DISCUSSION.

Mr. R. Morse said his remarks, less from the scientific than the utilitarian and commercial standpoint, would be confined to that portion of the paper which treated of machinery of modern type and now in use. Lifts that were obsolete, and performed no further uses in the community, could well be allowed to rest in peace. They consisted of worn-out garments, which, as the poet said—

> "Are good in their day, and customs and forms
> While they answer
> The need which called them to being, and for the nonce
> Endowed them
> With life; but their end being accomplished, disowns them,
> And rightly abandons."

Nevertheless, New South Wales ought to be thankful to the men who had contributed toward the uses which those, in many instances, crude labour-savers performed.

And it could readily be recognised, he thought, that Mr. Selfe had done a lion's share in the work. His (the author's) fertile brain had produced many monuments which would bear more lasting testimony to his native ability, his industry and perseverance, than the most flattering epitaph on the most costly tombstone his friends might devise and erect over his remains.

But coming more directly to the question, he held it as an important maxim that the chief aim of all designers should be to obtain the maximum amount of use with the minimum of expense, machinery and friction, while at the same time exercising due regard to safety. *Use* was the end of, or reason for, creation. The existence of anything of which a use could not be predicated was not justified.

The bearing of these remarks would be better apprehended further on, when touching upon the too common practice of erecting machinery for the machinery's, and not for the user's sake. Indeed, it was illustrated in the first item of practical importance in the paper. The passage read thus:—"There are single lifts at work which have cost more than all Messrs. Young and Lark's original plant, including four lifts with their engine, pumps and accumulator complete." The sentence did not convey its meaning too clearly; but he understood it to be, that in consequence of the multiplication of machinery between the power and the load, or between the man who wanted a certain work done and the work itself, more than one lift had cost as much as five. Which was equivalent to saying, that if a person wished to go to Balmain, he couldn't do better, under the improved conditions of modern times, than to go *via* the North Shore ferry. Or was almost on all fours with a doctor saying that, if you wanted to keep healthy, not to trouble about the ordinary laws of health, but get vaccinated. It was going a long and expensive way round to accomplish a given end or use, a fault philosophers and scientific people were too often guilty of. It, too, was the cardinal fault lying hidden in the Direct-Acting Lift which was referred to. Hidden, because one was apt, when admiring the beautiful machinery in motion, to forget that, after all, it only had work to do that was being done every minute of the day by omnibuses and other vehicles, having machinery proportionate to their use. There was the danger of mistaking the machinery for the end instead of the means.

The author said in another place:—"The result of wide-spread observations was to impress him with the great superiority of the Direct-Acting Hydraulic Lift, both for safety and smoothness of working, in all cases where capital was available for the increased first cost necessary for sinking shaft, &c." William Cobbett, in his *Grammar of the English Language*, was very caustic in his criticism on the prevalent use of the Latin

expression "&c." Where it was used by the author, it might be substituted by a costly piece of work, much more costly than that of sinking the shaft. It represented a piece of machinery which, if figured out at £27 per ton all round, including seven tons of dead weights, would cost £420—a sum equal to that required to supply and erect a well-equipped Suspension Lift, which would be referred to further on.

The "safety" alluded to was a mere word when comparing the lift with the Suspended type. In fact, its many hidden parts, many of which were in water, rendered it an object of tender solicitude on the part of the engineer, who could only occasionally get glimpses of the ravages made upon its vitals by the chemical action of soil and water.

A striking instance of this danger was afforded in the collapse of both of the Direct-Acting Lifts in the Australian Property Buildings, corner of Elizabeth Street and Flinders Lane, Melbourne. They had the highest rise of any lift in Australia, and were now being replaced with Suspended Lifts of modern type. One was to be constructed on the water-saving principle. The engineers who were replacing the lifts wrote as follows respecting the accident:—The whole cause of the collapse of the Direct-Acting Ram Lifts at the said buildings was the corrosion of the metal, both cast and wrought iron, through coming into contact with the mineral water in the deep shaft. The water had the effect of eating away the wrought-iron bolts and of converting the cast-iron into a material resembling plumbago wherever the skin had been taken off. The lifts worked splendidly up to the time the first one gave way; the second instantly followed from the falling machinery of the first. The seat of the trouble is far below the water level, and we do not intend to go to the expense of searching for it. Three years ago new bolts were supplied to all the flanges below the water-line, cast-iron shields were made for every joint, and were cast up with Portland cement in order to preserve the bolts from contact with the water. We

have samples of bolts which have been reduced to one-third their diameter by a little over twelve months' action of the water."

So much for the safety of these lifts. The "smoothness of working" claimed on behalf of the Direct Lift was not a matter that need be noticed at length, even if it were more marked than in a Suspension Lift, which he was not prepared to admit. When considered in connection with other vehicles that carried passengers much greater distances, its importance would be apparent.

Take as an example two lifts of modern type, made to carry similar loads through similar spaces. And the conditions surrounding the recently erected Direct-Acting Lift at the Public Works Office as regards pressure, load and rise.

First, the Direct Lift. The car containing the load of the former was supported upon a ram, which, with its cylinder, had to be accommodated in a shaft of a depth rather more than equal to the lift's travel; while usually a second large hole, of less depth, had to be provided to receive, according to the pressure used, either an immense reducing valve, or an intensifier, called a balance. Now, these holes in Sydney had usually to be sunk in rock, and, therefore, were very costly. The balance weighed 18 tons, and occupied about 35 ft. in a vertical direction, and 5 ft. square horizontally, except where the compensating weights come. These required about 7 ft. x 5 ft. in addition. The power water entered the operating valve worked by the car attendant, passed into the balance and completed its work by acting upon the power ram. The area of this ram was so adjusted to that of the displacement ram that the hydraulic connection between the latter and the car ram was either raised or diminished in pressure as compared with the pressure of the power water.

Members would, no doubt, think, after hearing the above description, that the Direct Lift was the most indirect of all. And the question may naturally occur to many, "Why the

necessity for all this trouble to alter the pressure?" Why not take the initial pressure *direct* into the work?

It was an unalterable natural law, that any diversion of a force from a straight line must be accounted for by the existence of another force, and could only be indulged in at the expense of efficiency.

In the lift in question, it was, of course, done to accommodate the car ram, which, being a loaded column of great length, must have a certain amount of "body" to enable it safely to perform its duty. In the majority of cases a ram of 2 in. or 3 in. diameter could be sufficient for an initial pressure of 700lbs. to the square inch. But then it would bend like a whip handle. On the other hand, an initial pressure of 30lbs. to the square inch would require the ram to be 10 in. or 12 in. diameter to enable it to receive sufficient statical pressure to lift the load.

The approximate cost of this lift might be put down, as follows:—

Sinking holes	£200	0	0
Direct ram with cylinder ...	200	0	0
Balance	420	0	0
Guides, Piping Valves and Car ...	150	0	0
Total	£970	0	0

It would thus be seen that the balance was by far the larger item in the general cost.

On the other hand, in the Suspended Lift, multiplied 4 to 1, the car was suspended from the bottom by *four* 2-inch steel wire ropes, each with a breaking strain of 11·7 tons, or capable of sustaining a load of 2¼ tons safely. This multiplied by the number, gave 9 tons that could safely be lifted, if necessary. But it need hardly be stated that when this size of rope was used, the load rarely exceeded 15 cwt., thus showing an absolute factor of safety with new ropes of 62·4 to 1. This was a margin sufficiently wide to allow of deterioration of

ropes. After leaving the car the ropes passed up over one or two head sheaves, then round three sheaves connected with machine, two of which were operated by the ram, and one revolved in a fixed bearing placed at a convenient position, either on the head of the machine or on the head beams in roof. It was angled so as to allow of the lines being plumb. The sheaves were not less than 36 in. diameter at rope centres, and had carefully turned rope grooves. They revolved with steel spindles in gun-metal bearings. The ropes were attached to the car, through the safety gear which was always provided beneath upon a safety plank. Thus any deviation from equilibrium at once affected the safety apparatus to an extent which arrested the car. Sometimes, if the lift attendant was careless in operating the valve, the supersensitiveness of these gears caused them to hold the car in space, and afforded a preliminary taste of what might be expected, should a rope attain the remote possibility of breaking.

In this class of lift no shafts were required. The machine was bolted to the wall or floor trimmers in a position most convenient. Moreover, it performed its use with the least intermediate machinery, and, because it did this, and so came under the maxim laid down in the beginning of his remarks, he advocated its adoption in preference to the Direct Lift, which was double the cost.

Further, the cost for maintenance of the two types of lift differed greatly. The machinery of the Direct Lift with its three large stuffing boxes—one $14\frac{1}{2}$ diameter—entailed more outlay in oil, waste and packing, than the single cylinder and ram with one $4\frac{1}{4}$ in. stuffing box.

That this is so would readily be perceived. Finally, he knew of no advantage possessed by the Direct Lift, which was not also possessed by a good example of the Suspension type.

There were several other important features in the paper he would have liked to discuss, but feared he had already monopolized more than his fair share of the members' time.

A word, however, about the Pilot valve, which the author adds to the main operating valve with a view to reducing resistance to the hand of the attendant when using a starting lever in place of the orthodox handline. It was a good device, yet not without its defects as compared with other means of attaining a like end, together with relieving the pressure on the main valve itself, which the author's device did not do. This pressure in large valves was enormous, amounting from $1\frac{1}{2}$ to 2 tons, and must, necessarily, increase the wear and tear on the valve, and therefore, the expense of maintenance. This latter advantage was gained by attaching to the valve casing a cylinder open at the top, in which worked a piston connected to the main valve. The pressure acting on the underside of the piston relieved the pressure on the valve in proportion to the piston's area. This idea, in relation to hydraulic work, was thought of by Mr. William Curry, a gentleman well-known to most of the members as having an extensive knowledge of the subject. But, unknown to Mr. Curry, the device was adopted in railway practice upon the low pressure slide valves, and was illustrated in the Proceedings of the Institution of Mechanical Engineers for January, 1890.

In many respects, however, the author's arrangement had an advantage, in that the valve was unaffected by the fluctuations of pressure, due to the valve moving across the ports, as was the case with the valve above mentioned, which, in consequence, could not have its piston reduced to the limit desired.

A striking similarity to the author's valve would be noticed in the Blake pump; and to anyone acquainted with the construction of the latter, the former would be better comprehended.

No doubt, many other aspects of the paper would be treated by the members.

Mr. T. Dickinson considered that Mr. Morse in his remarks had shown that the safety claimed for the direct-acting type of lift had not so very much in its favour, and that the two elevators in Melbourne referred to, built at a cost of £6000, and

after a life of only twelve months the whole of the bolts were eaten away by the chemical action of the water. This was, of course, an isolated instance, and was due to that locality (Flinders Lane) being below the level of the Yarra, the water of the river being salt, and highly charged with sewerage matter, which attacked the iron and rendered its life very short. It was, however, only fair to state that the conditions in this case were very exceptional.

He believed that better service was obtained with the suspended type of elevator, and it was a most decided advantage to have all ropes, safety gear, &c., in such positions that they could at any time be freely examined.

It would be interesting to see the figures showing the relative efficiency of each type of lift.

The author had done more in improving elevators than anyone else that he (the speaker) knew of, either here or in England, and every credit was due to that gentleman for the results he had achieved.

Mr. J. S. FITZMAURICE wished to know the cost of fitting the author's type of valve and starting gear to an elevator. He preferred the suspended type of elevator, on account of the first cost being less, and less trouble to keep in order. The direct-acting lifts of the General Post Office required their glands packing every three or four months.

Mr. W. NAPIER stated that the direct-acting lifts at the Hotel Australia were in constant work for 18 hours per day, and the packing in the glands only required to be renewed about every nine months, and, on one occasion, it had lasted for 15 months.

Mr. NORMAN SELFE, in reply, said that he could not entirely agree with the remarks made by Messrs. Morse and Dickinson, as he considered that the first cost of a lift was not such a very important matter, as a man, with capital and a magnificent building, requiring an elevator would view the outlay at the cost per annum, and, viewed from this standpoint, it would be

found to alter the whole argument as laid down by Mr. Morse. It was a well known fact that there had been dozens of accidents in Sydney and Melbourne, some resulting in death, with suspension lifts. Of course this should not happen, but still it did. He wished to know if anybody could cite an instance of a death resulting from an accident to a direct-acting lift? Neither of the gentlemen named had stated that any one was killed by the accident that occurred to the lift in Melbourne, but they seemed to think that because it was erected in such a position that corrosion took place that it was a fault of the lift. With regard to the cost of working he had shown in his paper that the direct-acting lift, with all its parts, took more water than one of the suspension type to lift the same number of people, but he had also shown where there was a wonderful saving. The prices of everything should be gauged by the services rendered, and he considered that there was no comparison between the duty of the average Sydney suspension lift as against one of the types he had described. In reference to the valve he wished to state that it was applicable to any type of lift, and would cost from £8 to £10. He had first seen that type of valve working on board a steamer in 1855. As to all that had been said about the cost of packing glands, oil, &c., he considered that Mr. Napier's statement clearly proved that there was not very much in this point. He considered the great fault of the present day was that all supervision was being squeezed out of the lift business, and all idea of paying for professional advice in Sydney was practically at an end. His paper only professed to deal with the rise and progress of lifts in New South Wales so far as they had come under his notice, and nothing had been said against the position he had taken up, viz., that lifts had developed in Sydney. Mr. Dickinson was doing justice in saying that "Sydney stands equal to any place in the world in the lifts she has now." In conclusion, he desired to thank the members for the kindly hearing they had given him, and also the manner in which they had discussed his paper.