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FUEL RESEARCH INSTITUTE

OF SOUTH AFRICA.

BRANDSTOF-NAVORSINGS-INSTITUUT

VAN SUID-AFRIKA.

(ADDENDUM TO REPORT NO. 17 OF 1952).

SUBJECT:
ONDERWERP: PERFORMANCE OF JEFFREY SINGLE ROLL CRUSHER INSTALLED AT VAN DYKSDRIFT COLLIERY.

DIVISION:
AFDELING: ENGINEERING.

NAME OF OFFICER:
NAAM VAN AMPTENAAR: P.J. v.d. WALT.

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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

REPORT NO. 24 OF 1952.

PERFORMANCE OF JEFFREY SINGLE ROLL CRUSHER INSTALLED AT VAN DYKSDRIFT COLLIERY.

(ADDENDUM TO REPORT NO. 17 OF 1952).

INTRODUCTION:

A Jeffrey single roll crusher was installed at Van Dyksdrift Colliery with the object of producing minus 6 inches coal suitable for firing in South African Railways locomotives. It was later decided to investigate the possibilities of using this crusher to reduce 180 tons per hour of rounds and cobbles to a size suitable for power stations and for other consumers of small coal. It was desired that the crushed product should contain a minimum proportion of cobbles and of duff.

A preliminary survey was made of the performance characteristics of the crusher and the results were reported in Report No. 17 of 1952. This investigation indicated that the crusher was capable of the desired performance provided that:-

(a) A 150 h.p. motor were substituted for the existing 72 h.p. motor and

(b) that the roll setting could be decreased to about 1 inch.

At the time of this survey, the roll and breaker plate shoes were out of alignment, consequently the slugger teeth fouled the shoes when small roll settings were used. By increasing the width of the grooves in the breaker plate shoes, roll settings down to about 1¼ inches were achieved, but it was not possible to decrease the roll setting still further.

TEST/..............

TEST CONDUCTED WITH 7/8 INCH ROLL SETTING.

A spare set of unused segments were available at the Colliery and these were fitted to the roll. The breaker plate requires a set of 4 shoes but unfortunately only 3 unused shoes were available. Since it was not possible to replace all the shoes with new ones, the Colliery decided that the old shoes should be left in position. Efforts were then made to correct the faulty alignment between roll and breaker plate. The Colliery Engineer achieved this and it was finally possible to reduce the roll setting to 7/8 inch without further increase of the width of the grooves in the breaker plate shoes.

On the 24th of September 1952, a test was conducted on the crusher using a roll setting of 7/8 inch.

The one tippler and screening unit was shut down and the tipping rate on the other unit was adjusted to approximately 4 tubs per minute. All the rounds contained in the feed were passed over a single picking belt and then through the crusher.

The average proportion of rounds in the run-of-mine coal and the tub factor are approximately 37% and 1.1 tons respectively. A tipping rate of 4 tubs per minute thus corresponds to a load of the order of 0.37 x 4 x 60 x 1.1 = 97 tons per hour on the crusher.

Rounds were passed through the crusher at the above rate for approximately one hour and the motor ammeter, crusher etc. were carefully watched. The degree of breaking of large lumps by hand on the picking belt was varied during the test period. It was estimated that the size of the feed to the crusher was varied in this way between the limits of minus 6 or 8 inches and minus 10 or 12 inches.

Estimation of the power consumption of the crusher from the motor ammeter readings is largely dependent on judgement and is consequently not very accurate. However, the author is

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of the opinion that the motor (72 h.p.) was just overloaded (say, about 80 h.p.) when dealing with minus 10 or 12 inches feed and that it was operating well within its rating (say, about 60 to 65 h.p.) when the feed was about minus 6 or 8 inches in size. In the former case the ammeter readings fluctuated more or less violently as very large lumps passed through the crusher while in the latter case the readings were fairly steady and the estimated power consumption should be a reasonably accurate reflection of the true value. At no time did the crusher show signs of stalling.

A sample of crushed coal, consisting of one increment of about 5 tons, was taken from the boom loader during the test period. The whole sample was screened at various sizes with the results reported in Table 1. The total weight before and after screening was determined and the loss of weight was ascribed to dust produced during screening and was accordingly added to the minus 1/8 inch fraction.

TABLE 1.

SCREEN ANALYSIS OF CRUSHER PRODUCT WHEN ROLL SETTING IS 7/8 INCH.

Size Fraction inches (square)	Yield.		
	Fractional lb.	Fractional %	Cumulative %
+2	125.5	1.25	1.25
-2 + 1½	1305.5	13.04	14.29
-1½ + 1	2421.0	24.18	38.47
-1 + ¾	1701.0	16.99	55.46
-¾ + ½	1101.0	11.00	66.46
-½ + 3/8	513.5	5.13	71.59
-3/8 + ¼	778.5	7.78	79.37
-¼ + 1/8	733.0	7.32	86.69
-1/8 *	1333.0	13.31	13.31
Total	10012.0	100.0	-

-1" Pea-duff, % of total 61.53

-¼" in Pea-duff, % of Pea-duff 33.5

* Includes 188.5 lb. lost during screening.

DISCUSSION:

From a sizing point of view, the performance of the crusher when operated with a roll setting of about 7/8 inch appears to be quite satisfactory for the production of small coal. Thus the crushed coal contained only about 14% of cobbles, (or oversize material) and it contained some 61.5% of pea-duff, the principal product desired. The duff content of the pea-duff also appears to be acceptable for power station consumption.

Comparing the data in Table 1 with those contained in Table 3 of Report No. 17 of 1952, it will be observed that reduction of the roll setting from 1¼ inches to 7/8 inch resulted in a decrease in the cobble size from about 30% to 14%. The pea-duff content of the product showed a corresponding increase (i.e. from 46.8% to 61.5%) while the nuts proportion remained almost constant. It will also be observed that, as predicted, the duff content of the pea-duff remained reasonably constant despite the increased yield of pea-duff.

Since the roll setting was only 7/8 inch the relatively high yield of plus 1 inch material (and particularly plus 1½ inches material) comes as a surprise. A similar characteristic was observed in the case of other roll settings (Table 3 of Report No. 17 of 1952). This fact may be an indication that the roll springs are not stiff enough for Van Dyksdrift coal (and possibly for several other South African coals). If stiffer springs are fitted it is probable that a smaller product would be produced at a constant roll setting. What the influence of the stiffness of the springs will be on the size distribution of the product is not known but it may be worth investigating. If it should be decided to fit other springs care should be taken that the length of the spring is sufficient to permit the roll to clear lumps of stone which may be present in the feed from time to time. The maximum displacement of the existing springs is

relatively/.............

relatively small and it may be worth considering to increase it.

The test indicates that the power consumption per ton of coal crushed to the desired size is liable to be of the order of 0.65 h.p. for minus 6 or 8 inches lumps and

0.82 h.p. for minus 10 or 12 inches lumps.

The latter value agrees very well with that predicted from the previous tests. If a 150 h.p. motor is fitted, it should thus be possible to deal with about 180 tons per hour of rounds and cobbles without difficulty.

Generally speaking, the present test confirms the conclusions previously drawn from the preliminary tests.

The crusher roll is at present fitted with manganese steel segments. It has been found that these segments wear relatively rapidly when operating with small roll settings (about 1½ inches). It is suggested, therefore, that the manufacturers should be informed and asked whether they can offer the segments in some other material which would have a longer life. Possibly cast steel segments may prove more suitable.

On account of the small potential movement of the existing roll springs, they are frequently fully compressed when hard material passes through the crusher. It is conceivable, therefore, that this may be an important contributary cause of the rapid wear of the segments. It is considered, therefore, that the question of modifying the springs should receive early consideration.

When the new segments were fitted and the roll and shoes were aligned it was found by the Colliery Engineer that the spacing between the grooves in the old breaker plate shoes varied substantially. The spacing of the grooves in the new shoes is reasonably constant. This may account to a large extent for the

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fouling of the slugger teeth which was previously experienced. When ordering replacement segments and shoes, it should, therefore, be clearly stated that the crusher is to be used for the production of small coal.

(Sgd.) DR. P.J. v.d. WALT.
<u>SENIOR TECHNICAL OFFICER</u>.

16th October, 1952.
P.v.d.W./MT.