AUTOMATIC COW IDENTIFICATION RECORDING MILK-YIELD AND FEEDING CONCENTRATE

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INTRODUCTION

In the Netherlands the number of cows per farm increases steadily. Although the number of cows per herd is increasing (1970-16, 1974-21), the process of growth is characterized by the large increase in the number of farms with about 100 milking cows.
On the larger dairy farms there are many problems connected with management. For good management it is necessary to have sufficient data about each cow. The milk production of the animals provides the farmer with the most important information for feeding and profitable breeding. He can then decide which animals have to be culled. To obtain this information the milker must identify each cow and feed the correct ration of concentrate. On smaller farms the cowman will recognize his cows during milking and he has time to adjust the feeders. On large farms, especially when milking is done by several milkers, the identification of the animals is difficult.
There are some methods for marking the cows such as ear tabs, plastic collars and freeze branding. But then the combination of the number of the cow and the amount of concentrate that each animal needs in the milking parlour will cause the milker much mental stress and the possibility of error will increase.
When automatic systems are used for feeding and for recording milk yield, a fully automatic cow identification system will make the task for the milker much easier, the rationing of the concentrate will be much better and more data about the cows will be available.

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AUTOMATIC INDENTIFICATION SYSTEM

The system which is described here, was developed by the Institute of Agricultural Engineering (IMAG) together with the Technical and Physical Engineering Research Service (TFDL).
In other countries such as England and the USA people are working to make cow identification systems praticable (1, 2 and 3). With the system developed in the Netherlands, the cows wear a transmitter which is attached to a collar around their necks (Fig. 1).
When the system was developed, it was decided that the number of the animal should be displayed in the milking parlour, where a receiver is installed under each manger (Fig. 2).
From experience with an automatic concentrate feeding system, use is also made of an electromagnetic energy transmission (4).
As soon as the transmitter comes in front of the receiver, the transmitter is activated and the number of the cow is transmitted.
In practice when the cow puts her head in the manger, the transmitter is near enough to the receiver (Fig. 2). A cow identification system was installed on the research farm "De Vijf Roeden" at Duiven at the end of 1974 in a double four herring-bone milking parlour.
When the animals enter the milking parlour, and the entrance door is still open at one side, the system is blocked for that side.
In this way when the cow puts her head in a manger, and then goes to the next manger the number is not picked up at the wrong place. When all animals are in their places at one side of the milking parlour, and the entrance door is closed, the system is released. As soon as the transmitter comes near the receiver, the number is picked up and made visible on a row of displays in the milking parlour (Fig. 3).
At the same time the cow number is passed on to an automatic concentrate feeding system and the number is recorded together with the milk yield of the cow on a magnetic tape recorder.
When the animals on one side leave the milking parlour the displays on that side are reset to zero.

TECHNICAL DESIGN OF THE COW IDENTIFICATION SYSTEM

The cow indentification system occupies the central position in the automation of the process in the milking parlour (Fig. 8).
The number of the cow is passed on by the transmitter and the receiver via amplifiers and filters to the other equipment (Fig. 5).
The transmitter is passive, i.e. no batteries are used.
For the energy transmission the transmitter circuit is supplied by

electromagnetic energy which is radiated by the receiver at the manger.

When the transmitter is activated in this way, the transmitter starts to transmit the cow number, according to a digital Pulse Code Modulation principle (PCM). To ensure that the right number is received, the receiver asks the transmitter 9 times to transmit the number. The numbers are registered in two shift registers and are compared each time in a special comparison circuit.

Every time both the shift registers have the same code, the counter is increased by one by the comparison circuit, the number in the second shift register disappears, the number from the first shift register shifts to the second register and the new number received enters the first shift register.

If, for instance through interference, a wrong number is received, which is not the same as the number in the second shift register, the counter immediately is reset to zero and the system asks again 9 times for the cow number.

This process works with electronic speed and takes 0.04 sec.

When the counter is filled up to 9, the receiver and the shift registers are locked. The shift registers now act as the memory for the cow number in binaryform.

A signal is sent to the other equipment via the positive leads. The position of the cow with that number is also known then. The cow number as a binary number is converted to different codes which are suitable for the other equipment. These codes are used for displaying the cow number for recoding the cow number and for controlling the programmable feeding unit through which the cow will receive its programmed amount of feed at its current position. As the pulse code of the number is built up from a pulse train of 8 bits, which are present or not present, this system can transfer 2^8 = 256 cow numbers.

AUTOMATIC CONCENTRATE FEEDING IN THE MILKING PARLOUR

When the cow number is picked up and the ready signal is there, this number is transmitted via an interface to a programmable feed box (Fig. 4). In this feed box, manufactured by Hunday Electronics at Belsay in England, the amount of concentrate required for 1000 animals can be programmed.

When the cow number is available there is a start signal from the central unit of the identification system to read off the displays. Via the feed box the right amount of concentrate arrives in the manger at the right place (Fig. 6). The amount of concentrate that is programmed in the feed box can be changed for every cow

very easily by a keyboard in the feed box.

RECORDING OF MILK YIELD IN THE HERRING-BONE MILKING PARLOUR

The cow number, which has been detected by the identification system, is also recorded together with the milk yield of that cow. In the milking parlour the milk is collected in containers, which are suspended from cantilever beams, provided with strain gauges (Fig. 7). When the animals on one side have been milked, and the front door at that side has been opened, the cow number, the stand and the milk yield are recorded on a printer and a tape recorder (Figs. 8 and 9). The magnetic tape is read off by a computer. In the memory of this computer are the data from each animal as days in lactation, age, average milk production, total milk production so far, etc. From these data and the values on the magnetic tapes, the new data are calculated for the next period. The amount of concentrate which is calculated for each animal can be programmed in the memory of the feed box.

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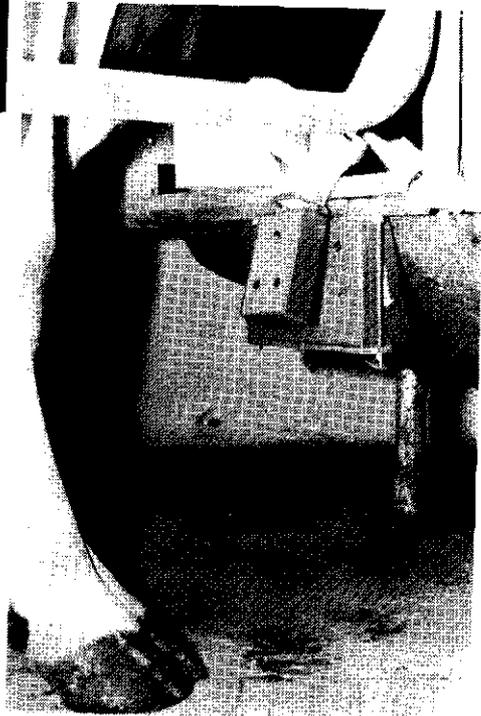
Fig. 1   Cow with transmitter
for identification.

Fig. 2   Transmitter near re-
ceiver at the manger.

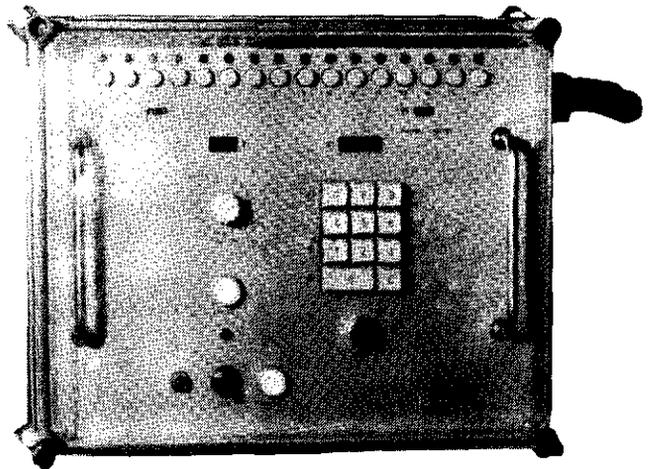Fig. 3   Displays with cow numbers in milking parlour.
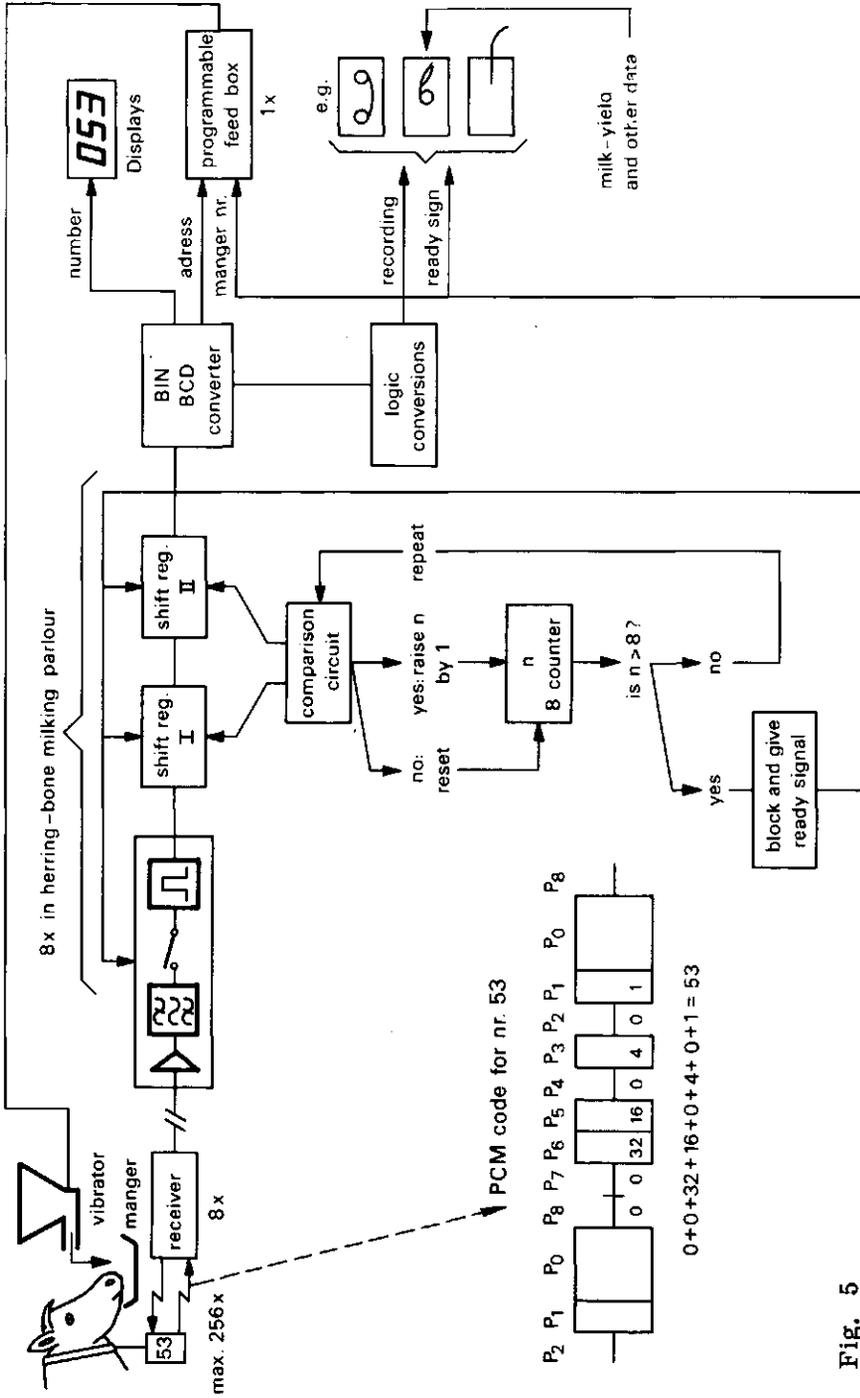

Fig. 4   Programmable feed box.

8 x in herring-bone milking parlour

vibrator
manger
receiver
8 x
53
max. 256 x

shift reg. I
shift reg. II

BIN BCD converter

logic conversions

comparison circuit

yes: raise n by 1

no: reset

n 8 counter

is n > 8 ?

repeat

no

yes

block and give ready signal

number
Displays
adress
manger nr.

programmable feed box
1 x

recording
ready sign

e.g.

milk-yield and other data

PCM code for nr. 53

P₂ P₁ P₀ P₈ P₇ P₆ P₅ P₄ P₃ P₂ P₁ P₀ P₈

0 0 32 16 0 4 0 1

0+0+32+16+0+4+0+1 = 53

Fig. 5

Block diagram of the cow identification system.

Fig. 6

Diagram of the
concentrate feeding system.

concentrate feeder

feedbox

transmitter and
receiver

central control
unit
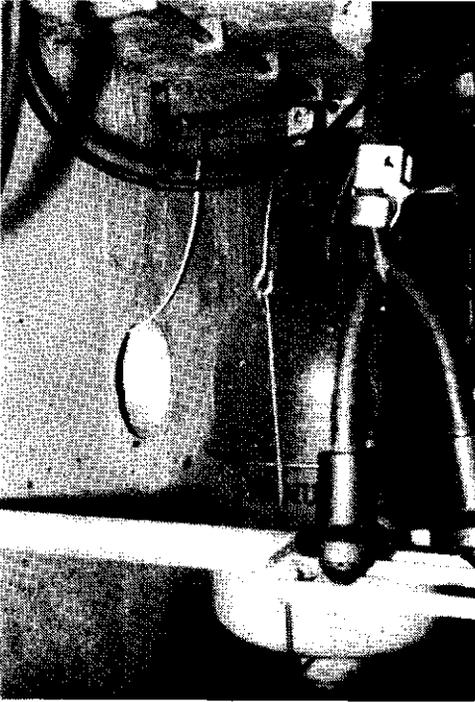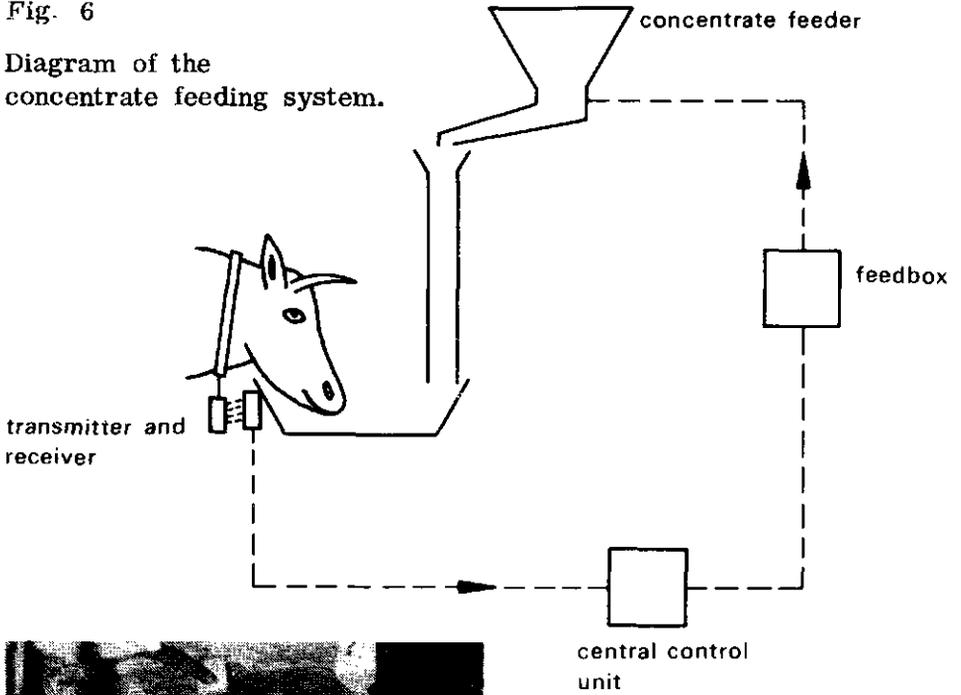
Fig. 7

Container suspended from a
cantilever beam for
weighing the milk yield
in the herring-bone milking
parlour.

amount of
concentrate
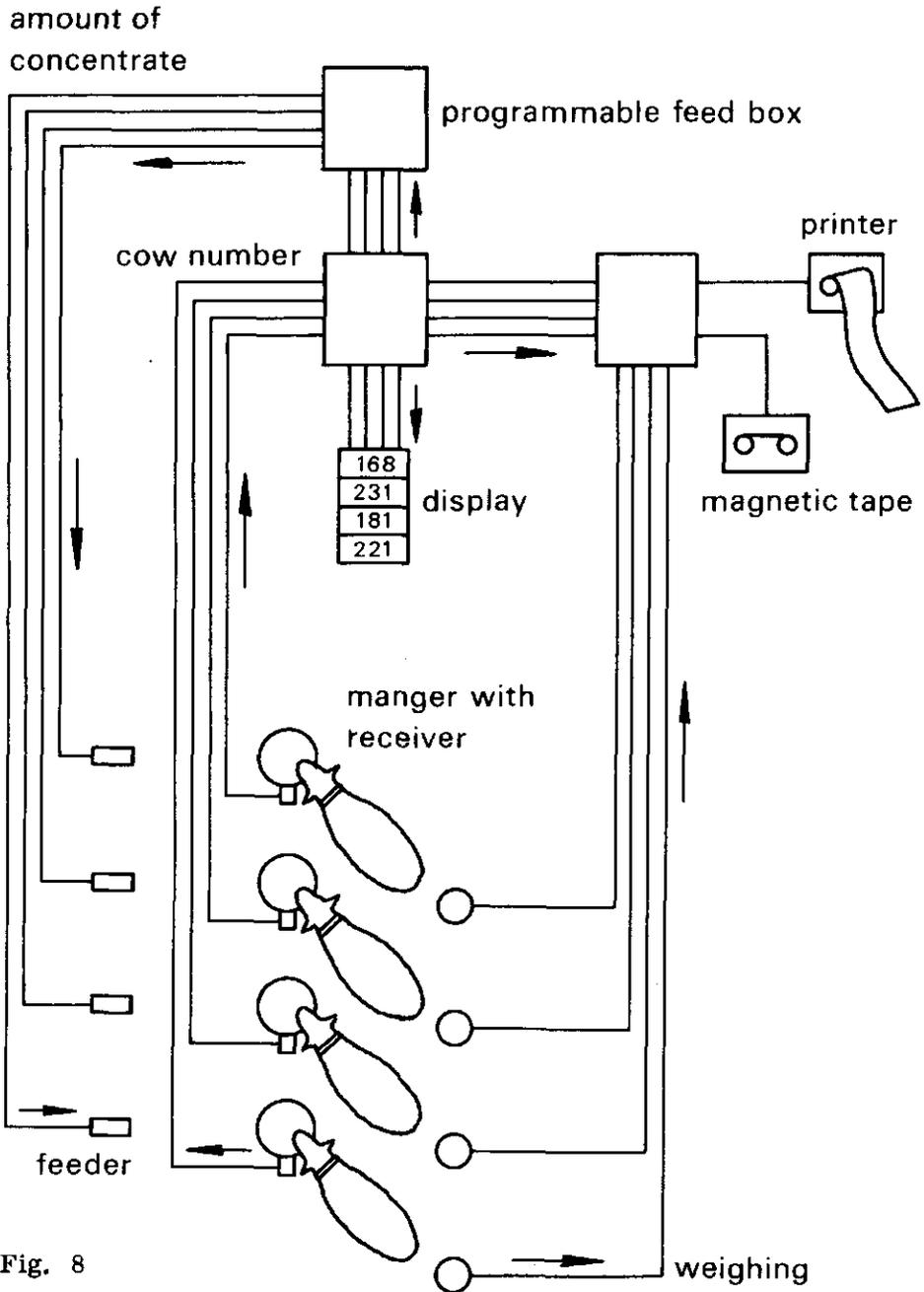
programmable feed box

printer

cow number

168
231 display
181
221

magnetic tape

manger with
receiver

feeder

Fig. 8

Diagram of the cow identification system
in combination with the milk yield recor-
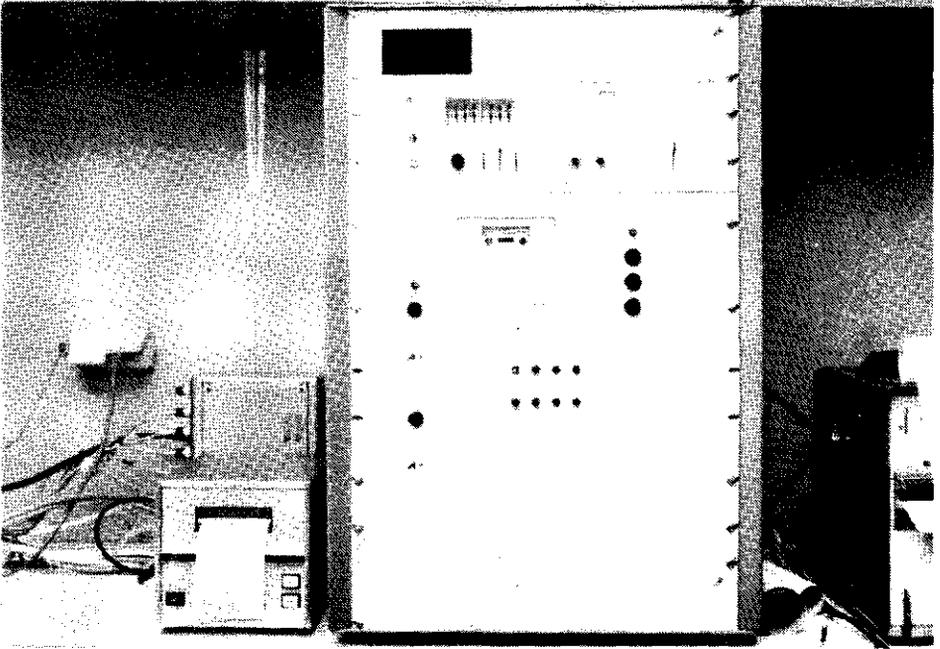ding and the feeding system.

weighing
containers

Fig. 9   Recording system
with printer and
magnetic tape re-
corder.