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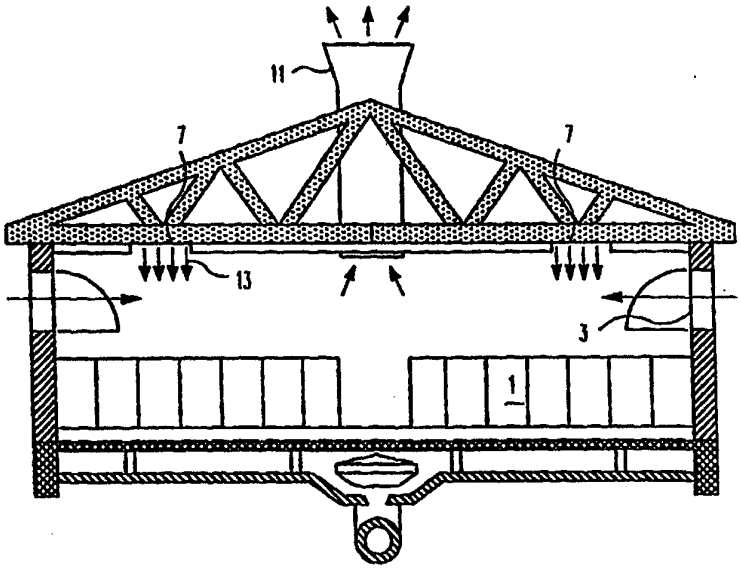
(54) Title: METHOD AND SYSTEM FOR VENTILATION OF A BUILDING



(57) Abstract

In the ventilation of buildings, especially animal stalls, use is made of a method and a system which is characteristic in that it comprises a diffuser element which ensures the intake of fresh air, and an extraction ventilator, in that the diffuser element is placed in areas above the animals and has a horizontal area which is less than or the same as the horizontal area in which the animals are placed, and that also in the building there is placed at least one valve for an additional supply of air, said valve being either closed or open. There is hereby achieved a draught-free ventilation of the stalls, while at the same time the temperatures do not exceed a level which is harmful or dangerous for the animals.

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METHOD AND SYSTEM FOR VENTILATION OF A BUILDING

BACKGROUND OF THE INVENTION

The invention relates to a method for the ventilation of a building with living beings, especially animals and especially a stall, and which comprises a diffuser element which ensures the intake of fresh air, and also an extraction fan. Moreover, the invention relates to a system for the ventilation of a building with living beings, especially animals and especially a stall.

Such a method and such a system are known, and here the number of revolutions carried out by the ventilator is governed by a control system depending on the temperature of the air. With increasing air temperature, the number of revolutions is increased so that a greater amount of fresh air is drawn into the stall by various openings. However, the system is not provided with any security, and in the worst case the animals in the stall can be harmed or die as a result of too high temperatures. Moreover, the ventilation gives rise to draught or temperature levels which are too high.

Methods and systems are also known from other quarters, where a so-called draught station provided with a thermostat-controlled drawbar controls the opening of wall valves along a wall in the stall building. This thermostat thus functions independently and is not suitable for cooperation with an automatic control system if, at high temperature, a high intake of fresh air is desired through the valves instead of through other fresh-air intakes in the stall.

EXPLANATION OF THE INVENTION

The object of the invention is to provide a method whereby it is possible to achieve a draught-free and uniform ventilation, especially in a stall building, while at the same time ensuring that the temperature does not exceed a level which is unpleasant for the animals.

This object is achieved by means of a method as disclosed in the preamble, and also where the diffuser element is placed in areas over the animals and has a horizontal area which is less than or the same as the horizontal area on which the animals are placed, and also that there is placed at least one valve in the building for an additional supply of air, said valve being either open or closed.

By having a diffuser element, for example in the form of apertures in the ceiling or a porous ceiling material, and where this intake is effected exclusively in the area above the animals, a laminar intake of fresh air is ensured, this being mixed with the flow of air in the upward direction which arises as a consequence of the animals' bodily heat. There is hereby ensured a draught-free, pleasant replacement of the air which will not be possible to attain if air in too large amounts is inducted, in that it will not be possible to mix these large amounts with the ascending flow of warm air. In such a case the fresh air will descend like a blanket down over the animals and give rise to draught.

However, the laminar ventilation through the diffuser element is not sufficient to ensure that the temperatures under given conditions cannot unintentionally increase, which is precisely why valves are placed in walls, the ceiling, the floor or other places, and which ensure that the temperature is regulated, in that these are opened when a given temperature is reached.

By using a method according to the invention as disclosed

in claim 2, it is thus achieved that the warm air rising from the animals does not seep up through the diffuser element and thus ruin the ventilation or the building construction.

By using a method according to the invention as disclosed in claim 3, there is achieved an intake and mixing of air which not only ensures optimum and draught-free ventilation, but also an optimum regulation of the temperature.

By using a method according to the invention as disclosed in claim 4, there is achieved a security opening of the valves to avoid temperatures which are too high and harmful. With normal operation, the thermostat - which for example can be connected to a draught station for a series of valves - is exposed to an overtemperature, so that the valves open when the load on the extraction fan is in excess of 60-100% of its maximum. With increasing temperatures, the regulation takes place by the intake of air through the valves, which can be opened more or less, depending on the requirements.

Consequently, great security is achieved for adequate ventilation, in that the valves are opened before harmful temperatures arise in the stall.

The control system is arranged to activate a draught station upon a signal from the thermostat when a limit value for the load on the suction fan is exceeded. A "draught station" in this connection is understood to be the control unit which opens and closes the valves. In addition to the system hereby being capable of being used with the method, there is the advantage that it is possible with simple means to change an existing system with draught station/valves to a combination system as disclosed.

By providing a system comprising a diffuser element for the

intake of fresh air and also an extraction fan, and in that the system also comprises at least one valve which can be opened and closed, and also that the diffuser element is placed above the animals, and that its horizontal area is less than the horizontal area in which the animals are placed, it is possible to establish an optimum ventilation system where on the one hand no draught is generated despite small to large replacements of air, and on the other hand where high temperatures do not arise.

By using a system according to the invention as disclosed in claim 7, a laminar airflow is achieved, which is optimum when it is desired to avoid draught.

With normal operation at low temperatures, for example below 12°C, the fresh air is drawn in only through the diffuser element placed in the ceiling. With increasing temperatures, and herewith increasing load on the ventilator, the wall/ceiling valves are opened, and fresh air at a temperature which does not give rise to draught over and around the animals can now be supplied to the stall.

By configuring the ratio of the area between ceiling and diffuser element as disclosed in claim 8, a suitably large surface for the through-flow of fresh air and herewith sufficiently low airspeed is achieved, without the costs of the building becoming too great.

It is preferred to position heating elements as disclosed in claim 9.

THE DRAWING

An example embodiment for the method and the system according to the invention will now be described in more

detail with reference to the drawing, where

fig. 1 shows a section through a piggery provided with the ventilation system according to the invention at low outside temperature,

fig. 2 shows the same as in fig. 1, but at high outside temperature,

fig. 3 shows the configuration of the control system, and

fig. 4 shows an enlarged detail section of the ceiling in the stall.

DESCRIPTION OF THE EXAMPLE EMBODIMENT

A piggery is provided with sties 1 for the animals, and in the sidewalls or the ceiling there are provided thermostat-controlled valves 3. The ceiling 5 is provided with openings 7 which are covered with textile, porous plates or perforated plates 9 which allow air to pass into the stall from above, and which have been called diffuser elements. The air given off from the stall is sucked out in the normal manner through a series of temperature-controlled and speed-regulated shaft ventilation fans 11 arranged in the stall's loft construction or floor construction.

When the ventilation fans 11 are running, a diffuser will constantly draw a flow of air 13 into the stall through the covering 9. That the flow of air is diffuse means that it it relatively slow and initially laminar.

In the situation shown in fig. 1, where the valves 3 are closed because it is not desired to create a cold draught down over the animals, the airstream 13 meets an upwardly-

rising, warm airstream 15 from the animals. In the situation shown in fig. 1, the outside temperature is low, i.e. between -30°C and +20°C. The cold outside air will therefore be inclined to descend and mix with the air 15 from the animals. There is hereby achieved the intended equalization of the air temperature and a calm change of air when the two airstreams are mixed.

As a consequence of the diffuser element being placed above the animals and allowing an evenly-flowing passage of air, it is ensured that the ventilation does not involve any draught.

The control system for the ventilation system comprises a combined control panel and control unit 17 which, automatically and depending on the temperature inside the stall and the outside temperature measured with a sensor 19, can regulate the speed of rotation of the ventilation fans 11. At the same time, the control panel 17 regulates the degree of ventilation in the ventilators' motors.

From the control unit 17 there is also a supply of power for the activation of a not-shown heating element in gas cylinder 21, or an electrically-controlled draught station which controls the opening of a series of valves 3 along one or more walls or the ceiling of the piggery. Upon an increase in air temperature, the speed of the fans and herewith the load on the motors in the ventilators 11 will be increased, in that all of the air is drawn in through the openings 7 in the ceiling when the valves 3 are closed.

When the control unit registers that the ventilator motors exceed a certain fraction of their maximum load, for example 80% or 90%, the heating element in the gas cylinder or the electrically-controlled draught station 21 is activated. The cylinder in the draught station 21 functions in the same way as known radiator valves with gas/liquid

phase exchange and influences drawbars on the valves 3 so that the valves 3 are opened. Upon activation of the heat source, the opening of the valves 3 takes place at an earlier time than that for which the gas cylinder 21 is normally set. It is preferred that this be configured so that the heat source increases the temperature 3°C in the thermostat 21 above the temperature of the surrounding air. This results in an opening of the valves to the situation as shown in figure 2. A relatively large amount of air will now flow in though the wall valves 3 as a supplement to the airstream 13 from the ceiling. Consequently, the load on the ventilators 11 will fall, but if the temperature increases, the degree to which the valves 3 are opened will naturally be increased.

In the situation shown in fig. 2, there does not occur the same degree of mixing of outside and inside air as that in fig. 1. However, the outside temperature is now so high that a possible flow of air from the valves 3 cannot harm the animals in the sties 1.

If the control unit 17 or the ventilators 11 fail, the valves 3 will still open, but merely at a slightly higher temperature, and the animals will thus receive emergency ventilation at an over-temperature higher than that selected in the control unit at normal operating conditions.

As shown in fig. 4, under the diffuser 9 there can be suspended convection heating elements 25, for example in the form of ribbed pipes, hereby enabling the air flowing in from the loft to be heated during the winter. The positioning can also be on the walls. A suitable registration of the average temperature of the air can be effected by suspending the sensor 19 down from the ceiling in a selected area. This area will be that place where possibly heated fresh air will be mixed with the warm air

arising from the animals, and the air in the area will thus have an appropriate average temperature which is suitable for use for the regulation of the ventilation.

The invention makes it possible to achieve the combined advantages of diffuse fresh-air intake through the loft and the valves, and a security for the ventilation of the stall in the event of failure of the electronic control system.

The method and the system according to the invention can naturally also be used for the ventilation of buildings other than stalls, for example cowhouses and poultry sheds. Use can also be envisaged for lecture halls and the like where many people are assembled and at certain predefined places.

C L A I M S

1. Method for the ventilation of a building with living beings, especially animals and especially a stall, and which comprises at least one diffuser element (9,13) which ensures the intake of fresh air, and also at least one extraction ventilator (11), **c h a r a c t e r i z e d** in that the diffuser element (9,13) is placed in areas above the animals and has a horizontal area which is less than or the same as the horizontal area on which the animals are placed, and also that in the building there is placed at least one valve (3) which can be regulated for the additional supply of air, said valve (3) being either closed or open.

2. Method according to claim 1, **c h a r a c t e r i z e d** in that the permeability of air through the diffuser element (9,13) and the horizontal extent of said diffuser is dimensioned so that an underpressure of at least 1 pascal arises in the building when the valves (3) are closed and the extraction ventilator (1) is active and reaches its minimum level of performance.

3. Method according to claims 1-2, **c h a r a c t e r i z e d** in that the flow of air from the valves crosses the flow of air stemming from the animals.

4. Method according to any of the foregoing claims, **c h a r a c t e r i z e d** in that the opening of the valves (3) is controlled by a thermostat which is set at an upper limit value, said thermostat being activated by the temperature level in the stall, and a draught station is activated when the extraction ventilator reaches a given level of load, so that the temperature registered by the thermostat exceeds the upper limit value.

5. Method according to any of the foregoing claims, **c h a -**

r a c t e r i z e d in that the draught station is controlled by the sensor's registered temperature at a variable level above the air temperature, preferably 0-10^{0}.

6. System for the ventilation of a building with living beings, especially animals and especially a stall, said system comprising a diffuser element (9,13) for the intake of fresh air and at least one extraction ventilator (11), **c h a r a c t e r i z e d** in that the system also comprises at least one closing/opening valve (3) which can be regulated, and a diffuser element which is placed above the animals and has a horizontal area which is less than or the same as the horizontal area as that in which the animals are placed.

7. System according to claim 6, **c h a r a c t e r i z e d** in that the diffuser element (9,13) is placed in the ceiling of the building and consists of one or more plane extended elements arranged in an opening in the ceiling or as a channel under the ceiling.

8. System according to claims 6-7, **c h a r a c t e - r i z e d** in that the ratio between the total area of the diffuser element or elements and the inside ceiling area of the stall is between 0.1 and 0.95.

9. System according to claims 6-8, **c h a r a c t e - r i z e d** in that elements for convection heating are mounted under the diffuser element or on the walls.

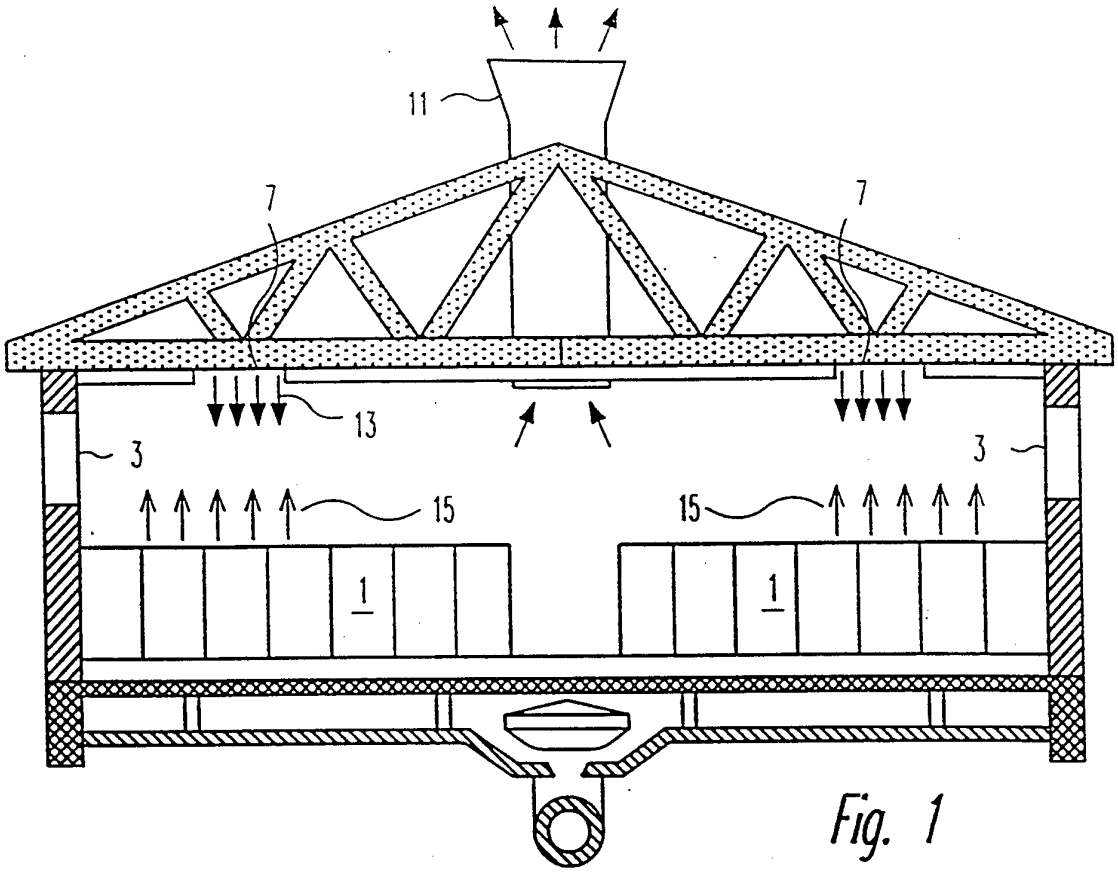

Fig. 1

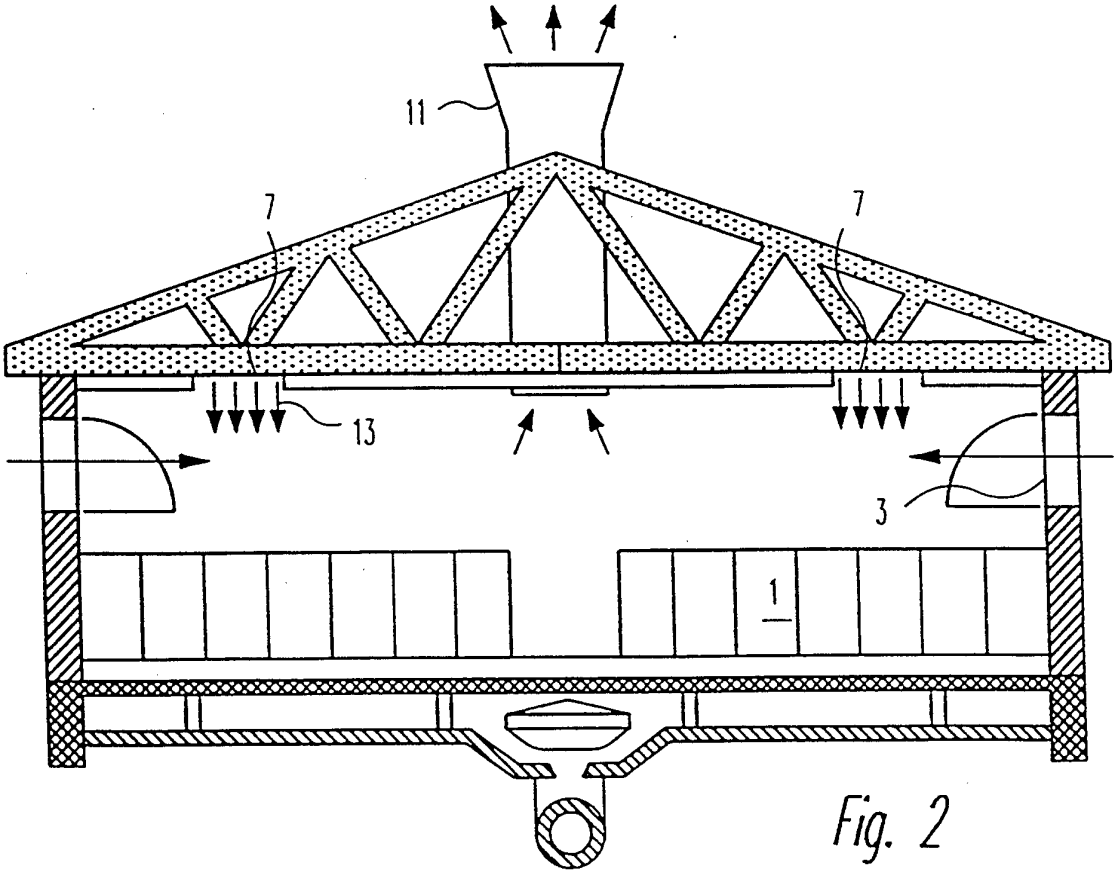

Fig. 2

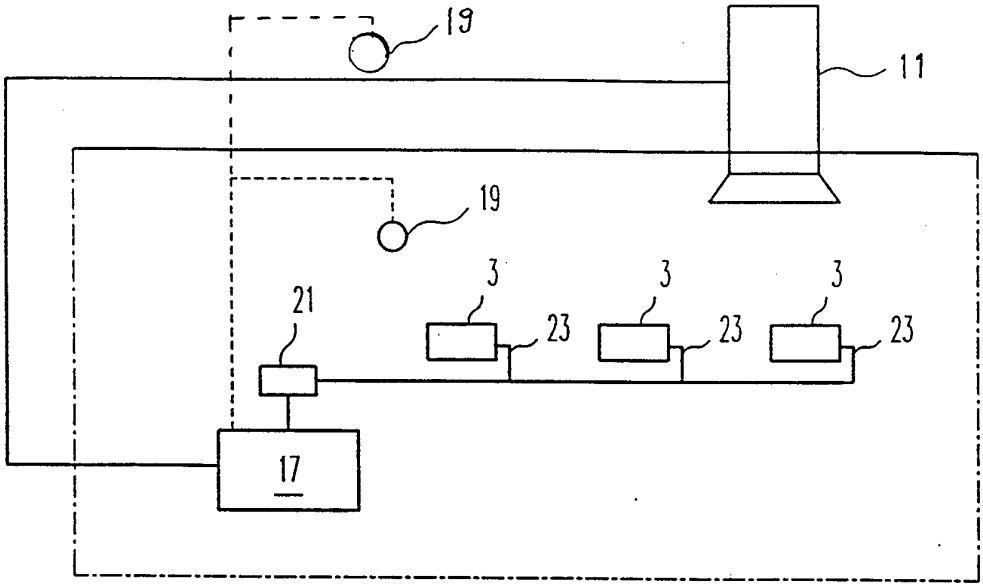

Fig. 3

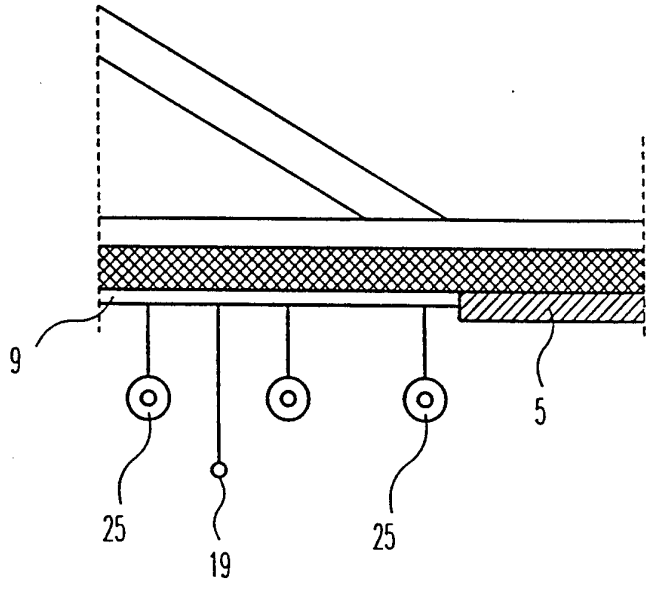

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 96/00245

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A01K 1/00, F24F 7/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A01K, F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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WPAT, CLAIMS, JAPIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2161688 A (C.A. KNOCK), 22 January 1986 (22.01.86), figure 1, abstract ---	1,6
A	EP 0171117 A1 (SMULDERS, A.H.J.), 12 February 1986 (12.02.86), figure 1, abstract ---	1,6
A	US 4151811 A (A. TRUHAN), 1 May 1979 (01.05.79), figure 1, abstract --- ---	1,6

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 2161688	22/01/86	NONE	
EP-A1- 0171117	12/02/86	SE-T3- 0171117	
		DE-A- 3560805	03/12/87
		EP-A- 0173374	05/03/86
		NL-A- 8402389	17/02/86
		NL-A- 8403082	17/02/86
US-A- 4151811	01/05/79	NONE	