FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 15 OF 1963.

# TO ASCERTAIN WHETHER A DENSITY GRADIENT EXISTS WITHIN THE DREWBOY WASHER.

BY:

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# TO ASCERTAIN WHETHER A DENSITY GRADIENT EXISTS WITHIN THE DREWBOY WASHER.

## OBJECT OF TEST:

The object of this test was to ascertain whether there exists variation in the specific gravity with spacial position within the bath of the Drewboy dense medium washer.

## SAMPLING APPARATUS:

In order to obtain medium samples at various depths within the bath of the Drewboy washer, the following apparatus was constructed. The apparatus consisted of a bottle, volume equal to a half pint, attached to a long sturdy handle with which the sample bottle could be lowered into the medium to various depths. The bottle was stoppered with a rubber stopper to which was attached a length of wire extending the length of the handle.

## OPERATION OF SAMPLER:

The empty bottle was initially stoppered and then lowered into the medium to the required depth at the required sampling position.

The rubber stopper was then removed by applying tension to the wire extending the length of the handle. The medium enters the sample bottle at the required depth below the surface and is subsequently withdrawn from the bath.

On withdrawal of the filled bottle, the bottle was left unstoppered since no great change would occur in specific gravity during withdrawal, if the withdrawal rate is relatively slow.

TEST .../

TEST PROCEDURE:

The dense medium circulation system for the Drewboy washer was brought into operation and the medium allowed to circulate through the bath. The specific gravity of the medium was adjusted to a value of 1.50 and the system allowed to operate for a period of at least 30 minutes to attain equilibrium. No coal was fed to the washer and hence no external water was added to the medium. The control of the specific gravity of the medium could thus be effected without difficulty and be kept remarkably constant. This was a necessary requirement since instantaneous sampling could not be effected at the various positions.

The sampling bottle was then lowered to the required depth at a specific sampling position and a sample of the medium obtained. This process was repeated until a sufficient volume of medium was obtained for the subsequent analysis.

This process was then repeated at various depths.

The above procedure was repeated at the various sampling positions as indicated in Figure 1.

At sampling points A and B, medium samples were obtained at only 6" below the surface. (Due to the construction, the depth of the bath at points A and B is of the order of 10" to 12".)

From each of the three sampling points D, C and E, three medium samples were secured below the surface, the first at 6", the second at 12" and the third at 18", respectively.

Sampling point F is situated outside the bath, viz. inside the discard removal wheel housing, and is separated from the bath by means of a partition, open at the bottom.

The medium feed rate was of the order of 200 gal./min. top feed, and approximately 80 gal./min. bottom feed.

No medium samples could be taken at the product removal side of the bath due to the positioning of the rotating flails.

RESULTS:

The analysis was performed as follows:
the medium sample was transferred to a mechanically agitated bath and thoroughly mixed.

During .../

During agitation, representative samples were withdrawn and volume and mass determinations were performed in duplicate.

| Sampling Point | S. G. at Various Depths | | |
|---|---|---|---|
| | 6" Below | 12" Below | 18" Below |
| A | 1.54 | - | - |
| B | 1.55 | - | - |
| $C_1$ | 1.50 | 1.55 | 1.53 |
| $C_2$ | 1.54 | 1.53 | 1.54 |
| D | 1.56 | 1.55 | 1.51 |
| E | 1.55 | 1.52 | 1.50 |
| F | 1.53 | - | - |

DISCUSSION:

During determination of B (6") and $C_1$ (6",12" and 18") the specific gravity of the medium in the medium circuit gradually dropped from 1.52 to 1.50. (Both are instrument readings). The deviation in specific gravity was corrected and the sampling procedure at position C was repeated. These results are tabulated as $C_2$. The value of the specific gravity for position B, 6" below, should thus be higher and may thus be of the order of 1.56.

It may thus be seen, that the results indicate a density gradient in the region where a stagnant condition may arise, i.e. away from the discard removal wheel. These results are in accordance with the results obtained in residence time distributions.

(SIGNED) T. C. ERASMUS.
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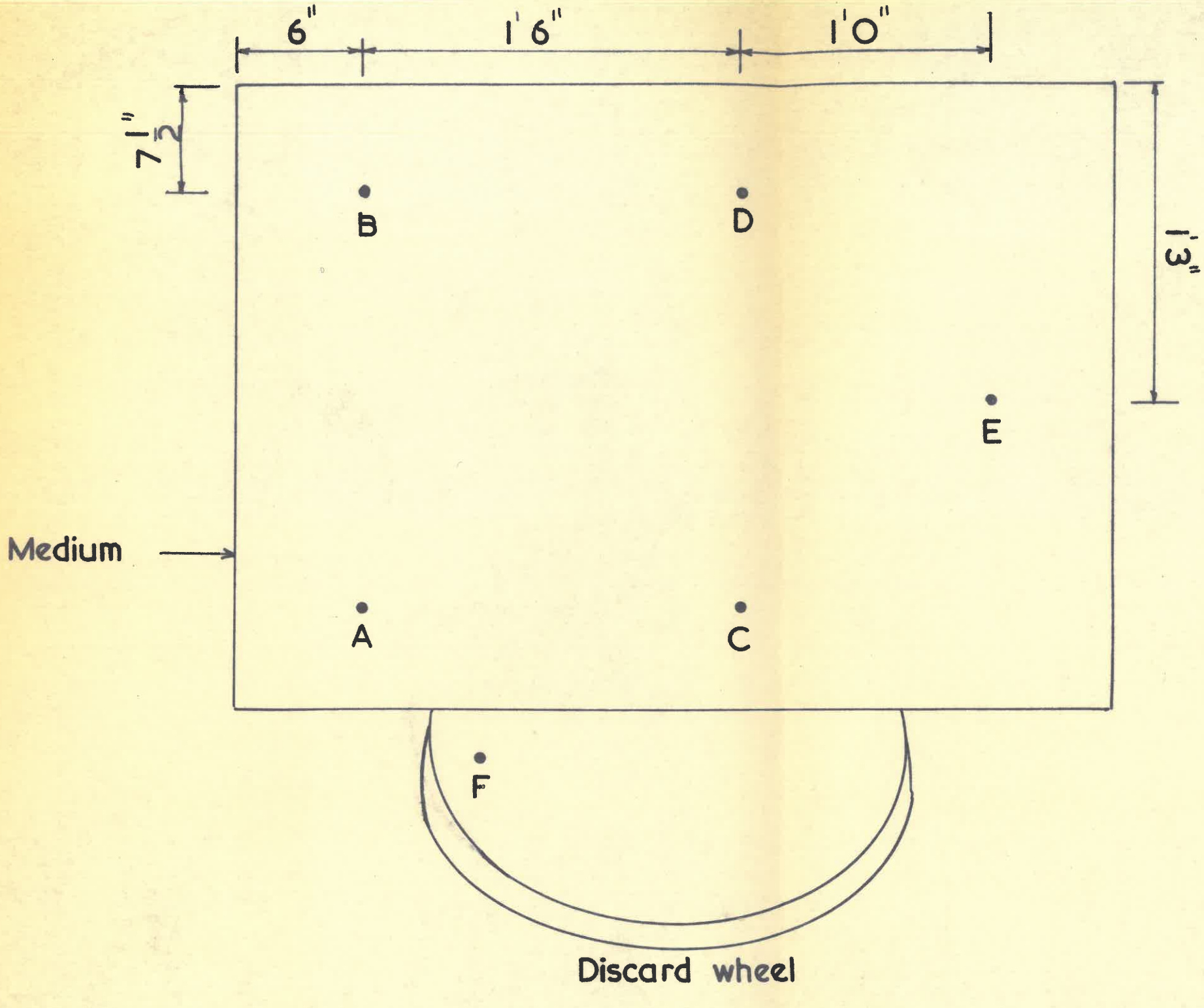
6"
1'6"
1'0"
7½"
1'3"
B
D
E
Medium
A
C
F
Discard wheel