"HOW TO IMPROVE THE PERFORMANCE AND OUTPUT OF YOUR TILTING PAN FILTER, INCORPORATING PROVEN DEVELOPMENTS FROM BIRD/PRAYON"

BY

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INTRODUCTION

Times are improving for the fertilizer industry. Acid demand and prices are up. Fertilizer company response to this trend is focusing more on plant debottlenecking than on new plants.

Bird and Prayon have developed new designs for filter components that are retrofittable to existing filters. Pan, valve, and turnover design have all improved.

This paper summarizes how each design improvement increases filter capacity. Please contact Bird or Prayon if you have questions or need more information.

PAN DESIGN

The Bird-Prayon Filter is a basically circular filter. Only part of the circle is used for filtration or the production of P205. This is the part under vacuum. Traditionally, the inactive part of the filter was considered the continuous non-vacuum sections of cake discharge, cloth washing, cell dry and feed.

Bird is now looking at the clearances between adjacent pans, and between pans and splash guards as inactive area. Using a Computer Aided Design (C.A.D) system, we now know the original clearances were conservative and can be safely reduced. Quite literally the length and width of a pan have been increased but still kept within the confines of all other existing filter components. The positive end result is that more active area can be built into an individual pan. By active area, Bird means exposed filter cloth area inside the caulking at the filter cloth elevation. Production increases are directly proportional to this area gain.

Pans of the new design are interchangeable with existing flat and sloped bottom pans.

In addition to increasing pan width and length the pan's cloth caulking system has also been improved. The original, triangular shaped rubber has been replaced by two thin flat pieces. The filter cloth is literally sandwiched between two pieces of rubber and held against the side wall of the pan. This design extends less into the pan and thus more area is available for filtration. A second benefit is that the design seals better and is quicker and easier to install. Its only drawback is that it requires a prepunching of the filter cloth. This prepunching can be done while the filter is in operation. Installation savings is 5-10 minutes/pan. This design is in operation on a 30D filter on hemihydrate and a 24D filter on dihydrate.

Combining the new larger pan and improved caulking, area or production capacity increases by 5%-10%.

A third improvement to pan design is called "Fast Drain". Virtually all users are aware of the sloped bottom pan and its benefits. Two 5° slopes accelerate filtrate to the center trough. Filtrate flow is perpendicular to the trough. In the fast drain design a third 5° slope is built into the pan's outboard end. This extra slope is essentially parallel to the trough. Its purpose is to increase filtrate drainage rate and decrease the distance to the center trough. The end result is a shorter reporting time to the valve. Being on the outboard end of the pan, the majority of

Pan Design (cont'd)

filtrate passes across this slope. The benefits of this design are expected to be lower dilution, better separation of product and wash filtrates, and better recovery because less filtrate is left in the pan at turnover. All of these benefits are expected to be maintained at fast filter speeds. To be discussed later is faster filter speed capability. A full-sized 24-60 (24C) pan is currently on test at Prayon's Plant in Engis, Belgium. Test data will be provided by the time of this papers presentation.

VALVE DESIGN

Many existing Bird-Prayon filters were sold for production rates of 0.5-0.6 TPD P205/Ft^2. Now these same filters produce 1.0 and higher TPD P205/Ft^2. At these higher rates evidence shows many valves have become a bottleneck. This bottleneck is particularly in the #2 section, the section of greatest hydraulic load.

As a particular valve section fills up with filtrate less vacuum gets to the pans in that section. A greater pressure drop occurs. This means slower filtration, lower production, and less washing efficiency or recovery.

Three options exist to minimize this occurrence. The lowest cost option is to modify the circular valve outlets to ovals. This irregular shape breaks up the vortexing action which occurs as air and filtrate tries to exit the valve. Liquid level in the valve is less, therefore less vacuum loss. Also, since less mixing of air and filtrate occurs, scaling within the valve is less.

A second more efficient option is to make valve modifications to provide larger diameter oval-shaped valve outlets in the #1 & #2 sections. The larger outlet orifices produce even less vacuum loss to maintain fast filtration.

A final option is complete valve replacement. The new valve could be of the standard design with larger outlets. Other options include an "AC" or "EX" design. Here the primary air/filtrate separation is made within the valve. Tests have shown that removing air ahead of a valve outlet increases the hydraulic capacity of that outlet by 35%-40%. In either the AC or EX design, vacuum loss is at an absolute minimum.

The AC valve was developed and patented by Prayon, particularly for hemihydrate applications. Here it is particularly important to minimize the cooling and scaling effects caused by mixing of ambient air and hot filtrate. Bird developed the EX valve as a lower cost alternate to the AC. Bird can provide either design for any filter retrofitting.

SPEED INCREASE

Filtration theory and experience clearly shows that production rate is proportional to the square root of the ratio of filter speeds.

Traditionally the Bird-Prayon Filter has been the slowest moving of all P205 filters. Now this disadvantage has been virtually eliminated. The sloped bottom pan with its "strongback" design is physically much stronger than its flat bottom predecessor. A CAD design system for pan turnover has reduced torsional loads which previously limited filter speed.

For example, 30D filters are now rated at 2:30 MPR. The old rating was 3:00 MPR. This translates into a 9.5% increase in capacity. Similarly a 24D now rated at 2:00 MPR increases capacity by 17.2% over older designs.

SUMMARY

This paper highlights the three most important areas where Bird and Prayon can help users of Bird-Prayon filters achieve more capacity. Up to 20% more capacity can be realized with a fraction of the expense of a new plant or larger filter. Please contact Bird or Prayon for more detail.

FINAL PAGE

Bird and Prayon will provide graphics of all design improvements at the time of this papers presentation.

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How to Improve the Performance and Output of Your Tilting Pan Filter, Incorporating Proven Developments from Bird/Prayon

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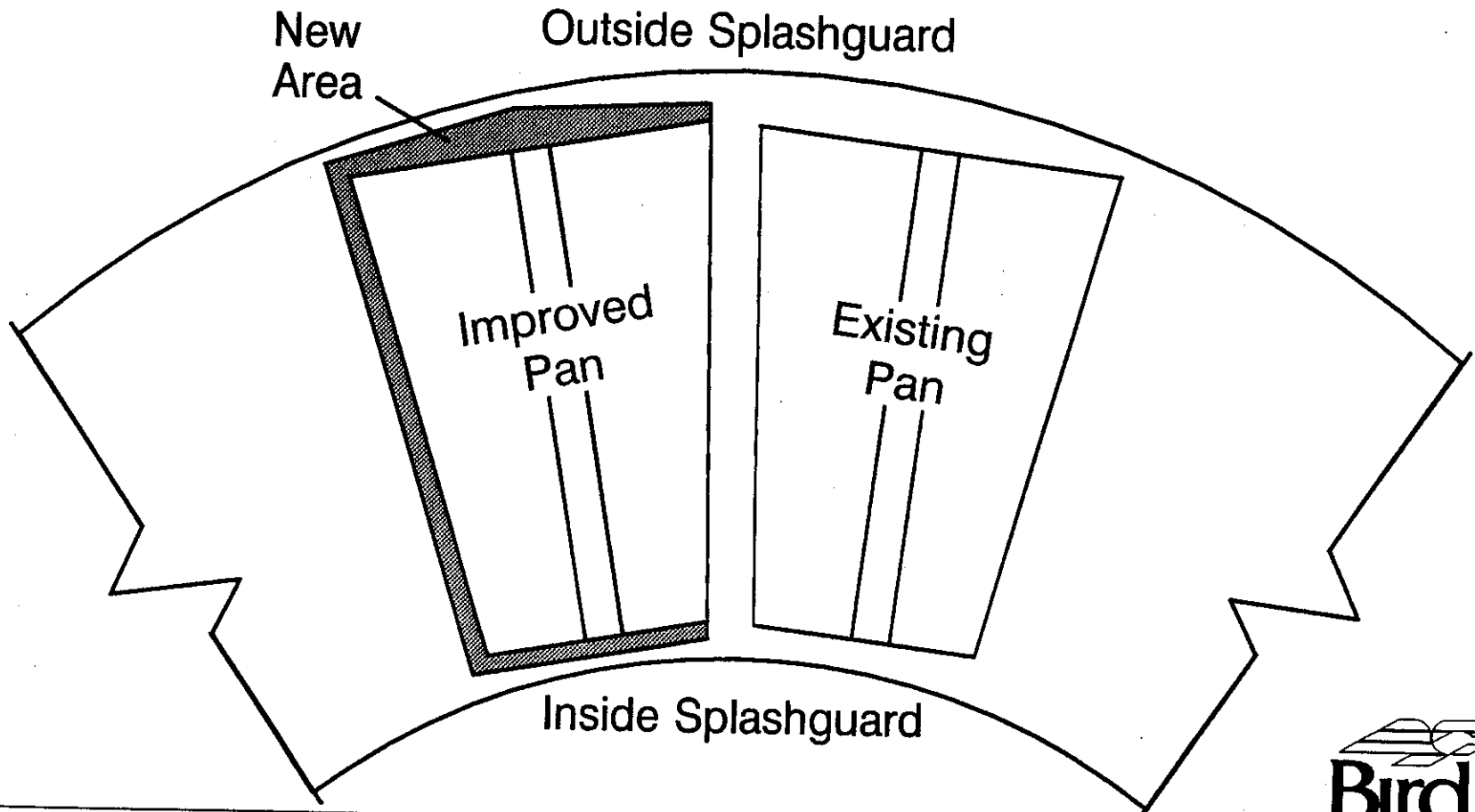
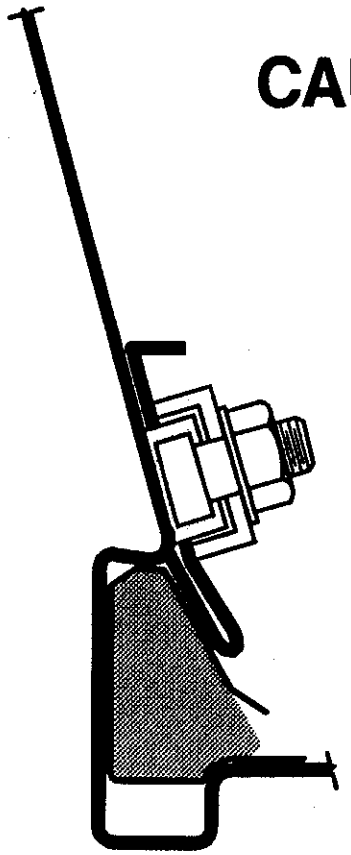
INCREASED PAN AREA FOR MORE PRODUCTION

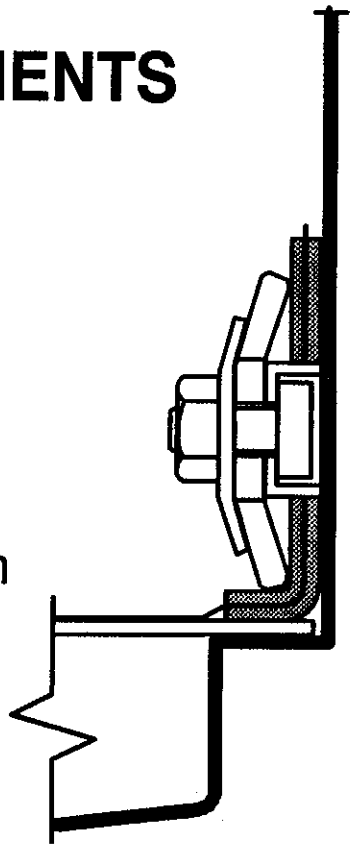


Bird Machine Company

CAULKING IMPROVEMENTS



- More Active Area
- Lower Profile
- Easier Installation
- Increased Production



Original Caulking Assembly
All Around Cell

Improved Low Profile Caulking
at Cell Sides

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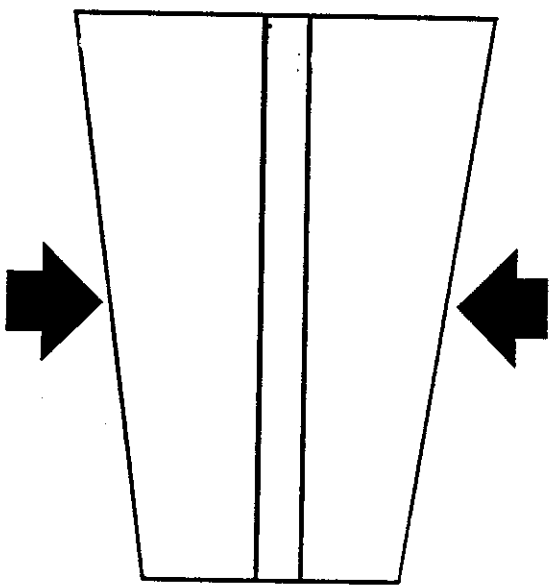
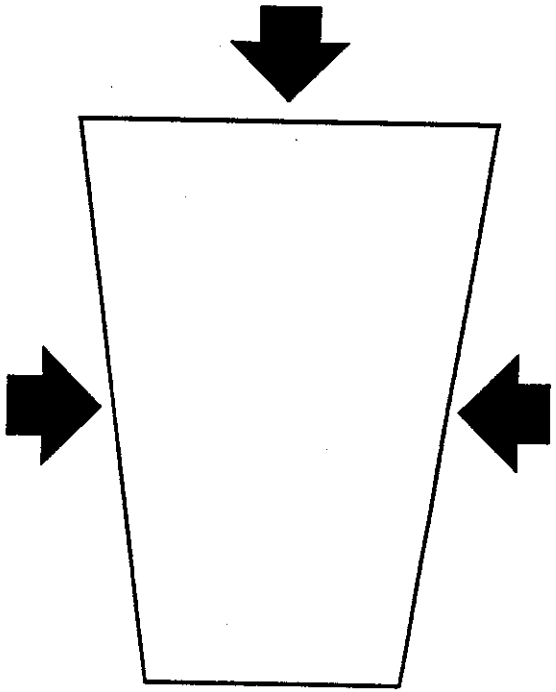
"FAST DRAIN" PAN DESIGN



Existing Sloped Bottom Pan with Two(2) 5° Slopes



New "Fast Drain" Sloped Bottom Pan with Triple Slope Design (Patent Pending)

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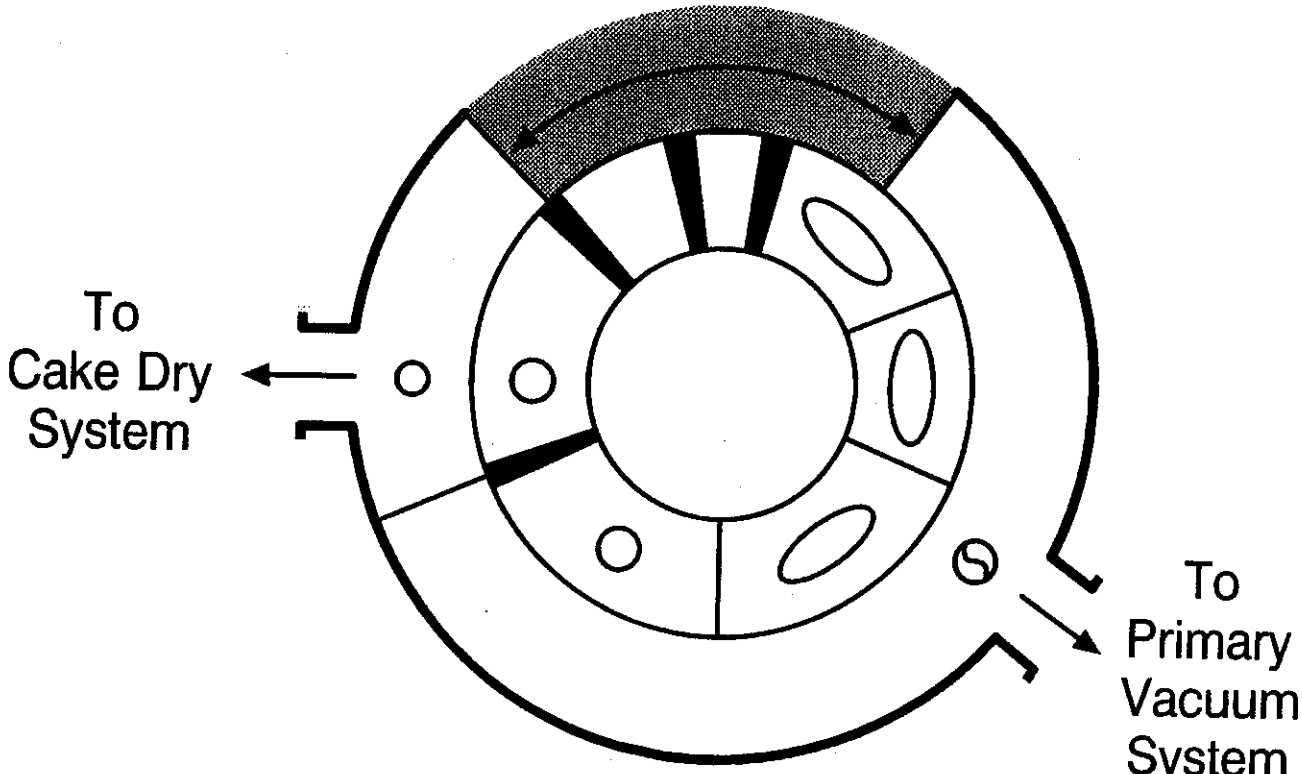
CENTRAL VALVE DESIGN



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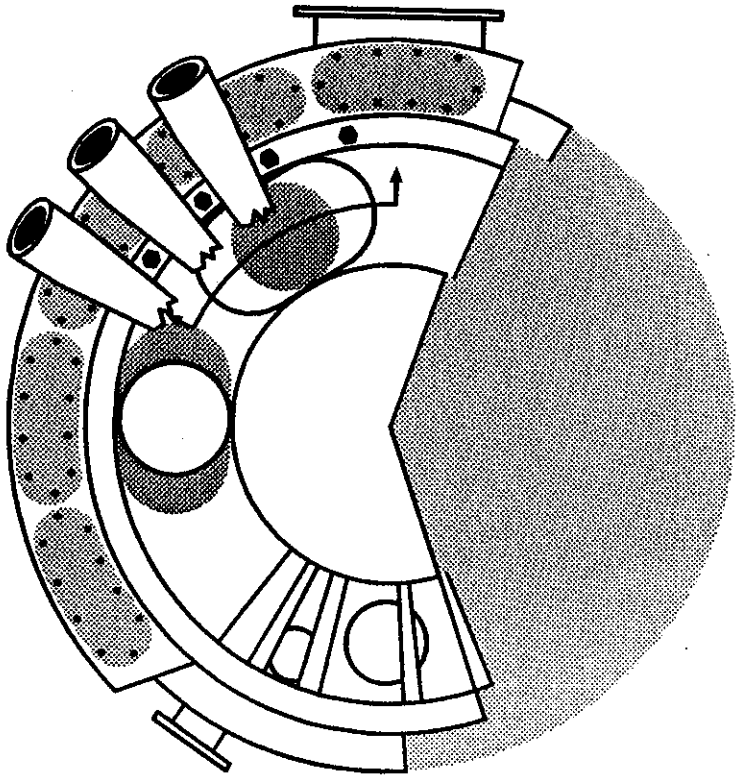
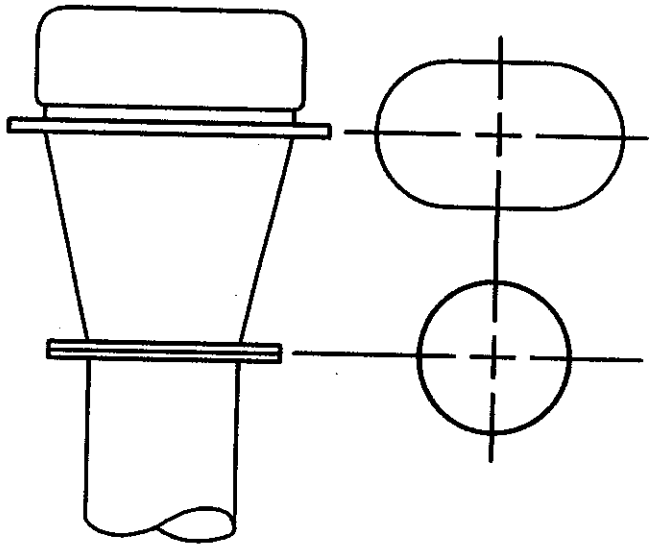
INCREASED HYDRAULIC CAPACITY THROUGH CENTRAL VALVE



Top View



Vortex Eliminator

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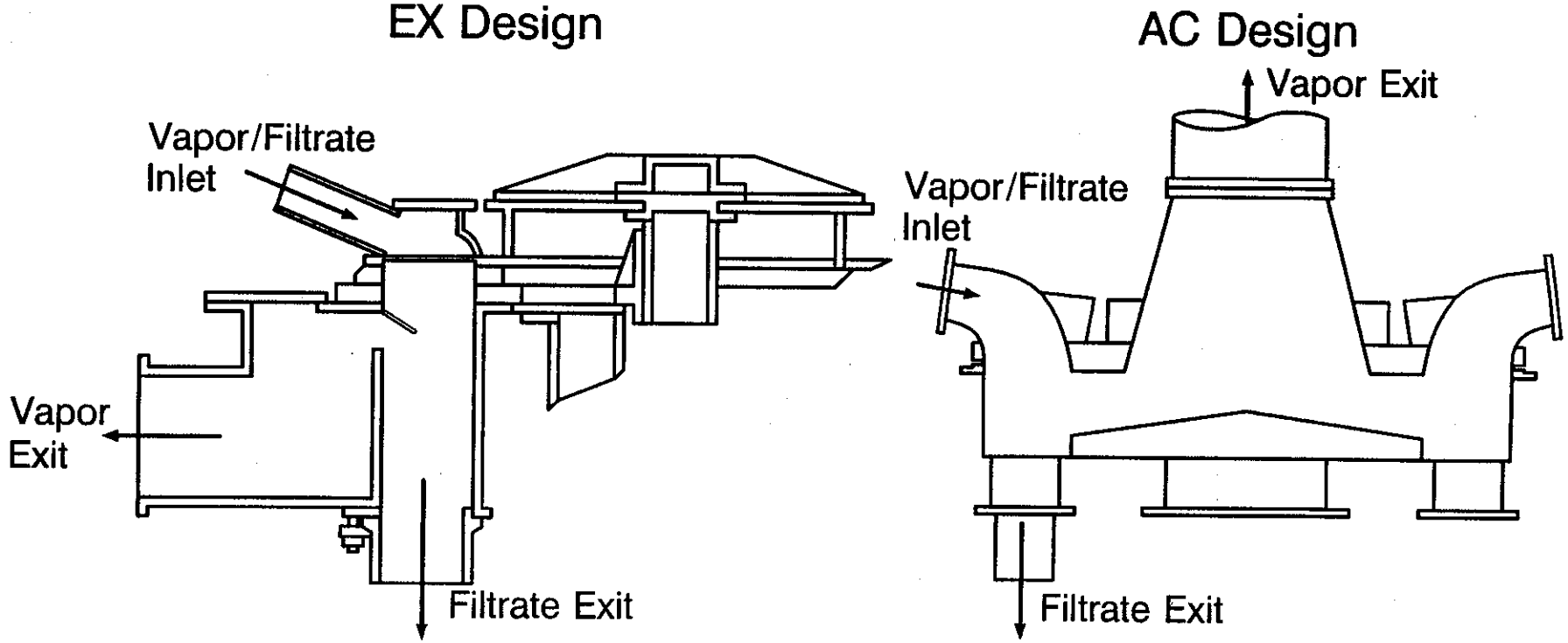
CENTRAL VALVE IMPROVEMENTS



- Increased Hydraulic Capacity
- Minimum Vacuum Loss

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United States Patent [19]

Davister

[11] 4,172,791

[45] Oct. 30, 1979

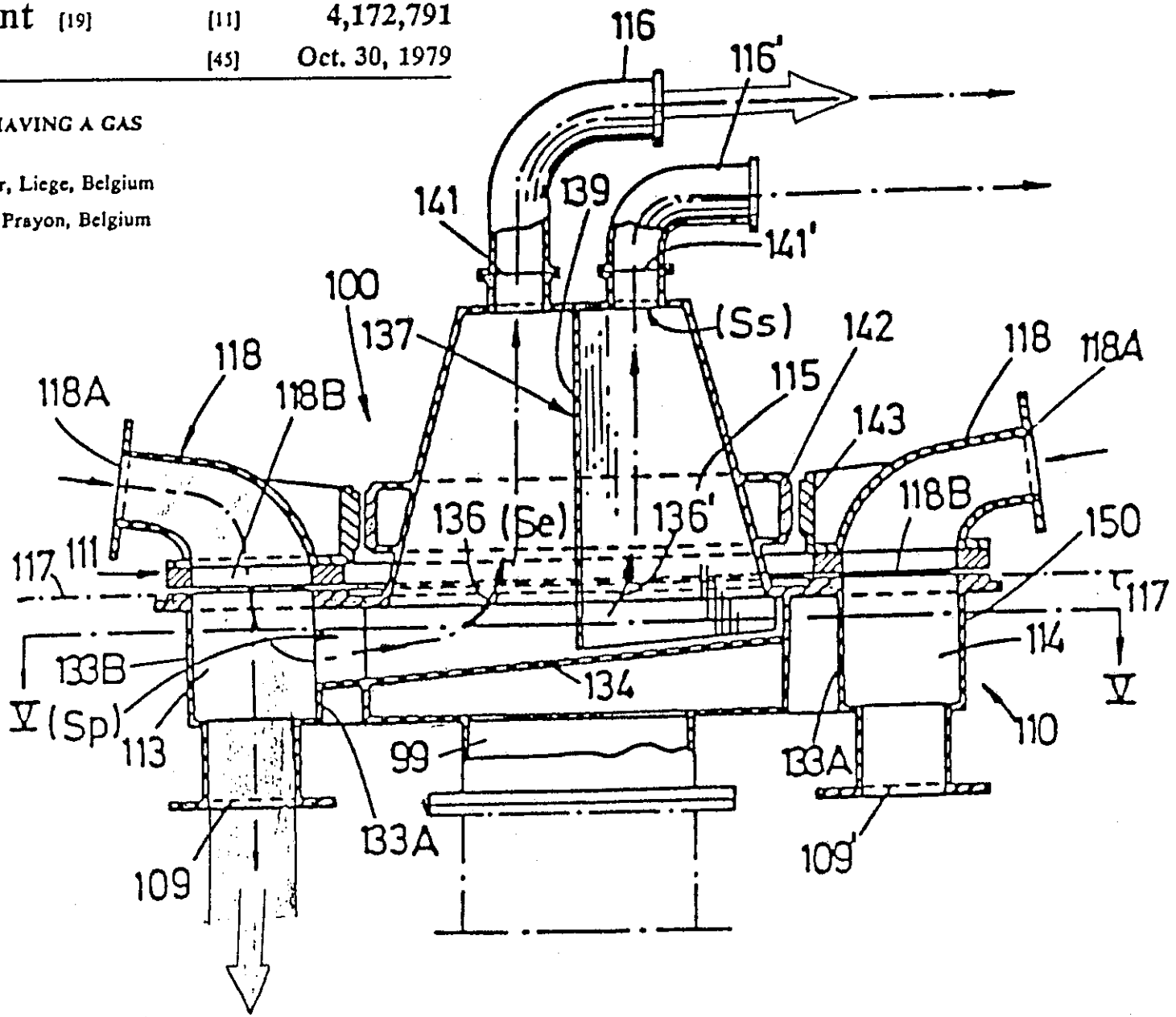
[54] MULTIPLE CELL FILTER HAVING A GAS DISCHARGE

[75] Inventor: Armand L. Davister, Liege, Belgium

[73] Assignee: Societé de Prayon, Prayon, Belgium

[21] Appl. No.: 730,657

[22] Filed: Oct. 7, 1976



United States Patent [19]

Martin et al.

[11] Patent Number: 4,752,390

[45] Date of Patent: Jun. 21, 1988

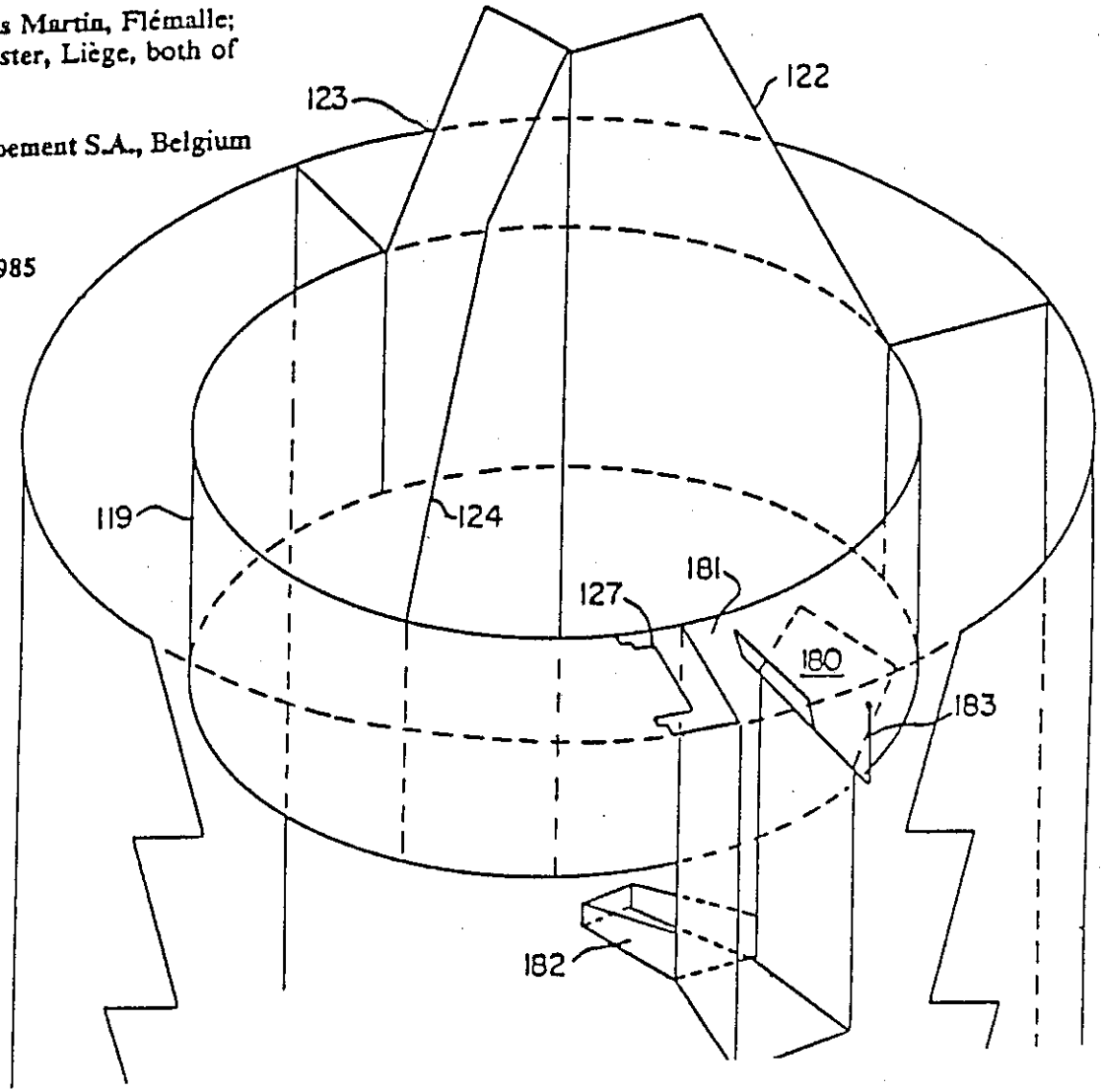
[54] ROTARY VACUUM FILTERS WITH A HORIZONTAL FILTRATION PLANE

[75] Inventors: Georges-Francois Martin, Flémalle; Armand L. Davister, Liège, both of Belgium

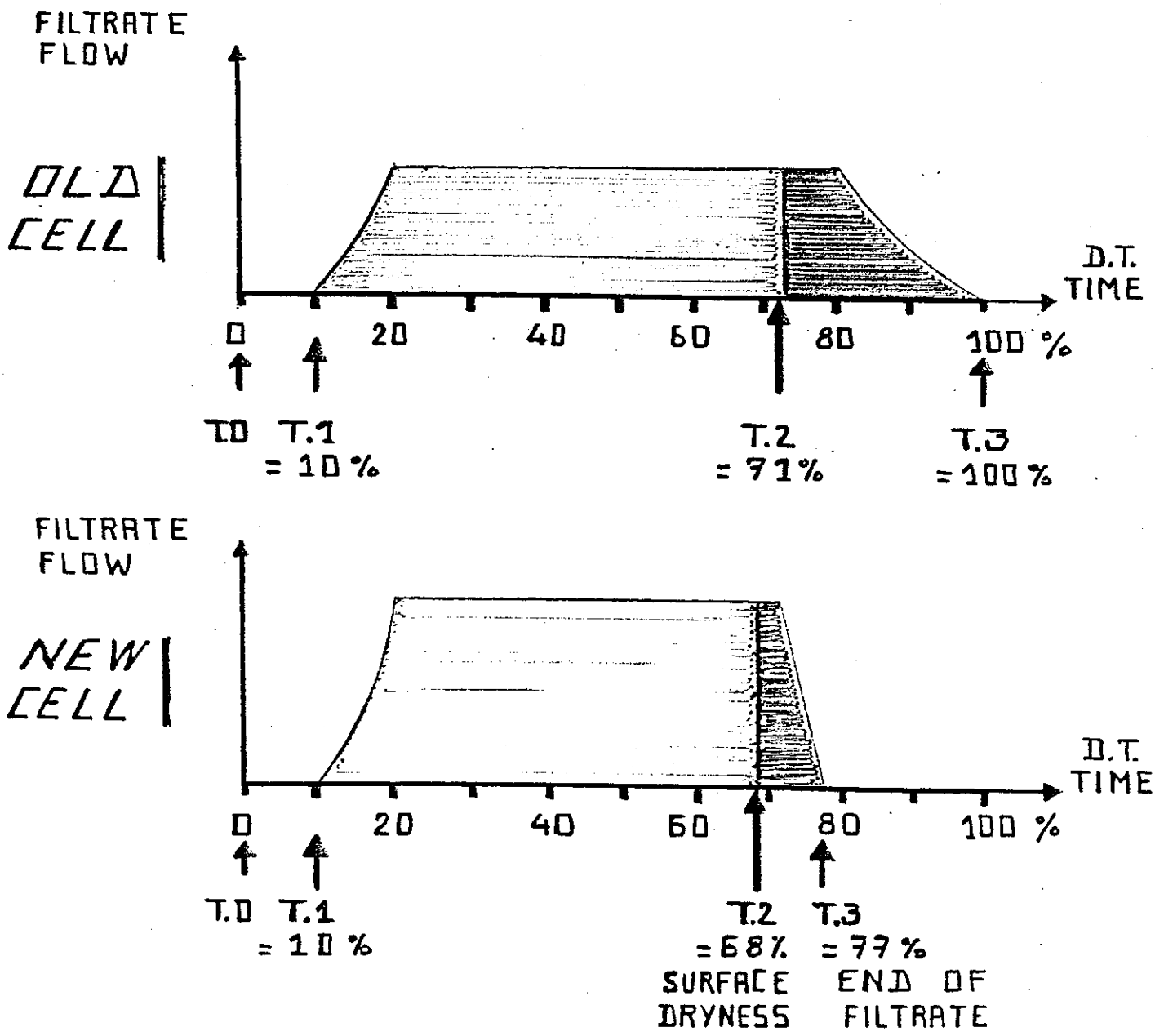
[73] Assignee: Prayon Developpement S.A., Belgium

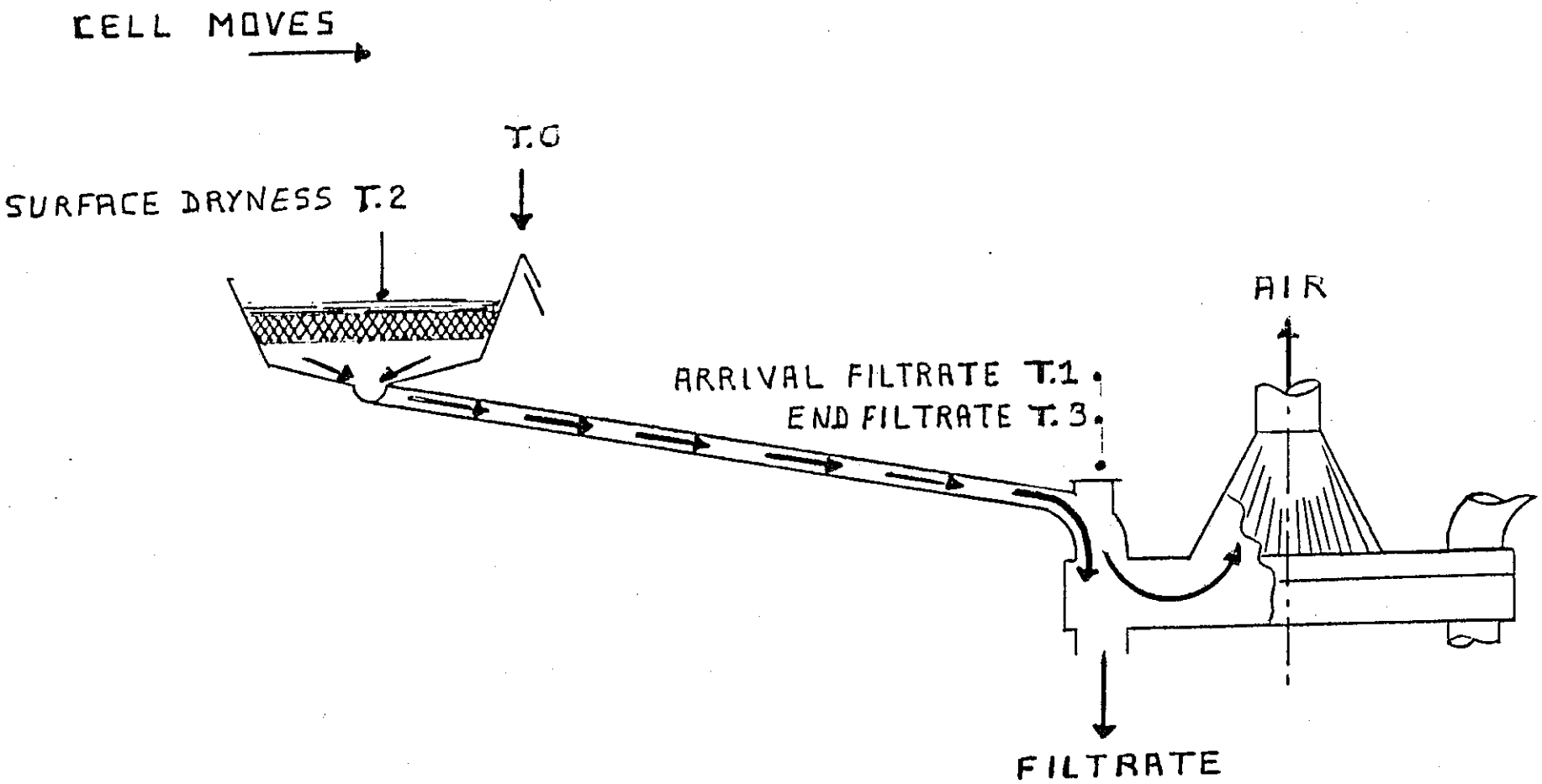
[21] Appl. No.: 810,308

[22] PCT Filed: Feb. 28, 1985



OLD / NEW CELLS DRAINAGE TIME COMPARISON





D.T.= TOTAL DRAINAGE TIME =(T.3 - T.0)