A CONTRIVANCE FOR EXPEDITING THE PLACING OF CONCRETE IN A VERTICAL SHAFT COLLAR.

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Since this short article is intended to describe the method of handling concrete at the Venterspost shafts, it is not necessary to allude to the ancillary work of reinforcing, form work or concrete mixing in detail.

The two shafts are identical and measure 36 ft. 3 in. by 12 ft. 6 in. inside the concrete collars to provide for six compartments. At the outset the depth to which the collars would need to be carried was doubtful, for although the approximate distance to the rock head was known, it was uncertain to what extent leaching of the dolomite had taken place.

Actually reinforced concrete walling had to be carried to a depth of 325 ft. at No. 1 shaft before the ground was sound enough to stand unsupported except for the normal timbering, whilst at No. 2 shaft concreting has been continuous to its present depth of 268 ft.

With this uncertainty as to the volume of concrete to be placed, no special arrangements were made for the handling of aggregates or concrete. The shafts are served by four temporary winches with a rope speed of 240 ft. per minute, and hoisting is done with 15-cu. ft. buckets.

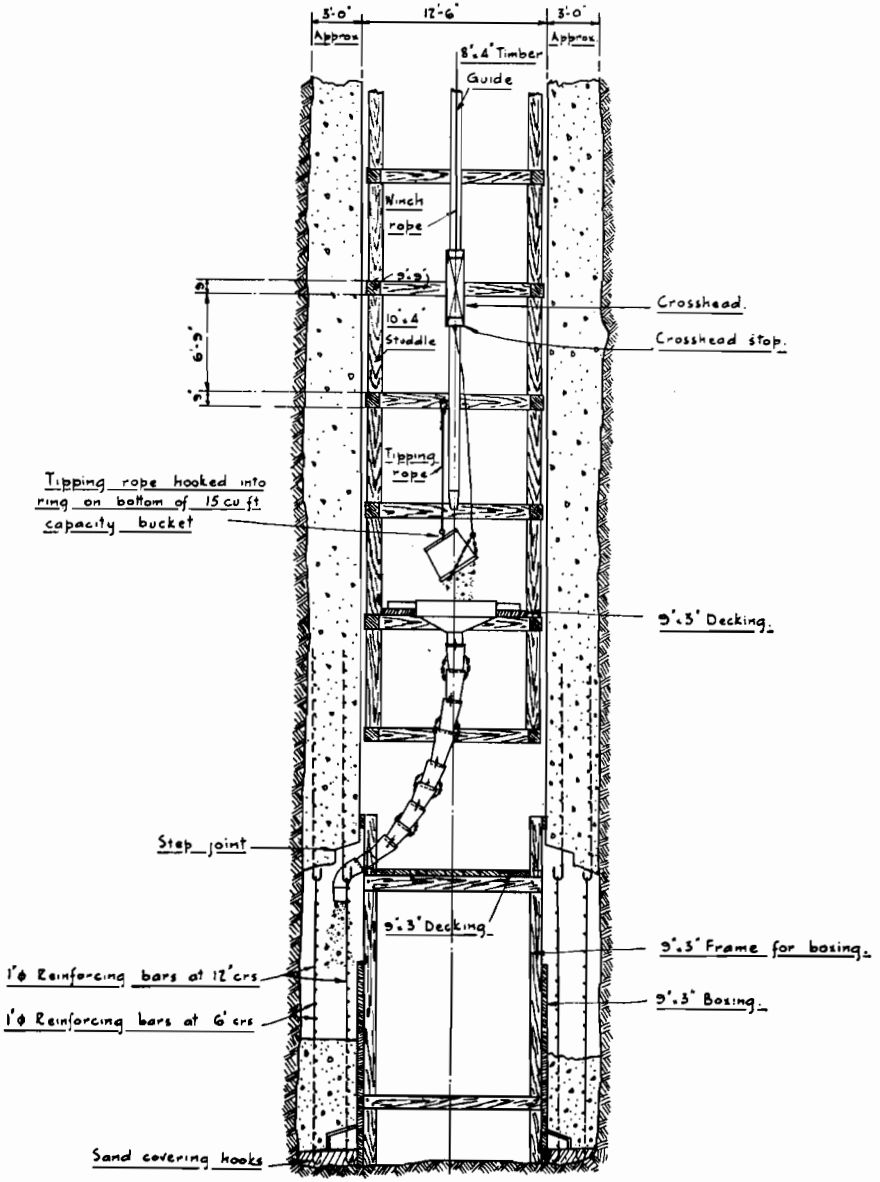
Surface Layout.—The buckets are mounted on cocopan chassis both for the disposal of rock in the precincts of the shaft and for conveying concrete from the mixers.

The mixers selected were six in number, petrol-driven, and tilting, and of 6-cu. ft. capacity dry mix, giving about 4⅓ cu. ft. of mixed concrete. The reasons for choosing this size were :—

1. It is a size in very common use, readily obtainable and easily disposed of.
2. Their portability enabled them to be transferred from one shaft to the other with facility.

Objections to the type may be enumerated :—

1. Excessive labour required to charge the machines with 1-cu. ft. measuring boxes in their elevated position.
2. Slowness in charging by making seven passes with measuring boxes to get the 1 : 2 : 4 concrete mix.
3. The cost of petrol driving so many small units as against electrically driving say two ½-cu. yd. mixers.



ARRANGEMENT OF STEEL CHUTE FOR PLACING CONCRETE IN VERTICAL SHAFT COLLAR.

FIG. 46.

Many prominent engineers debar the use of spouted concrete on two grounds :—

1. There is a tendency to make the mixture too wet in order to secure easy spouting—this detracts from the strength of the concrete.
2. The aggregates are inclined to segregate by the stone over-riding the mortar, this being particularly marked when the aggregate is large and not evenly graded.

At Venterspost the first objection has not been apparent because of the steep descent of the concrete in the spouts and the use of an iron rod to assist the passage of stiff concrete from the tipping trays into the spouts.

The second objection has, to a very large extent, been overcome by the use of the deflecting half-bends at the bottom of the spouts, but nevertheless rather more care is required in puddling the concrete when it is deposited behind the formwork.

Speeds of Placing.—The groundwork is excavated to admit a reinforced wall of 36 in. minimum thickness and in the earlier stages owing to soft ground it was only possible to excavate lengths of 7 ft. 6 in. before walling. Latterly 11 ft. 3 in. has been possible owing to the increase in the amount of solid rock encountered.

Using the same labour force of approximately 60 natives, the rate of placing concrete under the lashing method first described averaged 10 cu. yd. per hour, whereas with the spouting method placing is now carried out at the rate of 15 cu. yd. per hour.

Another feature worthy of mention is that the wooden forms are vibrated near the points of deposition. The necessary vibrations to the forms are given by light jackhammers or pneumatic chipping tools, and the general effect is to cause the concrete to " flow," thus reducing honeycombing to a minimum and producing denser, and therefore stronger, concrete.

T. H. L. Paull : It is my privilege to be Mr. Allen's neighbour and I know something of the difficulties that he has had to overcome, and any of us who are called on to sink shafts in country similar to that at Venterspost will always be grateful to Mr. Allen, who must be regarded as the pioneer of this class of shaft-sinking.

The setting of the collar of the new No. 3 north (circular) shaft at Randfontein presented no difficulties as Black Reef quartzites practically outcropped at the site chosen for the shaft. With the collar were incorporated the four foundations for the main legs of the headgear, the whole mass being 8 ft. above ground level. The shaft being circular, the main spouting pipe was suspended from a gantry down the centre line of the shaft and the concrete conveyed to the shaft side by means of a radial pipe attached by a swivel to the main spout which was shortened from time to time as the concrete advanced. The gantry was constructed over the collar and the headgear foundations at a height which allowed for the completion of the job and was connected to the concrete mixers by means of a trestled ramp. The inside shuttering consisted of mild steel tubbing which was constructed for the purpose of lining the shaft with concrete. The main dimensions are shown on Fig. 48.

The mixers are grouped in two sets of three mixers, so that all can discharge simultaneously into the sinking buckets and thus reduce delays.

In front of the two groups of mixers and between the mixers and the shaft are four turntables so that buckets may be switched to any of the four compartments, though in practice it was found that only three winches were needed for concrete, the fourth being reserved for riding and stores.

Underground Handling Arrangements.—During the early stages of collar construction it was customary to dump each bucket of concrete on to a platform supported by the transoms of the form trestles, the dumping being effected by attaching a fast rope to a ring on the under edge of the bucket. The concrete was then lashed behind the forms.

Objection No. 1 soon became manifest and with the standard labour of a sinking shift the best output of the mixers and winches was not being realized. It was with the object of economizing labour and speeding construction that this underground lashing was eliminated, and this article describes the measures adopted.

The economic features of spouting cement are undeniably attractive. In a shaft one has conditions ideally provided without recourse to the elaborate towers seen in surface construction, and in public works.

By tipping the buckets of concrete just sufficiently high in the timbered portion of the shaft and providing suitable spouting, the concrete may be gravitated to any point of the shaft. With this object in view the undermentioned appliances were constructed on the mine.

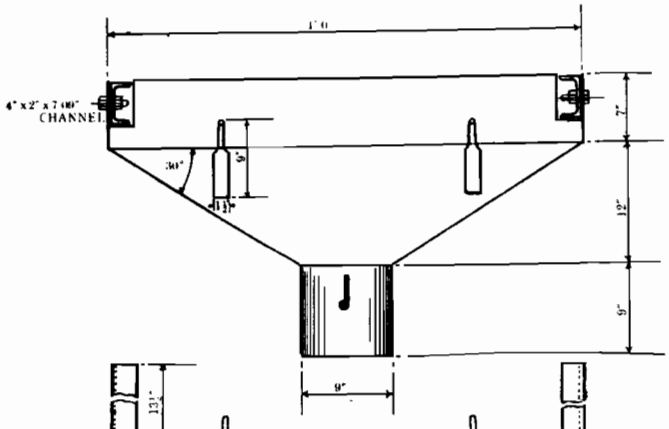
Tipping Trays.—These measure 4 ft. square at the top and are truncated to a 9 in. circular section of spout. They are made from $\frac{1}{8}$ in. welded plate and supported on timbers in the shaft by two projecting channels of 4 in. by 2 in. The angle of the truncated portion is important and a slope of 30° is probably the most satisfactory, for with greater angles, concrete of the right consistency tends to pack and bridge the outlet.

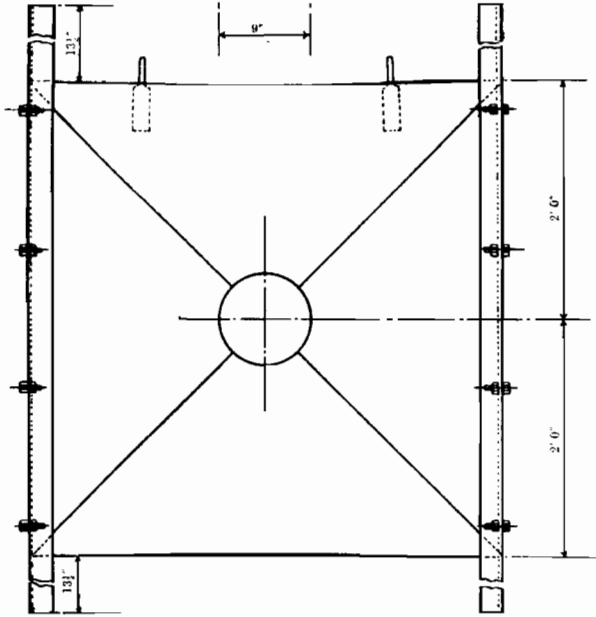
Three such trays are used and are mounted 15 ft. to 20 ft. above the desired point of discharge. On the shaft setts above, tipping ropes with hooks are secured, which engage rings fixed to the under edge of the buckets.

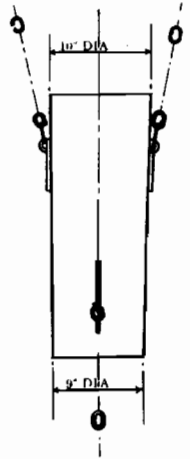
Spouting.—This consists of a number of slightly tapered pipes 10 in. in diameter at the top end and tapering to 9 in. diameter at the base and for convenience the pipes are 2 ft. 3 in. long. The pipes, which are made from 8 gauge steel sheet welded at the vertical joint, are joined together by short pieces of $1\frac{1}{2}$ in. by $\frac{5}{16}$ in. link chain, The effective length of each pipe is reduced to 2 ft. by inserting the narrower end or spigot into the wider top or faucet of the pipe below.

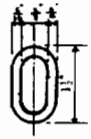
The two hooks at the faucet which engage the chains of the section above are placed at right angles to the two chains fixed on the spigot end, thus the line of pipes provides a universal joint enabling the spout to be moved in any direction at will.

At the lower end of the spout a half-bend (45°) is attached, the object of which is to check the tendency for segregation of the aggregates and deposit the whole charge of half a cubic yard more or less vertically into the forms.

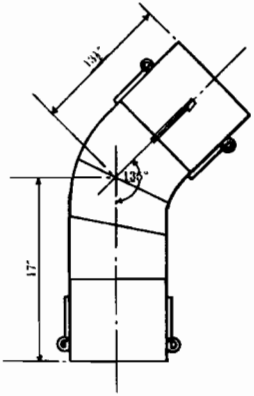








DETAIL OF LINK



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STEEL CHUTE FOR PLACING CONCRETE
IN VERTICAL SHAFT COLLAR

FIG. 47.