Mr. President and Gentlemen.

Deep Shafts.—In Victoria, at the present time, we have very nearly 30 shafts which range in depth beneath the surface from 1000 feet to 2409 feet. Many of these shafts are now being sunk to still greater depths at the annual rates of from 45 to 220 feet, and many more shafts are as rapidly approaching the depth of 1000 feet, and it may safely be stated that in a few years shafts deeper than 1000 feet in depth may be counted by scores.

Speed of Sinking.—The average speed of sinking five shafts, of which I have the particulars, was more than 140 feet during the year 1883, and it should be mentioned that this was the speed of sinking below 1000 feet. At this rate, in another decade many shafts will have reached or passed below 3000 feet from the surface.

Contemplated Depths.—That such depths as that last mentioned are contemplated may be more readily understood by my quoting one example. The Lazurus Company, New Chum Reef, Sandhurst, is now engaged cutting out an engine-chamber at the 1000 feet level. This chamber is being constructed for the reception of a powerful winding engine. The shaft is within a few feet of 1600 feet in depth, and is in course of being sunk at the rate of about 4 feet per week.
Winding in Deep Mining Shafts.

But, for the purposes of this paper, shafts of from 1000 to 2000 feet in depth will suffice, and my remarks on winding, which apply to them, will apply with still greater force to deeper shafts.

Winding Engines.—The most powerful engines now being erected for mining purposes are those intended for winding, which displace the smaller old engines that have served the requirements of their day, and are now no longer fit to cope with the demands for more power and speed, created by the rapid development of deep quartz mining.

The subject I desire to submit to the consideration of this Association of Engineers is one of growing importance to the mining industry, and one that will not inappropriately follow the "Paper on Tramways," especially as regards that portion of it which treats of wire cable haulage.

Winding.—I think we are perpetuating the present system of winding in our deepest shafts beyond the limits of its capacity for usefulness and economy, and that the time has arrived when we should review it, and replace it with a system more suitable to the requirements of the rapidly-developing circumstances.

The—what will I call for the objects of this paper—old system now in use is wrong in principle for shallow depths, although its shortcomings are not so manifest when so used as they are when applied to very great depths. For example, say one cage is at the surface and the other at the bottom of a shaft which is 1500 feet in depth. When winding up, the cages balance each other, being of equal weight; but there is the weight of 1500 feet of rope in the shaft attached to the bottom cage, which weighs, say, 2 pounds per foot, or nearly equal to 1 ton 7 cwt., added to which, when quartz is being hauled, is the weight of the quartz, say 7 cwt., the tram-waggons in the cages counterbalancing each other.

Here, then, we have 1 ton 14 cwt. more weight hanging on the pulley at the poppet-heads of the bottom cage than hangs on the pulley of the top cage. The load on the engine is at its maximum at the start, as it must then also overcome the resistance due to the inertia of the whole mass, but this load steadily diminishes as the cages ascend and descend until the weight of the rope paid out to the descending cage equals the load in the other compartment of the shaft. Then the descending cage, &c., begins to outweigh or overbalance the ascending cage and rope, and necessitates the use of engine or break force to counteract the rapid transfer of weight from the ascending to the descending cages. A forcible example of this interchange of weight in winding shafts may be observed on the goldfields, where cage
horse whims are used to wind from considerable depths. Conical drums and counter-balancing loads may be used to modify this difficulty, but the former has not often been adopted, and the latter device never, so far as I am aware, in this colony.

Where flat ropes are used, they coil upon themselves, and the drums in such cases may therefore be said to increase and decrease in diameter with the depths, or with the amount of rope wound or unwound, and necessarily the speed of the cages, and the leverage also, increases or decreases therewith.

In our deepest shafts, however, round wire ropes on flat drums prevail, and they are not compensating like are the flat ropes just mentioned. I have remarked that the weight of a rope in a 1500 feet shaft was about 1 ton 7 cwt. Now, if this shaft was sunk to 2000 feet in depth, the rope and load would increase in weight to a little short of 2 tons 3 cwt., and would increase, proportionately, for still deeper shafts. I need not, however, dwell on this point any further, nor is it necessary that I should more than mention that the constant stopping and starting of winding engines is as much a constant source of expenditure of power or money as is the pulling up and starting of railway trains.

Then we have another source of expenditure in the keeping the engine idle whilst cages are being landed, emptied, and returned.

Enough has been said to show that our system of winding in deep shafts is wasteful in principle and unsatisfactory.

The ever-varying and considerable difference in the weight of rope in the two compartments of a shaft, together with the load, introduces another element worthy of consideration, viz., the danger of overwinding where the transfer of weight is so rapidly exchanged, and reaches its maximum when the one cage is nearing the bottom of the shaft, and the other cage is rapidly approaching the surface and the poppet heads. All these facts are, no doubt, well known.

SUGGESTED NEW SYSTEM OF WINDING.

In thinking over these defects of the system of winding now in use in Victoria, the idea occurred to me that an endless flat rope, turned over a large sheave or drum, fixed above the level of the surface, and over another smaller sheave at the deepest level of a mine, would obviate a great many of the defects connected with the present system.

FLAT ENDLESS ROPES.—I will now briefly describe the outlines of the new system of winding, which I suggest could be more advantageously adopted than that now in general use.

It will consist of a flat steel endless rope, running over a large sheave or drum, say, 20 or more feet in diameter, fixed at the
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surface. The axle of this drum will lie immediately over, and in line with, the dividing timber between the two winding compartments of a shaft. In this rope a pair of strong iron hooks will be securely fixed, say, at every 200 feet, the top hook of each pair having its hook pointing upwards, and the lower one reversed. Each pair of hooks will be eight or more feet apart.

One half of this endless rope will be in each winding compartment of the shaft, counterbalancing each other.

A sheave or pulley at the bottom of the shaft may be necessary if the weight of the rope is not sufficient to give it the required tension.

CAGES.—Cages should be dispensed with, excepting for the raising and lowering of men.

Trucks.—The carriage and wheels of trucks ought not to be raised and lowered with the body and its contents. Two hinged strong iron bows should be attached to the front and back of the body. On the top of the carriage is a rim of iron surrounding two sides and one end, so made as to fit the bottom of the body of the truck, and just sufficiently strong to keep it in position when running empty. The bows attached to the front and back of the body of the trucks can be hooked up against the ends of the body when the trucks are running; but when the trucks reach the shaft they are dropped down, the front one projecting into the shaft against the rope, in order to be caught by the next upward passing hook. When so caught, the body is lifted off the carriage of the truck and carried up the shaft. By running the carriage into a fixed dock at the shaft, I think the carriage could be prevented from being drawn into the shaft. If this could not be prevented by some simple plan, then I would attach the body of the truck to the carriage, and let the complete trucks be hoisted and lowered, although by doing so we add to the weight on the rope over 1 cwt. for every truck. Trucks must be provided with strong iron covers to prevent quartz, &c., from falling out during transportation in the shaft.

Guides.—Guides will be placed in the winding compartments of the shaft just the same as they are now, excepting that those in one compartment lead up to one side of the drum, and those in the other to the opposite side. In place of having ears or wings fastened on the trucks, I would have them attached to a light steel or iron framework, which should be fixed at the back of the flat rope. This framework need only consist of two light, flat, steel or iron bars running behind, and fastened to the top and bottom hooks, and having ears at their ends to partly pass round the guides in the usual manner. The ends of these bars will be
connected by two light, flat steel or iron bars, crossing each other so as to stiffen the framework.

**Landing Trucks.**—The drum at the surface will have a sheave in its centre. Supposing the complete truck to have reached the drum at the surface, it is there carried round with the drum until it turns over the centre, when its weight and impetus forces it forward faster than the drum; the back bow catches on the reversed hook, the front bow is thus freed from its hook, the wheels and truck run on to a couple of tram-rails leading to a surface tramway, and the back bow is freed from its hook by the revolution of the drum and sheave. The connecting couple of tram-rails are then raised off the drum.

**Empty Trucks.**—Empty trucks are brought to the opposite side of the drum and hooked on, turn over the drum, are caught and suspended by the hind hook and bow, and, when they reach the level required, a plank of wood fixed at a high angle upwards in the shaft is dropped forwards so as to intercept the wheels of the tram-waggon and run it into the level. The bow slips off the hook as the rope passes downward below the level, thus detaching the tram-waggon, and the plank is withdrawn from the shaft until additional trucks are required.

By this proposed system the following advantages will be obtained over the system now in vogue:—

1. There will not be such irregular and excessively heavy strains on the rope and engine—through successive starting and stopping without counterpoise—consequently the life of the rope will be considerably increased, and the power of the engine and boiler decreased.

2. Winding will be continuous, therefore there will be an increased output from the shaft at a decreased cost per ton.

3. Several levels can be drawn from at the same time.

4. No expensive poppet-heads will be required, and no overwinding accidents can happen.

5. Shifts of men can be changed in less time than is occupied now.

6. The speed of the engine and rope will be diminished and become regulated, resulting in economy in steam and wear and tear.

In submitting this outline of a proposed new system of winding in deep mining shafts, I have not attempted to perfect it in details, but merely to give my first crude ideas of its possibilities, believing that this Association will assess the proposed system at its proper practical value, point out its defects, and make suggestions for its improvement.
Winding in Deep Mining Shafts.

I think you will agree with me that there is considerable room for improvement in the mode of winding at present adopted in our deep mines, and, whatever may be the outcome of the system which I have briefly sketched in this paper, I hope it will at least be the means of directing attention to the urgent demand which now exists for an improved system of winding in deep mining shafts in Victoria. A trial, at least, should be made of the effects of a counterbalancing rope attached to the bottoms of cages and connecting them. An old rope might be used for this purpose, and the experiment would cost only a few pounds, which would, most assuredly, be saved in wear and tear and steam or firewood in a very short period of time.

Since writing the foregoing remarks, I have observed that the endless rope system has actually been adopted in Belgium, and is in work in the Bestwood Colliery, near Nottingham, where the rope is said to pass through the cages, and attached thereto by clamps. But I have not been able to obtain any further information or details of its working beyond what I have just stated, and that a large sheave is fixed over the shaft, the two cages working up and down in each compartment in the usual way as is done now in Victoria. In these cases, in fact, the one-half of the endless rope is merely used as a counterpoise to the other half, and is not adapted for continuous winding as I have suggested.

APPENDIX A.

<table>
<thead>
<tr>
<th>Weight of cages used in Victoria, about</th>
<th>Cwt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>trucks</td>
<td>10-12</td>
</tr>
<tr>
<td>&quot; carriage and wheels</td>
<td>3 1/2</td>
</tr>
<tr>
<td>&quot; quartz in trucks</td>
<td>1</td>
</tr>
</tbody>
</table>

Speed of cages in deep shafts, 500-1100 feet per minute, or only about 6-12 miles per hour.
Library Digitised Collections

Author/s: Nicholas, William

Title: A new system of winding in deep mining shafts (Paper)

Date: 1885

Persistent Link: http://hdl.handle.net/11343/24231

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