BELTCON 8

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DRUM RECLAIMERS

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KRUPP SOUTH AFRICA

WORKSHOP - BELTCON 8
on
26 OCTOBER 1995

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KRUPP SOUTH AFRICA (PTY) LIMITED

(Fig. 1 : Table of Contents)

DRUM RECLAIMERS

1. INTRODUCTION

Drum reclaimers were first developed and introduced less than 30 years ago in order to meet the needs of process plants for improved blending effects, at increasing flow rates and with minimum particle size degradation and wear rates.

Over this period a total of 64 drum reclaimers were built around the world. In South Africa alone 16 drum reclaimers, or 25%, are in use today.

The fields of application worldwide are in :

Iron Ore	:	60%
Coal	:	30%
Other Minerals	:	10%

Amongst this world population the drum reclaimers range from 25m span or rail gauge to 43m and from 500t/h reclaim rate up to 5'000t/h.

2. PRINCIPLES OF OPERATION

(Figs. 1 and 2 - Arrangement of Drum Reclaimer)

The construction of drum reclaimers is illustrated in Figures 1 and 2. The main components are:

- a bridge spanning the stockpile supported on two sets of portals and equalised rail mounted bogies on either side of the stockpile. The bogies are driven to allow longitudinal travel in the direction of the stockpile;
- a drum with riding rings supported on rollers situated in the portals. The drum rotates by rack and pinion drive and is equipped with a set of buckets on its circumference;
- a cross conveyor at the centre of the drum onto which the buckets discharge;
- a reciprocating harrow which brings the material down the sloped face in a controlled way.

(Fig. 3 - Principle of Stacking)

Stacking of the material is to the chevron mode. One bed is being stacked to whilst the second bed is reclaimed from.

(Fig. 4 - Principle of Reclaiming)

During reclaiming the drum reclaimer travels at a controlled speed in the direction of the stockpile. The adjustable harrow retains the full face of the stockpile at an angle slightly shallower than the natural angle of withdrawal of the material being reclaimed. In this way the harrow induces the material to flow down the face of the stockpile in a controlled way into the approaching bucket without avalanching. As the buckets rotate they are in turn filled and discharge their contents gently into the cross conveyor feed chute. The feed chute is wide enough to ensure :

- that the buckets do not discharge prematurely onto the ring chute;
- that the buckets are entirely discharged by the time they pass beyond the far side of the chute.

3. SALIENT FEATURES OF THE DRUM RECLAIMER

The key features which have enabled drum reclaimers to capture and hold a significant portion of the market are :

3.1 The Highest Degree of Blending and Homogenising

(Fig. 5 - Illustration of Blending Effect)

This is achieved by :

3.1.1 Simultaneous full face reclaiming.

3.1.2 Consecutive buckets discharging their contents on top of that of other buckets onto the moving cross conveyor.

3.2 Minimum Degradation and Wear

At Sishen the two drum reclaimers TAS40 commissioned in 1974 have already handled some 500 million tons of the most abrasive iron ore in the world. This performance demonstrates in the most practical way that the wear which occurs in the case of drum reclaimers is minimal. At the same time this low wear rate proves that there can be no significant particle size degradation. The reasons for this exceptional performance may be ascribed to the following features :

3.2.1 The function of the harrow ensures that only a small portion of material is reclaimed by digging whereas the major portion of material flows freely into the buckets.

3.2.2 The buckets are designed to carry the material over the apex of the ring chute before material is discharged.

3.2.3 The circumferential velocity of the buckets is low at approximately 1,0m/s.

3.2.4 There is no significant rolling of the material inside the drum reclaimer buckets.

3.2.5 The free fall height between buckets and rubber lined cross conveyor chute is small.

Note: All the above observations are sunstantiated by the fact that the installed power on the drum reclaimer for 4'000t/h reclaim rate is only 2 x 75kW.

3.3 Low Maintenance and Ease of Automation

The construction results in :

3.3.1 Simple and maintenance friendly automatic operation, as only the travel speed of the reclaimer is variable to produce the desired reclaim rate - all other movements such as belt speed, drum speed and rake oscillation are constant.

3.3.2 Low maintenance due to few and only slow moving components.

3.3.3 Low power consumption as all movements are directly engaged in the task of reclaiming. No dead and/or unproductive masses such as counterweight have to be accelerated, respectively decelerated.

3.3.4 Low cost rail track as wheel loads are constant, wheels equally spaced and equally loaded. There are no significant side forces acting on the rails.

4. RECENT INNOVATIVE IMPROVEMENTS :

A number of technological improvements were effected in recent years, such as :

- single shell drum, instead of the original double shell arrangement which was costly to fabricate. Finite element analysis techniques have enabled optimisation of shell thickness;
- counter balanced split harrow arrangement.

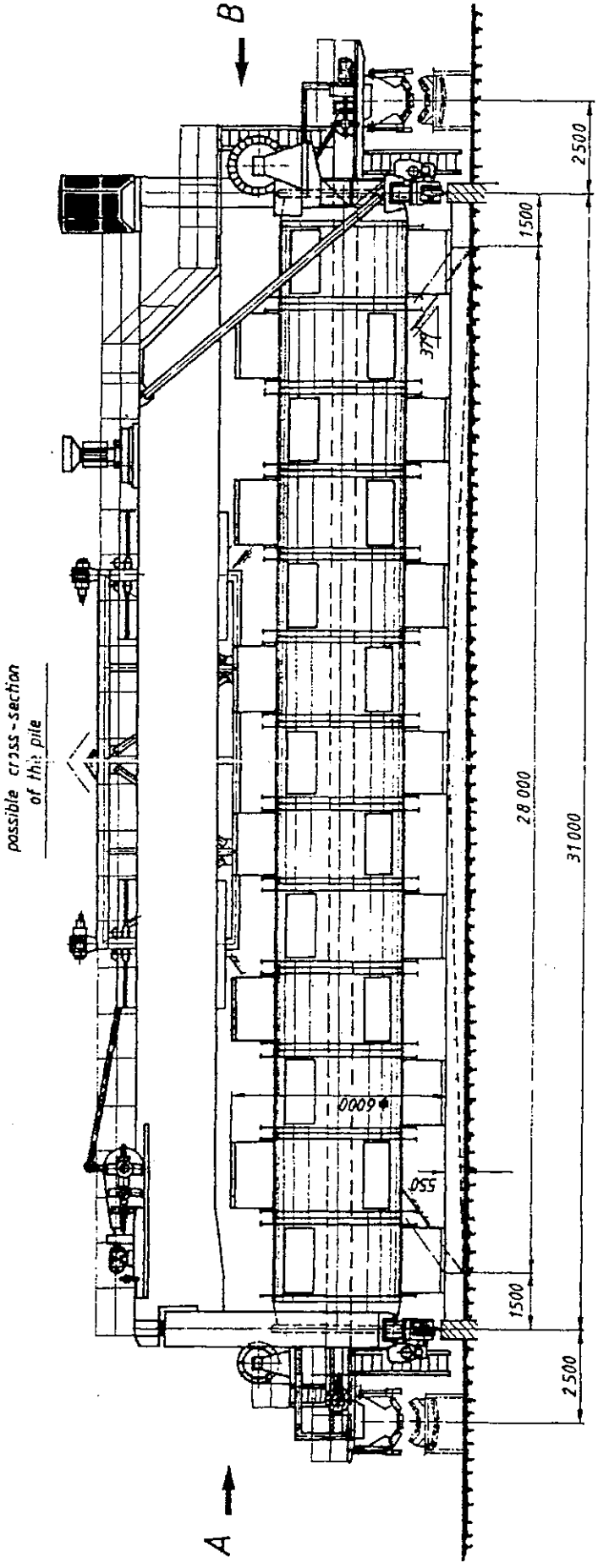
(Fig. 6 - Principle of Cascade Buckets)]

One outstanding innovation has been the development of the Krupp patented cascade bucket for bi-directional reclaimers. Previously the buckets were equipped with hinged flaps which provided ample volumetric space and material retention. The disadvantage was frequent sticking of the flap in one position, as well as high maintenance. The novel solution was the development of the cascade buckets to utilize the reserve space in the lower half of the bucket.

5. CONCLUSION

For blending applications where either the required reclaim rate is over 2'000t/h, or the material is abrasive, or there is a need to minimise degradation, the drum reclaimer represents a good solution as well as an excellent investment.

THANK YOU VERY MUCH!



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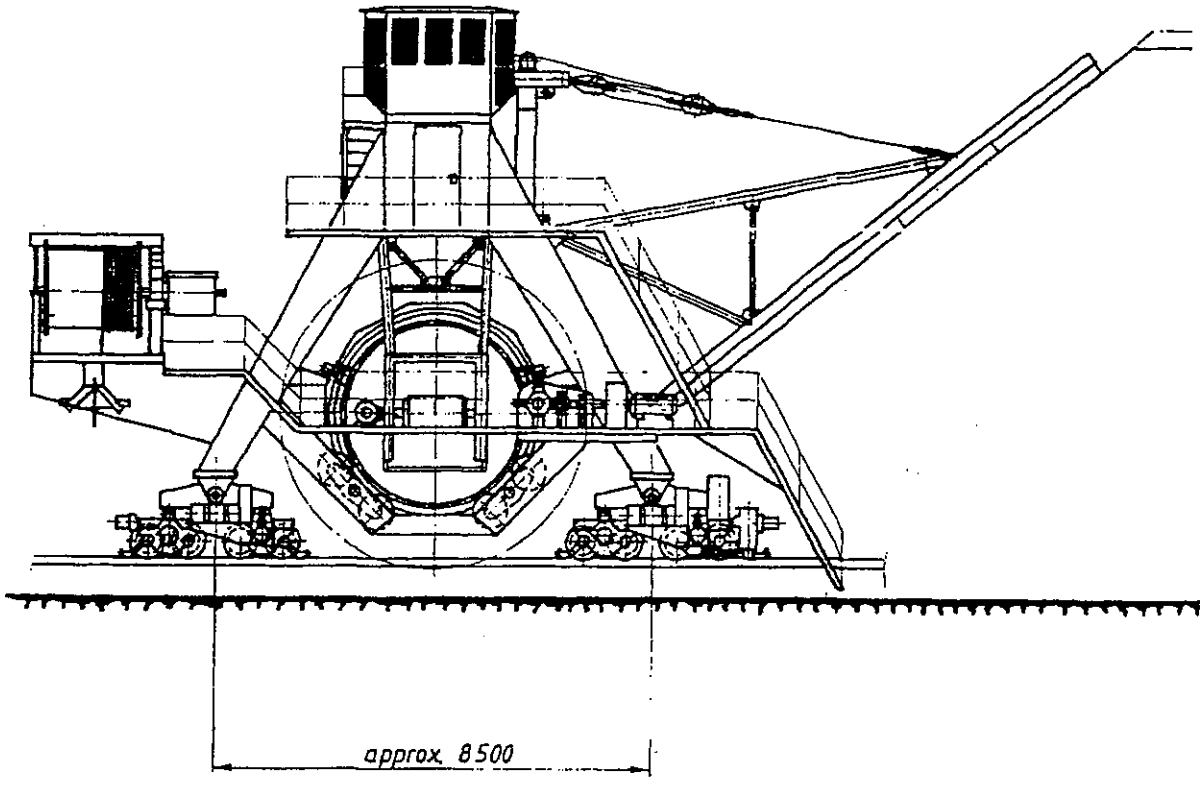
ARRANGEMENT OF DRUM RECLAIMER

1

View B



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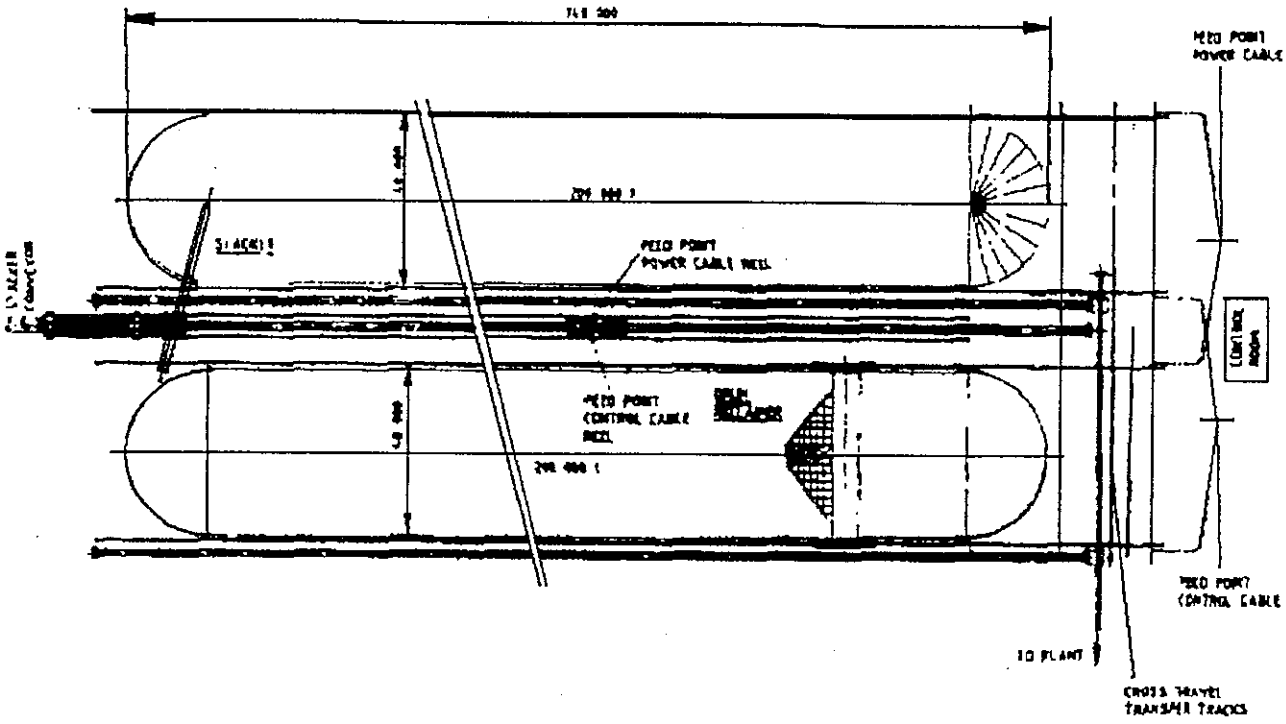
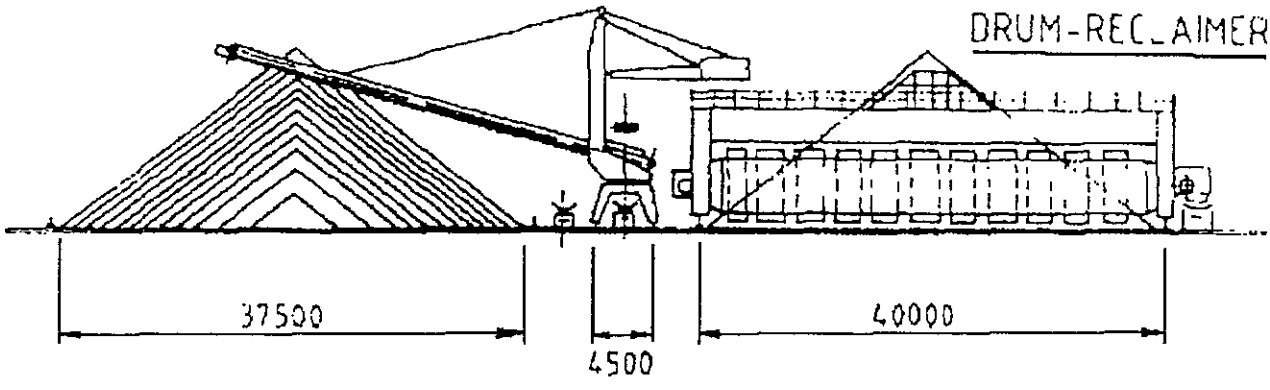
SIDE ELEVATION OF DRUM RECLAIMER

2



STACKER

DRUM-RECLAIMER



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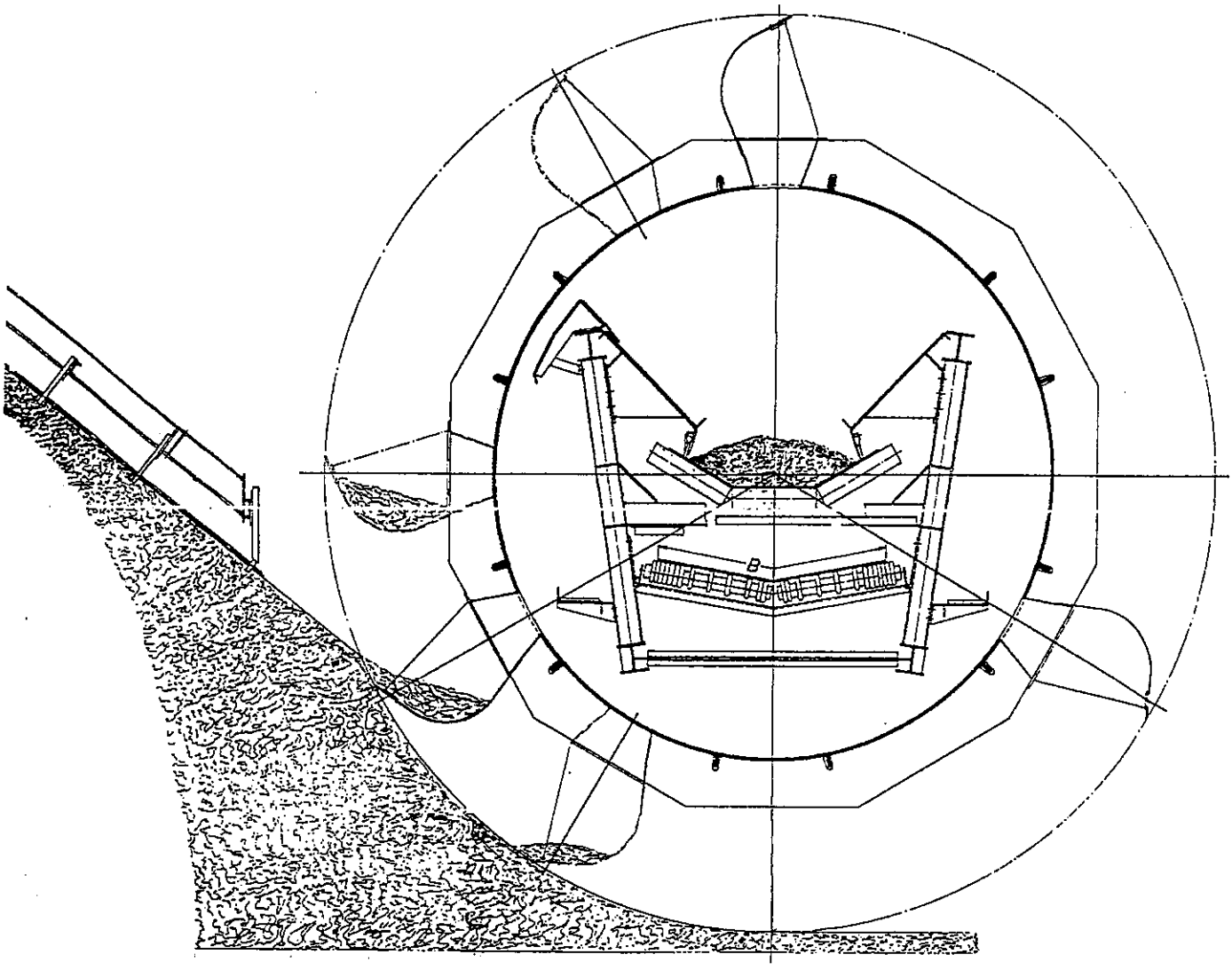
PRINCIPLE OF STACKING



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PRINCIPLE OF RECLAIMING

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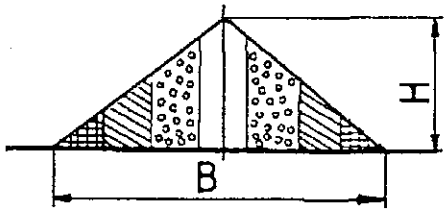
Stockpile Width
B = 37,5 m

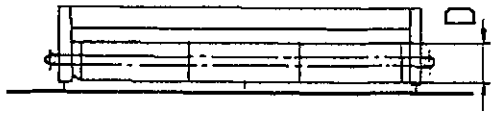
Stockpile Height
H = 14,6 m



STOCKPILE CROSS-SECTION

Reclaiming Capacity of Machine
Q_m = 2150 m^3/h

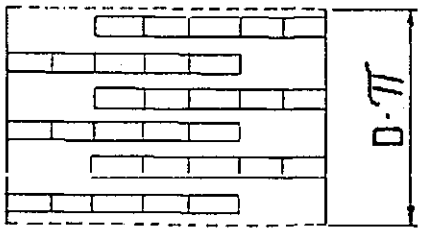
Drum Advance Rate
$v = \frac{2 \times Q_m}{B \times H \times 60}$ = 0,13 m/min.



RECLAIMER

Drum rpm
n = 4/min.

Number of Bucket Rows on Circumference
i = 6

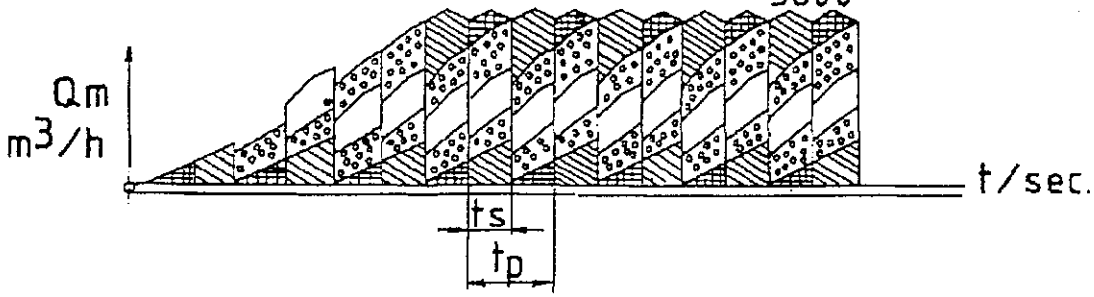


VIEW OF DRUM WITH BUCKET LAY OUT

Time per Discharge
$ts = \frac{60}{n.i.}$ = 2,5 sec.

Cycle Time
$tp = 2 \times ts$ = 5 sec.

Quantity Reclaimed per Cycle Time
$M = \frac{Q_m \times tp}{3600}$ = 3 m^3



DISCHARGE CONVEYOR LOADING WITH DRUM RECLAIMER

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ILLUSTRATION OF BLENDING EFFECT

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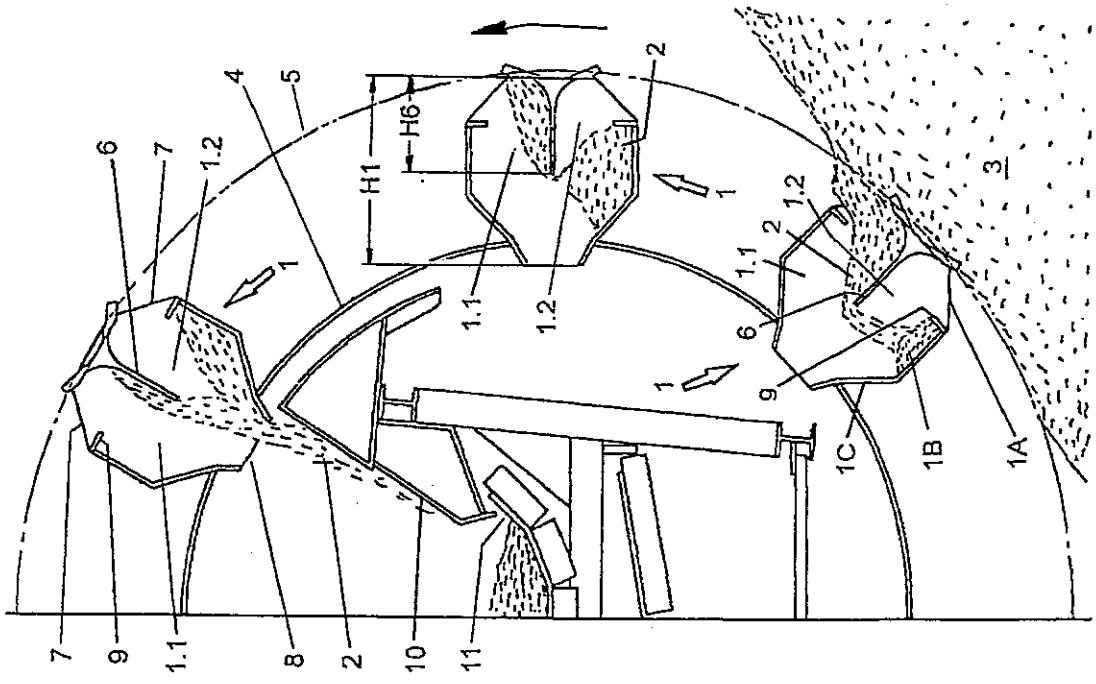

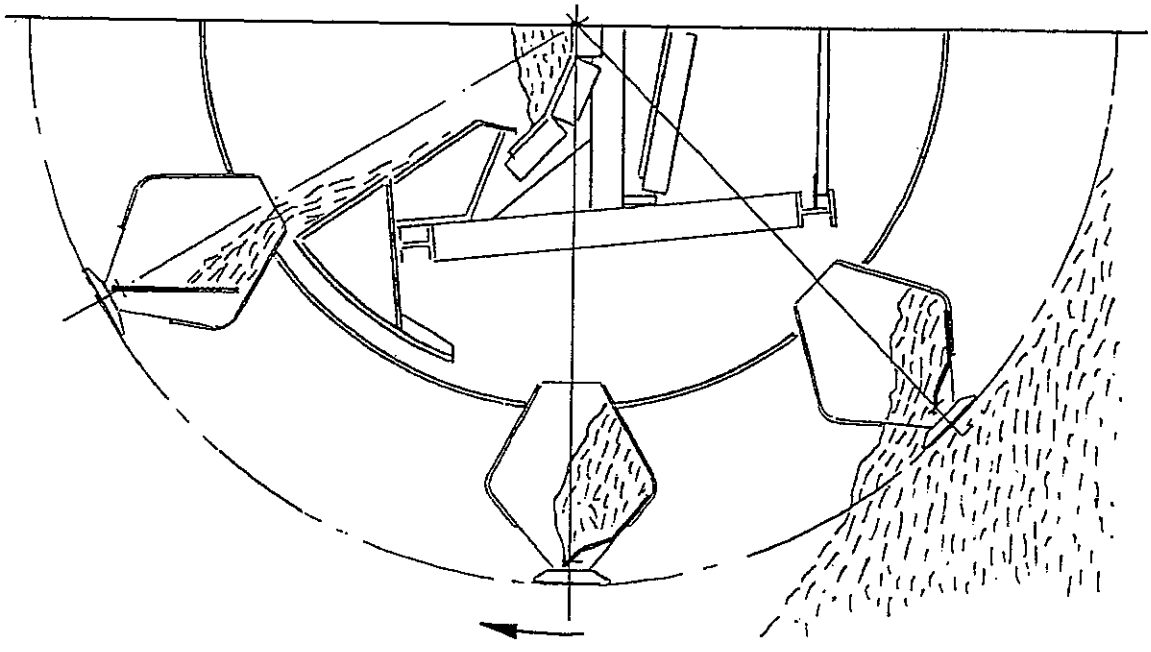

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Principle of Cascade Buckets

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