the lift under these conditions, on account of the difficulty in arriving at the actual horse power used by the compressor; but in both cases these lifts are regarded as eminently satisfactory by the managers.

It appeared to the writer that under the last named conditions the efficiency of this lift was much greater than had hitherto been estimated. The following data, however, taken from observations at the Guests Gold Mine do not show a high efficiency This was probably due to the fact that the compressor was a very crude one, and that being above the capacity required, the back pressure of air may have averaged less than the figures taken. At this mill, of 20 stamps, there is 11.25 cubic feet of pulp, containing 93 lbs. sand, delivered per minute. This was elevated 28 ft., equal to a lift of 21,000 lbs. 1 ft. per minute. Theoretically this would require 11.25 cubic feet of air, at a pressure of one atmosphere (or 22.5 cubic feet atmosphere) delivered to the lift per minute, and this would work out at the equivalent of one horse power. But as the capacity of the lift was considerably greater than was required, the surface of the pulp was generally about 4 ft. below the top of the well, and the lift air gauge showed a pressure of from 9 lbs. to 11 lbs. This lift has a 4 in. column air inlet through 1 in. pipe; depth of well, 28 ft.; height of lift, 27 ft. The compressor took 50 cubic feet of atmosphere per minute, which, at 11 lbs. pressure per square inch, was (approximately) 32 cubic feet, and as that was brought from the air compressor cylinder directly into contact with the cold pulp, there would be a considerable loss due to the lower temperature. This had not been accurately determined, but he estimated it at about 14 per cent. (on the basis of 18 per cent. of one atmosphere), and, making allowance for that, they would have 29.7 cubic feet of air at the temperature of the pulp. Therefore, the volume of compressed air in the rising main would be at 2.64 to 1 of pulp—an average compression of 6 lbs. of air. At 11 lbs. pressure the average load against the compressor piston was 8.914 lbs. per square inch, which would work out in the compressor employed at 2.165 horse-power. This was employed to lift (approximately) 21,000 lbs. 1 ft. per minute, showing an efficiency of only 32 per cent. of the power required for the compressor.

The principal points in favor of this system are:—

1. Cheapness of installation.
2. Absence of wearing parts.
3. Uniform continuity of operation.

The cost of installation involves the sinking of a well or bore hole to the depth required to be lifted, and an ordinary pipe of the size required from the bottom of the well to the delivery point, and an air pipe from the compressor to the bottom of the delivery pipe. When the rising column was of a size proportionate to the volume required to be lifted, there was very little sign of wear on the pipes, except on the top bend, which wore out on top in about six months.

Regarding uniformity of operation, when the installation was once made, there was no chance for anything to go wrong. Pieces of stone, which might be washed into the well through the breaking of screens, were carried up through the pipe without difficulty.

At both the mines mentioned there had been no stoppage during the last nine months from any cause due to the faulty working of the elevator. At the Guests mine the pipe was vertical to the required height, and thence horizontal over a series of vats; but the rising column may also be taken in a sloping direction.

As the efficiency of all compressors decreases in proportion to the pressure required, it is evident that the pneumatic elevators will give greatest efficiency where the lift required is not very high. In cases where the lift required is not excessive, the cheapness of installation, coupled with the unfailing continuity of operation, may be found to be strong recommendations for employing this form of elevator.

The Refining of Lead Bullion.*

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By F. L. PIDDINGTON.

In presenting this account of the Parkes' process of desilverising and refining lead bullion the writer claims no originality, but hopes that a description of the process as carried out at the works of the Smelting Company of Australia may be of interest to members; it is possible, also, that the subject may borrow some additional interest from recent developments on these fields.

The Parkes' process may be conveniently summarised as follows:—

1. Softening of the base bullion to remove copper, antimony, etc.
2. Removal of precious metals from the softened bullion by means of zinc.
3. Refining the desilverised lead.
4. Liquation of gold and silver crusts obtained from operation 2.
5. Retorting the liquated alloy to drive off zinc.
6. Concentrating and refining bullion from 5.

Softening is done in reverberatory furnaces. In large works two furnaces are used—copper, antimony and arsenic being removed in the first and antimony in the second. The size of the furnaces is naturally governed by the quantity to be treated. In these works (refining some 200 tons weekly) a double set of 15-ton furnaces were at work. The sides and ends of these furnaces are protected by a jacket with a 2 in. water space, the jacket extending some 3 in. above the charge level and 6 in. to 9 in. below it. The furnace is built into a wrought iron pan, and if the brickwork is well laid into the pan there need be no fear of lead breaking through below the jacket. The bars of bullion (containing as a rule 2 to 3 per cent. of impurities) are placed in the furnace carefully to avoid injuring the hearth and melted down slowly. The copper dross separates out and floats on top of the charge, which is stirred frequently to expose fresh surfaces. If the furnace is overheated some dross is melted into the lead again and will not separate out until the charge is cooled back. However carefully the work is done some copper remains with the lead and its effects are to be seen in the later stages. The dross is skimmed into a slag pot with a hole bored in it some 4 in. from the bottom; any lead drained from the pot is returned to the charge. The copper dross is either sent back to the blast furnace direct or may be first liquated. By the latter method some 30 per cent. of the lead contents of the dross is recovered in the refinery. Base bullion made at a customs' smelter will often vary greatly in composition and it is, therefore, difficult to give any hard and fast figures as to percentage of metals in the dross. As a rule our dross showed 65 to 70 per cent. lead, copper 2 to 9 per cent. (average 4 per cent.), gold and silver values varying with the grade of the original bullion, though it was difficult to detect any definite relation between bullion and dross. It was, however, noticed that gold and silver values increased with the percentage of copper.

Immediately the copper dross is skimmed off, the heat is raised considerably and very soon a tin (and arsenic, if present) skimming appears. It is quite "dry" and may be removed in an hour or so. It is a very small skimming and the tin not being worth saving, is put with the copper dross.

The temperature is now raised again and antimony soon shows in black boiling oily drops, gathering in time into a sheet covering the surface of the lead. When the skimming is about ½ in. thick, slaked lime, ashes or fine coal is thrown on and stirred in. The dross soon thickens up and may be skimmed off easily. This operation is repeated

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