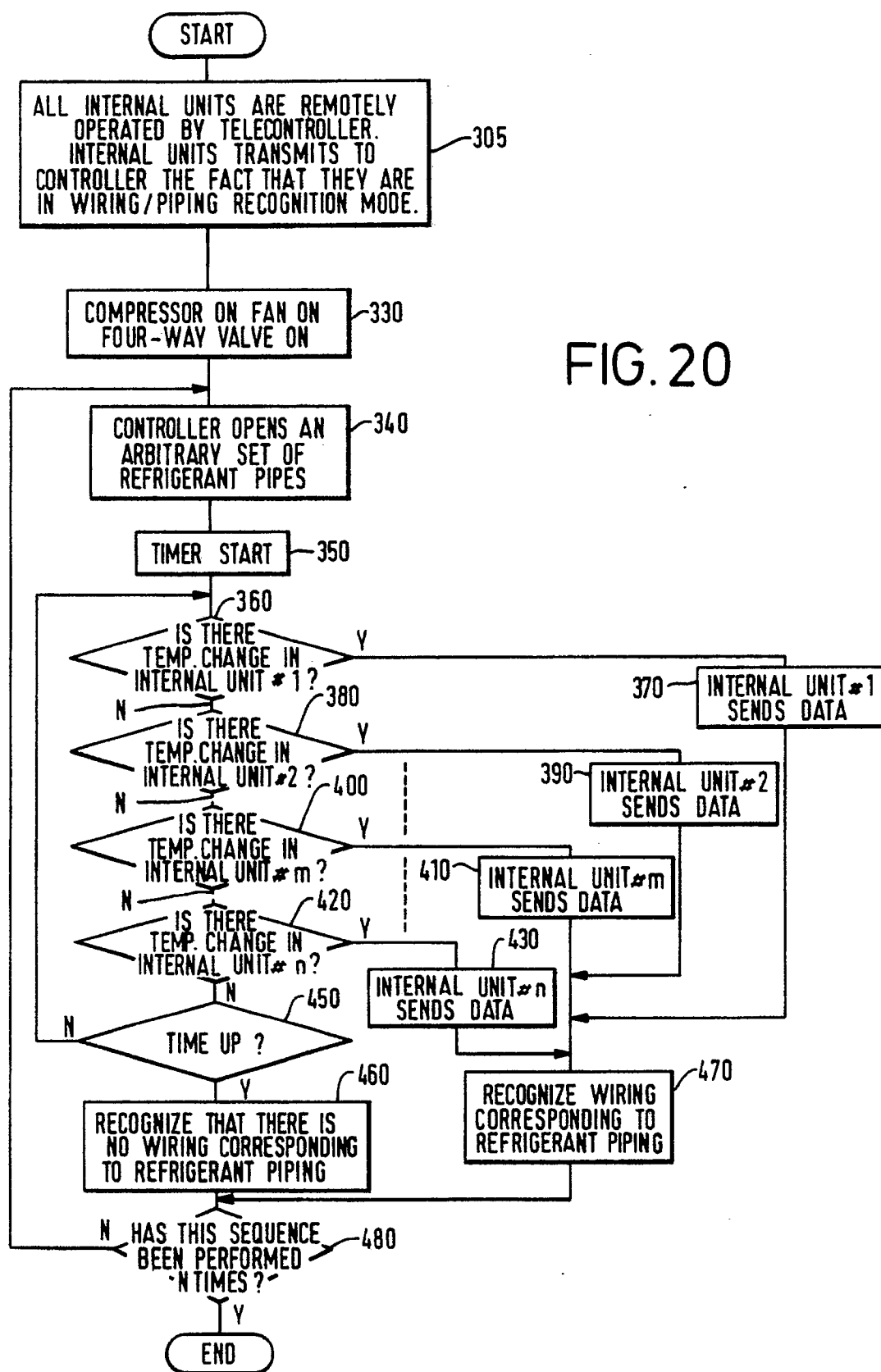


FIG. 21

