SAFETY MINING CAGES.

REPORT

OF THE

BOARD OF INQUIRY ON SAFETY MINING CAGES 1878-9;

TOGETHER WITH

PROCEEDINGS OF THE BOARD AND APPENDICES.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY HIS EXCELLENCY'S COMMAND.

By Authority:

JOHN FERRIS, GOVERNMENT PRINTER, MELBOURNE.

No. 31.
REPORT.

To the Honorable the Minister of Mines.

Sir,

The Board appointed by Order in Council of the 9th day of May 1878, for the purpose of investigating the subject of mining safety-cages, have the honor to present their Report. The Board were requested "to examine the several inventions for safety-cages brought under the notice of the Mining Department, and to report as to those which appeared the most effective for the purpose intended." Very soon after commencing their investigations the Board became impressed with the fact that the subject was of more than local importance, that it was one in which the safety of miners in all parts of the world was concerned, and that in order to arrive at a satisfactory result it would be necessary to elicit a free expression of the opinions held by the large class interested in mining operations throughout the colony.

For years past eminent engineers in Great Britain, Europe, and America have directed their attention to the subject of providing increased safety appliances for mining, thereby tending to diminish the risk attached to an occupation naturally fraught with danger. The lives of men in all the larger mines are now almost entirely entrusted to machinery, and, such being the case, accidents beyond the power of human forethought to prevent are, sooner or later, certain to occur. A prolific source of danger has been shown to exist in the ascent and descent of the shaft. The great depths to which mining operations are now carried, as well as the immense length of rope and the rapidity of motion between the surface and the bottom of the shaft, have severally added to the danger to which the underground miner is exposed. As a rule, the workings are carried on at a greater depth every succeeding year, necessitating a greater stretch of rope, and thereby increasing the liability to accident, not only as regards the breakage of ropes, but possible derangement of the winding gear, and the cages themselves. In such cases of accident the only chance of saving the lives of the occupants of a cage is by the instantaneous action of specially constructed appliances, and this can only be accomplished by resorting to machinery, which is, in turn, liable to derangement and consequent failure in a case of sudden emergency.

Human ingenuity up to the present time has failed to discover an invention which affords complete immunity from accident, but the various appliances that have been brought forward have had the effect of lessening the danger to which miners are exposed. In this colony the safety appliances have not been generally adopted, although special legislation has been enacted to compel mine owners to provide for the safety of their men while ascending or descending the shaft. At Sandhurst no less than seven different inventions have been brought forward within a period of as many years, but they have all presented one leading principle in common, i.e., levers drawn up and inward by the traction of the rope, and in a contrary direction by the tension of a spring, which tends to throw the levers outward upon the skids or guides, so as to press upon or into them with a force capable of stopping the fall of the cage in case of the rope breaking, or sudden descent of the cage after "sticking." Several of these inventions have been tested in actual practice, and in more than one instance with a successful result, but there has been no uniformity in the conditions under which they have been worked. Mr. George Collins Levey, in his report on the mechanical inventions shown at the Philadelphia Exhibition, gives some interesting information on the subject of safety mining appliances, from which it would appear that by some of the largest companies in England and other parts of the world the safety-cages have been discarded in favor of inventions considered more reliable, one of which, known as the "man-engine," has been brought into general use. The machinery required to work the man-engine is somewhat expensive, while the room required in the shaft proves a strong objection to the application of the invention to shafts of small size. Man-engines are all alike in principle. They are simply movable ladders, and are termed such on the continent of Europe. They consist of two strong beams or rods, hung side by side in the shaft of a mine. Each beam has platforms or landings, large enough for a man to stand upon, placed at equal distances from the top to the bottom; and handles to be
grasped by the men are attached at a convenient height above each platform. One of these beams, or both of them, are connected with an alternating movement combined in such a manner that at the moment the movement changes the stages of both beams or rods are level with each other. The difference of one man-engine and another consists only in the particulars of construction, and in the manner in which the motion is given to the rods. From the experience already gained it has been shown that man-engines are safe, and their use greatly facilitates the expeditious transit of miners up and down the shaft, but their expensive surroundings preclude general adoption in this colony at least, where the shafts are nearly all of small gauge. With regard to safety-cages the same objections do not exist, as the special appliances may be attached to any cage of ordinary construction, provided the guides or skids are of sufficient strength to withstand the sudden shock of the cage being arrested in its descent. It is stated that perfectly new cages, solidly constructed, and fitted with safety appliances, can be supplied on any of the Victorian goldfields for about £20; consequently the expense is not likely to prove an obstacle to their adoption in the event of the being shown that safety-cages are desirable. Their introduction into American and Continental mines has been attended with considerable success. At the mines of Anzin, from 1851 to 1859, in fourteen shafts supplied with safety-cages, twenty-nine cable ruptures occurred, after which "parachutes" were adopted, and saved the lives of one hundred and fifty men. Commissioner D'Aligny, while at the Philadelphia Exhibition, stated that at the Blanzy mines the experience had been similar, and expressed his opinion "that if an account had been taken of all the accidents by the rupture of cables since parachutes (safety-cages) came into use, it would show that the men who had been thus saved from certain death were numbered by thousands." Professor G. G. Andre, F.G.S., in his recent work on "Mining Machinery," contributes the following information:--"Some of the cages in general use are constructed with various appliances to ensure safety, so that in case the cage or winding apparatus should break, the progress of the cage may be arrested wherever it may be at the moment of the accident, and so preserved from falling to the bottom with its load. The various devices applied for this purpose to these "safety-cages" differ a good deal in detail of construction and in degree of efficiency, but they generally depend on a spring so fixed with regard to the rod by which the cage is attached to the cable as to be compressed while the weight of the cage exerts any strain upon the cable; but if that strain is relaxed by the breaking of the cable or other parts of the winding machinery, the spring is permitted to act upon some mechanical contrivance, by means of which stout iron teeth are forcibly projected against, or caused to grasp the guides along which the cage is moved. The teeth are so arranged that, when the spring is compressed, they move along the guide without coming into contact with it, but, when the spring is relieved, act with the greater force the heavier the load on the cage.

One of these contrivances may be described as follows:--A horizontal movable bar of iron crosses the cage near the top from side to side. The lifting rod by which the cage is attached to the cable passes through this bar, and is so connected with it that the latter may move upward and downward between guides according as the rod is raised or suffered to fall. When the rod is raised by the strain of the cage on the cable, the bar is elevated; but if the strain on the cable is relaxed, the rod consequently falling, the bar moves downward, and a strong spring is introduced to force it down whenever this condition occurs. To each end of this cross-bar, on opposite sides of the cage, is attached at right angles a shorter horizontal bar, and to each extremity of each of these last-named bars is attached one end of a system of levers, by means of which two stout iron teeth or "dogs" at the other end are thrown against the guide-rods in the shaft when the cross-bar is down, or drawn from the guide-rods when the cross-bar is raised.

This kind of safety-cage has been proved to be very efficient. On one occasion, at the Savage mine, a cage was descending at usual speed, with thirteen men, when by a singular accident the cable became detached from the lifting-rod of the cage. The latter stopped almost immediately, but with so little shock that the men on the cage were not even led to suppose that an accident had happened. The engineman, not perceiving any difficulty, continued to unwind the cable, which, passing down between the cage and the side of the shaft, attracted the attention of the men, who rang to stop. Another cage was sent down in the adjoining compartment, when the state of the case was discovered and the men relieved.
MITCHELL AND OSBORNES
PATENT
SAFETY CATCHES FOR MINING CAGES

Scale 4' to 1"
SEYMOURS PATENT SAFETY CAGE
and Safety Detaching Hook
Attached to this Report are sketches of four inventions which will serve to illustrate the leading principles of the various safety-cages brought under the notice of the Board. Three of these cages are described as follows:—

**Plate.—Seymour's Patent Safety-cage and Safety Detaching-hook.**

In figure No. 1 the cage is suspended by the catching levers, holding against the guides or skids in the shaft, with the covers lifted to show the levers and the draw or centre bar. The edges of the catching lever points are serrated. The draw or centre-bar works through the main strap of the cage, and is shackled to the coupling chain above. The two catching levers are connected with the draw-bar by two pins, and also to the main strap by two fulcrum pins fixed on the top of the main strap. At the bottom end of the draw-bar there is a fixed nut, below which there is a joint to receive the fulcrum pin of another lever with a pin through a small bracket fixed under the top of the main strap; at the top end of the lever there is a connecting piece with a pin at the lower end through a compound or hand lever. The hand lever is fastened at the end by a fulcrum pin through a bracket fixed on the side of the main strap of the cage. The compound or hand lever places the cage entirely under the control of the man in it, when ascending or descending the shaft. The cage may be stopped at will by pulling down the hand lever. The two flat springs fixed on the top of the main strap with the ends placed under the catching levers are set to carry the weight of the empty cage only. Any extra weight, such as tools, trucks, men, &c., will cause the fixed nut at the end of the draw-bar to shut against the main strap and take all extra weight off the springs. Supposing the rope to break, the springs have an upward pressure against the catching levers to equal to the weight of the cage (about 4 cwt.), which would throw the points of the catching levers against the guides. The fulcrum pins of the catching levers work in a slot hole, which enable the levers to follow the guides for 4 inches wider than the drawing No. 1; this would come into useful operation if a guide should yield or break under the pressure.

No. 2 drawing shows the cage being drawn to the top of the poppet-head with the safety detaching-hook about to come into contact with two pieces of wood which are so placed that the lever ends of the hook must strike against them. The pressure cuts through the copper or wooden pin placed in the hook, and causes the jaws of the hook to open and let go the cage, when the catch levers of the cage come into operation against the guides. The detaching-hook is remarkably simple, and having reference to the drawing for method of construction may be described as two pieces of iron with a hook bent on one end of each, connected together by an ordinary shackled pin.

No parts of the gear of the safety-cage extend beyond the width of the main strap of the cage to interfere with the sending down of long timbers, slabs, &c. There is no intervening motion between the rope and the catching levers, and, as will be seen on reference to the drawings, the levers are direct acting.

**Plate.—Plynt's Safety-cage.**

The sketch shows three sections of Plynt's safety-cage in a shaft. By the arrangement of this cage levers are made to catch in the sides of the shaft instead of in the skids, as in other safety-cages. The parts marked A on the sketch are the levers, or catches, to stop the cage in case of the rope breaking. There are four levers fitted to the cage, as shown by the side view, two on each side; each pair of levers is fitted together with joints similar to rule joints. Each end of the cross-bar marked B is fitted in the holes of a joint—the cross-bar is arranged to rise or fall in slot holes fitted to the centre bar of the cage—consequently, as the bar rises or falls, the levers will draw back or press out into the sides of the shaft. The distant bar marked B is worked by a rod connected with the main shackles, the pin of which works in a slot in the top of the cage, so that, should the rope break, the weight of the shackle and levers would be sufficient to press the latter out, and their joints would catch immediately in the sides of the shaft. The lever marked C on the cross-bar marked B provides a means whereby a person standing in the cage can at will stop its descent, as by pressing the lever upwards the catches are disengaged from the rod connected to the shackle, and are brought immediately into operation. Any ordinary cage can be easily fitted with this safety apparatus.

**Plate.—White's Mining Safety-cage and Detaching-hook.**

The accompanying sketch shows the safety-cage and detaching-hook. The safety appliances differ very materially from other safety-cages, being constructed with four rollers, one on each side of the two skids, which roll up into a tapered shoe immediately on the rope becoming detached, and prevent the cage from falling down the shaft. Any extra weight causes the rollers to tighten themselves more securely between the skid and the shoe. The advantage that the rollers have over other sharp-pointed catches is that they do not damage the skids, and catch equally as well on smoothened iron as on wood. The rollers are worked by levers, which are merely to guide the rollers, all the weight of the load being on the two nuts on the slide-bar, on which the frame of the cage is suspended. The rollers grip equally on the skids, with a downward pressure, thereby causing no risk of displacing the timber in the shaft; and no accuracy is required in the size of the skids, as they will grip a two-teeth skid as effectively as a full-sized one. Two indiarubber springs are applied to cause instantaneous action. The position of the rollers on the sketch shows them gripped on the skids, but when the cage is suspended they are altogether clear of the skids.

The safety-hook, which is constructed of three steel plates with slots, and connected together with a shackle, on being drawn through the ring fixed below the poppethead, forces the plates together, thereby cutting the copper rivets and altering the position of the slots so as to disconnect the cage in case of overworking. Immediately below the hook are attached the two folding caps or covers for protecting men while ascending or descending the shaft.

The object of this invention is to make the cage as useful as possible, no part of the safety gear interfering in any way with the ordinary work or the lowering of long timber, slabs, &c. The safety gear can be attached to any ordinary cage now in use and is inexpensive in construction.

The statistics of mining accidents during the last eighteen years reveal the fact that in Victoria alone there have been 41 fatal cage accidents, of which more than 60% half
were caused by the sudden descent of the cage down the shaft, owing to the breaking of ropes, overwinding, or similar accidents. The number of accidents by which men were injured and maimed for life cannot be accurately determined; but from the records of the Mining Department—compiled since the initiation of the new system of regulating the mines of the colony—the number of cage accidents between the years 1874-77 inclusive reaches the large number of 36, of which 10 were fatal. Since January 1878 cage accidents have been of more frequent occurrence—the frightful catastrophes at the Britannia and Oriental mines, both within a month, resulting in the deaths of four men, while two others were badly injured. In each case the accident would, in all human probability, have been averted had the cages been furnished with special appliances for checking a sudden descent. Shortly before the lamentable occurrence at the Britannia mine a case of overwinding occurred at the Hoffnung mine at Talbot, which very nearly resulted in the loss of several lives, two occupants of the cage escaping without injury, while a third was less fortunate, although his injuries were not of a very serious nature. Four men were also injured by another cage accident at Tarradale, while the terrible death of the manager of the United Huslers and Redan Co. at Sandhurst only a few weeks since affords another exemplification of the imminent danger to which occupants of cages are exposed.

The following return shows the number of cage accidents that have happened within the last twelve months, together with the names of the companies in whose shafts the cages were at work:

<table>
<thead>
<tr>
<th>Locality</th>
<th>Name of Company</th>
<th>Date</th>
<th>Killed</th>
<th>Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creswick</td>
<td>Dyke's Freehold G. M. Co.</td>
<td>2nd April</td>
<td>1 man</td>
<td></td>
</tr>
<tr>
<td>Castlemaine</td>
<td>Angelo Mining Co.</td>
<td>18th April</td>
<td>1 man</td>
<td></td>
</tr>
<tr>
<td>Eaglehawk</td>
<td>Snobs Hill G. M. Co.</td>
<td>14th May</td>
<td>1 man</td>
<td></td>
</tr>
<tr>
<td>Stawell</td>
<td>Prince Patrick Co.</td>
<td>23rd July</td>
<td>1 man</td>
<td></td>
</tr>
<tr>
<td>Talbot</td>
<td>Hoffnung Co-operative Co.</td>
<td>10th August</td>
<td>1 man</td>
<td></td>
</tr>
<tr>
<td>Ballarat</td>
<td>Britannia Q. M. Co.</td>
<td>29th September</td>
<td>3 men</td>
<td></td>
</tr>
<tr>
<td>Stawell</td>
<td>Oriental Co.</td>
<td>22nd October</td>
<td>1 man</td>
<td>2 men</td>
</tr>
<tr>
<td>Tandilale</td>
<td>Trafalgar Trib. Co.</td>
<td>8th November</td>
<td>1 man</td>
<td>4 men</td>
</tr>
<tr>
<td>Sandhurst</td>
<td>United Huslers and Redan Co.</td>
<td>14th February</td>
<td>1 man</td>
<td></td>
</tr>
</tbody>
</table>

The returns comprised in Appendix A show the number of cage accidents that have occurred in this colony from the year 1860; but, owing to the fact that only imperfect records were kept prior to the Regulation of Mines Statute being enforced, the actual number of casualties arising from the use of cages cannot be definitely ascertained.

The Board held several sittings at Ballarat and Sandhurst for the purpose of eliciting the views held by the leading members of the mining community on the subject. A large number of mining managers, directors, and tributors gave evidence at both places, and the Board were also careful to elicit the opinions entertained by the working miners, who, as a class, are the most interested in the result of the investigation. While several mining managers of long experience supported the general adoption of safety-cages in the deeper sinkings of the colony, the preponderance of evidence was in favor of a suspension of the 16th sub-section of the Mining Act, which renders the use of safety-cages imperative. Most of the witnesses were agreed on one point—that the use of safety-cages, providing a perfectly safe appliance could be invented, would be attended with very great advantages to the mining community; but they contended that, up to the period the Board entered upon their investigation, no such invention had been brought forward. In the majority of instances witnesses pointed out that the various inventions were well enough in theory, and the models from time to time exhibited were excellent in themselves, but when reduced to actual practice they would be found quite unreliable. The ordinary work of a mine, in which rapidity of ascent was the desideratum, would involve a constant wear and tear, calculated to throw the complex machinery of the safety apparatus out of order, and when an accident did happen the chances would be against any check being imposed on the sudden descent of the cage. It was further stated that the general introduction of safety-cages would tend to render engine-drivers and miners careless in the management of the shafts; and that the mine owners and companies would repose too much confidence in the safety-cages, and work ropes longer than under ordinary circumstances, thereby leading to more frequent breakages.
The evidence of the manager of the Arcadia Catherine Company at Sandhurst was strongly in favor of the general adoption of safety-cages; and, as he was one of the managers who recorded their actual experience, his statement is quoted to show the earnestness of his belief:

"I have had two safety-cages in my shaft for the last sixteen months, and am satisfied with them. I tested one of the cages yesterday, at stand-still, and the catches gripped almost instantaneously. I feel myself safer in a safety-cage, even with a good rope, than in a cage of ordinary construction. I believe that a good safety-cage would be an immense boon to the mining community. I have always taken an interest in such appliances, and look after those under my care. The springs, &c., are carefully cleaned and oiled at least once a week, and the chances of their being found out of repair when suddenly required are thereby reduced. The miners employed in our workings feel themselves safer in the safety-cages than in the ordinary cages in use."

This evidence was endorsed by the manager of the Sneanaboa Company (Sandhurst), who added the result of a severe test which had been applied quite unexpectedly, in the shaft of the company, to another safety-cage a few months before. The cage had been pulled right up to the poppet-heads by the engine-driver, and before he could stop the engine the pulley-wheel and bearings were smashed, and fell on the top of the cage, which, however, held fast. Had there been no safety apparatus on the cage, nothing could have saved its rapid descent to the bottom. On the other hand, several witnesses narrated cases in which the safety appliances affixed to cages had signally failed on being put to the test in actual work. One of these failures occurred at the mine of the Magdala Company at Stuwell, where a sum of £185 had been expended on what the directors considered two perfectly safe cages. This heavy expenditure was incurred by the directors in their anxiety to secure as far as possible immunity from accident, which, in a shaft of such great depth (over 1,900 feet), would have been attended with serious consequences. The cages were worked in the usual manner. About nine months after their suspension one of the cages was wound up to the poppet-heads; on coming into contact with the wheel the patent hook gave, but the cage, instead of catching, slipped down to the doors, where it was caught. It was found that certain pin-holes had been rusted, but nothing else seemed to be the matter. Subsequently the manager and directors examined the cage very closely, but could not detect any disarrangement of the apparatus beyond a slight enlargement of the holes in which some of the bolts went through; nothing else appeared to be wrong with the apparatus.

Considerable diversity of opinion was shown to prevail with reference to the 16th sub-section of the Act. At Sandhurst, one of the leading mining managers said, "It is my opinion that the clause in the Act stipulating for the provision of safety-cages is a highly useful one, as it is an additional guarantee of safety to the miners. New ropes are almost as liable to breakage as ropes that have been for some time in use. Three instances of new ropes breaking a day or two after being placed in the shaft have occurred within my own experience. A good safety-cage is what is required as much as anything I know of, for it is impossible to predict when a rope might break." The manager of the Countess Tribute Company also gave the following evidence before the Board, at Ballarat: "I am not in favor of the 'cage' section being expunged from the Act, if some cage is proved to be a 'safety' one. In my company there have been three breakages, which cost them about £120. The question of cost ought not to be a moment to be considered; it is a silly objection, as one breakage would entail more damage than half-a-dozen cages would cost. Three ropes have broken in our shaft, and in no instance did they give any sign of weakness before snapping."

Several witnesses, both at Sandhurst and Ballarat, however, advocated the repeal of the clause in question; one miner, whose experience extended over the last fifty-three years, stating that, in his opinion, the Government should not enforce the clause, because, if they did, the responsibility of accident would be shifted from the company to the Government. Another witness, the manager of a large company at Sandhurst, while pointing out that a good safety-cage would give miners a chance for their lives in the event of a rope breaking, added, with reference to the retention of the clause, "Mining managers have already a great amount of responsibility, and I consider that the clause in the Act relative to safety-cages increases their responsibility considerably; therefore it would be impolitic to insist on its enforcement."

In the course of their investigations, the Board were gratified to find that the question of expense would not be raised as an objection to the general adoption of
safety-cages, in the event of its being demonstrated that an invention of undisputed utility would be forthcoming. On this point there was a consensus of opinion, nearly all the witnesses examined stating that companies have always been distinguished by liberality in providing for the safety of their men. The manager of the Garden Gully United Company informed the Board that his company were then employing 147 men, and anything to promote their safety would not be objected to on the score of cost—that would be a purely secondary consideration with the directors. The manager of the City of Ballarat Company also informed the Board that he had never found any demur on the part of the companies to expend money on inventions for increasing the safety of their men—the question of cost was never considered. A director of the same company also stated that money would be no object where the purchase of a cage which would ensure absolute safety to the miners using it was concerned. The manager of the Trunk Lead Company, at Haddon, in the course of his evidence, said, "It does not pay mining companies to neglect the safety of their men, as one accident would probably entail more expense than the cost of a dozen safety-cages. In our shaft I reckon it would cost £200 to place a safety-cage in working order, but this heavy expenditure would not be allowed to remain an obstacle to its being provided in the event of a thoroughly safe invention being discovered.

Evidence of this description was readily tendered; and, throughout their investigations, the Board found no lack of experienced and intelligent testimony—clearly evincing the interest with which the subject of providing increased safety for miners has been regarded in this colony. Some of the witnesses stated that they had seen the models of safety-cages only, and that, consequently, they would require a practical demonstration before passing a decided opinion as to their utility, while others described experiments they had witnessed twenty-eight years before, and gave the history of safety-cage inventions both in England and in this colony. After eliciting this general expression of opinion the Board proceeded to make the necessary arrangements for subjecting all the cages brought under their notice to a series of uniform trials in a shaft specially set apart for the purpose. The trials of several cages at the commencement of the investigation were unsatisfactory, owing to the absence of any test such as a cage would have to undergo in ordinary practice. The sum of £200 was finally granted by the Honourable the Minister of Mines for the purpose, and the Board decided to grant each inventor a substantial subsidy, in order to ensure the various cages being placed in the shaft in such a manner as to afford the application of a thoroughly practical test. The shaft of the City of Sandhurst Company, at Sandhurst, was granted by the directors, on the sole condition that any damage done would be repaired at the cost of the Board. The experiments commenced on the 19th December, and extended over four days; the proceedings having been delayed in consequence of several inventors mistaking the gauge of the shaft, and making their cages too large. Owing to this cause, the experiments were not so complete as first contemplated; but the Board were, nevertheless, enabled to form an opinion as to the adaptability of the cages for general practice. Eight cages were entered for trial, but, from the cause given above, only six were subjected to a test of such severity as to afford any approximation as to their utility while in ordinary work. The trials were publicly conducted—a very great amount of interest being manifested in the proceedings by the mining community. Mining managers and other representatives of the industry were present from all parts of the colony; and, notwithstanding the danger attendant on such trials, there were no accidents.

From the appended report of the trials, it will be seen that the following inventions were tested:—

1. Nance’s.
2. Williams’ patent.
4. Seymour’s patent.
5. Allan’s patent.
6. Hassan’s.

The cages illustrative of Prys’s and Nancarrow’s inventions were too large for the shaft, and could not be tested, although the first-named inventor was afforded an opportunity for displaying the principle embodied in his cage at the surface.
Having carefully considered all the evidence tendered at the various sittings held in the leading mining centres, conjointly with the result of the trials at Sandhurst, the Board beg to submit the following resolutions embodying their conclusions on the subject under investigation:

1. That the preponderance of evidence given by miners and others qualified to form an opinion is strongly in favor of the adoption of a safety-cage for general use in the mines of this colony, provided that a reliable invention can be brought forward, and its practical utility satisfactorily determined.

2. That, in view of the rapid increase of cage accidents, and supported by the evidence before them, the Board are of opinion that some special provision should be made to check such a prolific source of danger as is shown to exist in the working of the shaft and machinery employed for winding purposes.

3. That this check could be imposed by means of such a regulation as that at present contained in the Statute, i.e.;—"Every cage used in a mine shall be fitted with special and suitable appliances, to prevent its sudden fall down a shaft, and also to prevent its coming into contact with the poppet-heads." The Board, however, consider that mine proprietors should be permitted to exercise their own discretion in the selection of safety-cages, but safety-hooks and balance-catches must be used in connection with every cage.

4. That the Board have witnessed trials of all the inventions brought under their notice, and from the result of their observations the members are of opinion that the adoption of these safety appliances will afford additional security to the large section of the community engaged in mining operations.

ALEX. KENNEDY SMITH, Chairman.
GEO. R. FINCHAM,
HENRY ROBERTS WILLIAMS,
ROBERT CLARK,
R. RICHARDSON.

Parliament House,
July 7th 1879.
REPORT OF THE TRIALS OF SAFETY MINING CAGES AT SANDHURST, 17th, 18th, 19th, AND 20th DECEMBER 1879.

FIRST DAY.—TUESDAY, 17th DECEMBER 1878.

The Board held a short sitting before proceeding to the scene of operations, the following members being in attendance:—Messrs. A. K. Smith (Chairman), R. Clark, G. R. Fincham, and H. R. Williams, M.L.A.’s.

It was decided to ballot for the order in which the cages should be tested, and this was done, with the following result:—

1. Allan’s Patent (Ballarat).
2. Nance’s (Sandhurst).
3. Williams’s Patent (Stawell).
5. Hasn’t’s (Daylesford).
7. Pryor’s (Egerton).

The interest manifested in the proceedings was very great, representatives of the mining community being present from all parts of the colony. Major Touchman, Secretary for Mines, and Messrs. Charles Stewart, W. H. Granger, and H. B. Nicholas, mining inspectors for the Ballarat, Sandhurst, and Castlemaine districts respectively, were also in attendance throughout the proceedings: the three last-named gentlemen affording the Board valuable assistance.

The Board were prepared to submit the first invention to a test at half-past ten o’clock, but, in consequence of an error on the part of the constructor, the cage would not work in the shaft, and a considerable delay ensued. Pending the necessary alterations being effected, the Board examined a well-finished model of a safety-cage and hook which was exhibited on the ground by Mr. David White, of Stawell.

In conjunction with Allan’s safety-cage a patent safety-hook was shown and tested above the surface. The experiment was perfectly satisfactory, both the hook and gripping apparatus on the cage acting almost instantaneously when called upon.

A patent hook, the invention of Messrs. Jackson and Middleton, was next tested, and also answered admirably, the experiment being extended to Nance’s cage, to which the hook was attached.

Arrangements were made by the Board for the first experiment to be made in the shaft while the cage was ascending at full speed, each cage to be weighted with a load equal in weight to at least four men. The second experiment the Board decided should be with the cage while in the act of rapid descent, also with a full load on. In order to carry out the first experiment it was arranged to lower the cage to the 350-feet level, where detaching shackle, known as a “trigger-catch,” was utilised for the purpose of joining the cage to the end of the rope. On being adjusted the rope was gradually tightened until quite taut; and, all being in readiness, the cage was hauled up at full speed until a full-ripe, 100 feet long, attached to the catch, was brought into play with a sudden jerk. The result was expected to be the instantaneous detachment of the cage from the rope, thereby affording, as nearly as possible, a test equal to the breaking of a rope in actual work.

In order to make the necessary observations below the surface the following party descended the shaft, and took up a position in the plat at the 250-foot level, at which point the detaching apparatus was to come into play:—Mr. Charles Stewart, Mr. H. B. Nicholas, Government mining inspectors; Mr. James Thomson, Secretary to the Board; Mr. John Coburn, journalist.

The necessary arrangements having been effected at the surface, the invention of Mr. John Nance was then tested. The empty cage was run rapidly up and down the shaft to prove its adaptability for ordinary work, and, after this had been satisfactorily demonstrated, it was lowered to the 350-feet level, where the trigger-catch was fitted to the shackle and chain. A length of rope was then let out from the 350-feet level sufficient to allow the cage to travel without impediment till it reached the plat at 250 feet, where the party of observation were stationed. The rope was fastened at the 350-feet level, and the cage drawn up at the rate of about 500 feet per minute, and when it arrived opposite the 250-foot level the trigger was pulled, and the rope disconnected, with the result that the cage fell with considerable violence 7 feet before it caught. The grippers caught the skids, and marked them in several places, till the cage struck 7 feet 2 inches below the 250-feet level, but there it held tight enough. The rope was then re-connected, and the cage drawn up to the surface, apparently uninjured.
As quickly as possible the next cage was fitted into the shaft, but, owing to the fact that nearly all of the cages were too large for the shaft, the order of drawing was not observed. The next cage tested was the invention of Mr. Williams, of Snowell. The same conditions were observed in this instance, the empty cage being first submitted to the test of running up and down the shaft. The cage was then hauled up at about the same rate of speed as in the previous trial, the severance being effected at the 250-foot level, and in full view of the party of observation. The gripping apparatus did not, however, act instantaneously, the cage dropping 10 feet 9 inches before being checked. For nearly 3 feet above the point of stopping the skids were indented by the grippers, but not to any serious depth.

The third invention tested was a safety-cage invented and patented by Messrs. Jackson and Middleton, of Sandhurst. The cage was subjected to the same test as those preceding, being lowered and hauled up the shaft while empty. It was then sent down to the 350-foot level, and weighted with a truck load of stones. All being in readiness, the signal to heist was given, and the cage rose at great speed—about 550 feet per minute. The detachable apparatus acted admirably, and opposite the 350-foot plat, and in full view of the party stationed there, the severance was effected. Unlike either of the inventions previously tested, however, the cage was not checked in the slightest degree, the grippers apparently failing to act. The cage crashed down to the 350-foot level, a sheer descent of 100 feet, smashing a portion of the catching-gear, breaking the truck, and jamming the cage in the shaft in such a manner that further progress was impossible.

Mr. Middleton, one of the firm of inventor, was on the plat at the time of the trial, and stated that he was perfectly satisfied with the treatment his cage had received, and attributed its failure to a defective arrangement of the gripping machinery.

The Board having ascertained that the work of raising the damaged cage and repairing the shaft would involve several hours’ delay, decided to adjourn the trials until eight o’clock next morning.

SECOND DAY.—WEDNESDAY, 18TH DECEMBER 1878.

The Board assembled at the City of Sandhurst Company’s mine at eight o’clock a.m. The following members were in attendance:—Messrs. A. K. Smith (Chairman), R. Clark, G. R. Fincham, and H. E. Williams, M.I.A.’s.

As on the previous day, the four gentlemen forming the party of observation were lowered to the 250-foot level.

The first safety-cage to be tested was that of Mr. R. Allan, of Ballarat, but after several attempts it was found that it could not be made to descend the shaft below the 250-foot level, in consequence of some timber at the plat preventing it, but which did not hinder the descent of other cages. In order to save time the cage was taken out of the shaft, and the Board directed the invention of Mr. T. Hassan to undergo the test. This cage was fitted into the shaft, but did not work easily. It was clearly too large for the shaft, and after considerable delay and repeated attempts to obtain a trial, the cage was hoisted to the brace and removed.

The next cage tested was that of Mr. Seymour, of Sandhurst. This cage worked easily in the shaft, a slight warp in the skids at 160 feet causing it to move somewhat stiffly at that point. It was hauled up to the surface, weighted with a truck full of broken stone, and then lowered to the bottom. The usual preparations were made at the 350-foot level, and without much delay the signal was given to haul up, which was done at the rate of 500 feet per minute. On the connection being severed the safety apparatus of the cage acted instantaneously, and caught the skids at once, the cage not slipping downwards in the least perceptible degree. The trial, viewed from the place of observation (350-foot level), was entirely successful, the safety apparatus appearing to act instantaneously.

Hassan’s cage was next placed in position, the inventor having made an effort to reduce the width of his cage, in order to secure a trial. The cage was a tight fit, and clutched the skids at several stages in its descent without the aid of the safety apparatus. Finally it was lowered to the 350-foot level, and duly weighted. It was run up at full speed—530 feet per minute—and suddenly detached, when it dropped about 4 feet. The test was unsatisfactory, inasmuch as one of the springs had been previously broken, and the cage was not an easy fit in the shaft.

A safety-cage known as Nancarrow’s patent was next introduced into the shaft, but the objection that had previously arisen with respect to the gauge was repeated in this instance. The cage was too large for the shaft, and, after a considerable delay, all hope of testing the invention in the form presented had to be abandoned. It may be stated, however, that after a great deal of trouble the cage was lowered to the 350-foot level, and the test was about to be applied when an order was received from the surface to send it up again, to test whether it would work in the shaft freely or not. This was done, but it was found impossible to make the cage work properly, and orders were given to clear the shaft for the next cage.

The party of observation were hauled to the surface, and the Board then tested Seymour’s patent hook and cage above the surface. A fixture had been placed across the skids above the brace, and the hook drawn up against it, but there had been too much space left, so that on its first trial the invention did not act. The sheets across the skids were then narrowed so as to catch the hook properly, when the cage being drawn up, the hook severed the connection with the cage.
and rope, and the gripping machinery acted at once. This trial was perfectly satisfactory, so far as a demonstration of the principle was concerned.

The Board at seven o'clock adjourned until eight o'clock next morning.

THIRD DAY.—THURSDAY, 19TH DECEMBER 1878.

The Board assembled at the shaft at eight o'clock a.m. The following members were in attendance: Mr. N. A. K. Smith (Chairman), R. Clarke, and H. R. Williams, E.L.A.'s.

The proceedings commenced by lowering the following party of observers to the lowest available level, 390 feet, Mr. Charles Stewart, inspector of mines; Mr. H. B. Nicholls, inspector of mines; Mr. James Thomson, Secretary to the Board.

The shaft was inspected and found to be in perfect order. As soon as possible Seymour's cage was made ready for the first of the final series of tests, which the Board had decided should be as severe as the circumstances permitted. It was arranged that each cage tested should be started from the surface and let go by the man at a speed of 540 feet per minute, till it reached about 320 feet in depth, where the end of the rope, which was loose, ran off the drum, and the cage either stuck in the shaft or went to the bottom, according to the efficacy of the catching apparatus. When the rope flew out from the engine-house, its velocity was so great that in one instance it swept the hand-rails off the brake and tore the railing round the top of the penthouse into splinters, sending the pieces flying into space in every direction. An old rope, procured for the purpose, was attached to the drum, Seymour's cage being then connected in the usual way. The cage was then weighted with a load of stone, equivalent to 8 cwt., and lowered to the 350-feet level, when a strong staging or pent-house had been placed to prevent the further descent of a falling body down the shaft. In attempting to raise the cage to the surface, and when about 30 feet from the bottom, the old rope broke at a rotten place, and the invention acted perfectly. The rope parted close to the drum, the end flying out of the engine-house, over the pulley-wheel, and going down the shaft. The whole weight of the rope fell on the cage, which, however, remained fast in the shaft until hauled to the surface. The old rope being again adjusted, the cage was then subjected to the real test, by starting it from the surface and lowering it at the rate of 540 feet per minute till within about 50 feet of the bottom, when the end of the rope flew out of the engine-house, knocked the hand-rails off the brake and top of the poppet-heads, and fell down the shaft. On examination below, the cage was found to have caught at the moment the severance from the drum was effected, but the weight of the falling rope forced it to slip about 7 inches. The outward pressure of the grippers forced the skids nearly 2 inches out of their position, but otherwise the shaft was not injured. The cage was not visibly affected by the shock, the appliance being in the same condition as before the trial.

The next cage tested was the invention of Mr. John Nance. As in the previous trial an old rope was adjusted on the drum, and the cage sent away at full speed down the shaft. When the tension was relieved by the rope flying out of the engine-house the invention acted, but the grip on the skids was not sufficiently strong, and the cage fell from 10 to 12 feet, tearing the timber all the way. The good rope was sent down and bent on to the old one, and the cage was being raised to the surface when the old rope broke again, and the cage caught well, so that Nance's cage also had two trials.

A derangement having occurred in the engine-house, whereby the winding-gear was thrown out of order, a delay of three hours ensued before another cage was placed in the shaft.

The next cage to be tested was that known as Nancarrow's patent, exhibited by Mr. J. P. Carolin, of Sandhurst, a joint patentee. It was tried up and down the shaft empty, but stuck repeatedly. A full truck of stone was then placed on it, and the cage let go, but it stuck about 80 feet down while being lowered, and 100 feet of slack rope carried down on top of it. The slack of the rope was drawn up, and the cage again hauled to the surface, when it was discovered that the invention had become deranged, and the cage was consequently unworkable. As the Board were of opinion that there was no chance of testing the invention satisfactorily, the cage was taken out of the shaft.

Allan's patent safety-cage (which had been altered) was then placed in the shaft, and found to move freely. The same mode of treatment was observed, and the cage, after being weighted with a full truck of stone, was attached to the old rope. Little time was lost, and the signal being given to lower, the cage was sent away at full speed. The rope ran off the drum with great velocity, but the safety apparatus worked admirably, for directly the tension of the rope ceased the descent of the cage was checked. Although the whole of the rope fell down on the covers the cage was found to have held fast, subsequent examination of the shaft showing that the cage had not dropped the tenth part of an inch after gripping. The test was one of the severest applied during the series, but the shaft was not perceptibly damaged in any way, the indentation of the skids being very slight.

Hasan's cage was next subjected to a similar test, but one of the springs regulating the gripping apparatus having been broken on the previous day, the experiment was not satisfactory. The cage on being released from the tension of the rope went with great force to the bottom, where it was allowed to remain.

Williams's cage was next tested, and with a better result. On the rope being released from the drum the gripping apparatus caught the skids and held the cage securely after a fall of 11 inches from the point where the tension of the rope apparently ceased.
The cage was left in the shaft, the hour being too far advanced to permit of any further experiments being made that night. The party of observation returned to the surface by climbing up the ladders from the 350-feet level, and the Board then adjourned till the following morning.

FOURTH DAY.—FRIDAY, 20TH DECEMBER 1878.

The Board assembled at the shaft at half-past eight o'clock a.m., the following members being in attendance—Messrs. A. K. Smith (Chairman), R. Clark, and H. R. Williams, M.L.A.'s.

The last cage tested on the previous evening (Williams's) having been raised to the surface it was replaced in the shaft by Pryor's invention. This cage was too large for the shaft, and it could not be made to descend more than 20 feet. As the Board were, however, desirous of witnessing the action of the principle embodied in the invention, arrangements were made to suspend the cage at the surface and suddenly detach it by means of a safety-hook. This was done, and the catching apparatus worked instantaneously, the cage remaining at the place where the severance was effected.

The Board then left the ground, and the series of experiments ended.
CONSTITUTION.

COMMISSION ON SAFETY MINING CAGES.

Office of Mines, Melbourne, 8th May 1878.

The Governor, with the advice of the Executive Council, has been pleased to appoint—

Robert Clark, Esq., M.P. (Sandhurst),
G. R. Fincham, Esq., M.P.,
A. K. Smith, Esq., M.P.,
R. Richardson, Esq., M.P.,
H. R. Williams, Esq., M.P.,

to constitute a Board to examine the several inventions for Safety Mining Cages which have been brought under the notice of the Mining Department, and to report as to those which appear to be the most effective for the purpose intended.

W. COLLARD SMITH,
Minister of Mines.

On Wednesday the 5th day of June 1878, the Board proceeded to Sandhurst, and, at ten o'clock on the following morning, a preliminary meeting was held in the Shamrock Hotel, the following members being present:—Mr. R. Clark, M.L.A., Mr. G. R. Fincham, M.L.A., Mr. H. R. Williams, M.L.A.

The Secretary read apologies for non-attendance from the Chairman (Mr. A. K. Smith, M.L.A.), and also from Mr. R. Richardson, M.L.A. The absence of the Chairman was due to severe indisposition, which confined him to his room.

The Board then decided upon making an inspection of all the models of inventions forthcoming, and also of those safety-cages in actual use in the district. With this object in view the Board visited the School of Mines, where the members were met by the secretary for the school, and the chairman and several members of the Mining Board. Several models of safety-cages were produced, and fully examined, the inventors being in attendance to explain their working. The models were examined in the following order:—

1. Seymour’s Patent.—Letters issued in August 1875, for improvement in safety-cage; primary improvement being combination of levers, both for land and self-acting; also, patent safety-hook to prevent accidents from over-winding.

2. Nancarrow’s Patent.—Letters patent issued in 1876, for improvement in safety-cage; the leading principle of the invention being that the natural forces of gravitation were applied to catch the cage in its descent, in the event of the rope breaking.

3. Davidson’s Safety Cage.—Not patented.

4. Model of safety-cage belonging to the School of Mines, working on the eccentric principle.

5. The invention of William Battle—not patented.

After a careful examination of the various inventions the Board arranged to hold a series of inspections forthwith, for the purpose of witnessing the cages in actual practice.

At two o’clock the Board visited Messrs. Robert’s foundry, where arrangements were made for a trial of Nancarrow’s patent safety-cage, by the joint patience, J. P. Carolin. The working of the invention was fully explained, and the members of the Board were afforded an opportunity of forming an opinion as to the probable utility of the invention in actual mining. Two upright pieces of timber were placed in the position of skids, and the cage fitted therein; a weight of about 10 cwts. (of iron) was placed in the cage, and, in addition, four men stood on the dead weight. The cage was then suddenly detached from the rope, when the gripping apparatus caught almost instantaneously, the full of the cage being imperceptible.

The Board next proceeded to the claim of the City of Sandhurst Company, where a trial of “Nance’s” safety-cage was witnessed. The City of Sandhurst Company had ceased operations, but the cage (which had been in use for some months previously) was still in the shaft. It was hauled to the poppet-heads, and the principle of its safety appliance was explained by the inventor, Mr. J. Nance. This cage had been subjected to a severe test some six months before, in the presence of Mr. Nicholas, the mining inspector, and had passed successfully through the ordeal. The invention was favorably reported on at that time. On the present occasion, however, the cage was suddenly detached from the rope, and the safety appliance proved an utter failure. The cage was not checked is the slightest, and but for the fact that the mouth of the shaft had been...
timbered over, the cage would have crushed down to the bottom. In this instance the inventor stated that the failure was owing to the length of time during which the cage had hung idle in the shaft—two months; the springs had become rusted, and the indiarubber employed in connection with the catching apparatus had also lost its elasticity.

The Board then visited the claim of the Shenandooh Company, where one of Messrs. Jackson and Middleton’s safety-cages was at work. This cage had also been tested previously, and had created a favorable impression, but the Board were only afforded an opportunity of witnessing the cage on the surface. While stationary, the rope was detached and the grippers at once caught the skids, preventing the cage from descending; but the trial was not very severe, the cage being without any momentum whatever. A patent safety-hook, to guard against accident from over-winding, was also exhibited; together with a simple invention attached to the top of the skids (at the poppet-heads), to prevent the cage falling, in case of over-winding and consequent breakage of the tackle. Both appeared to answer remarkably well.

The Board visited the mine of the Garden Guilly United Company, and inspected a working model of Davidson’s invention, but no practical experiment was witnessed, owing to the apparatus not being applied to a cage.

The next mine visited was the Sandhurst Company, near Eaglehawk, where a cage, fitted with Seymour’s safety appliance, was examined. In this, as in the other inventions inspected, the motive power supplied to the gripping apparatus was steel springs. The Board did not witness any experiment, the similarity of the principle involved with those previously examined shewing that necessity.

Before returning to Sandhurst, the claim of the Acadia Catherine Company was visited, where two safety-cages were seen on the surface. The hour was advanced, and work in the mine had been suspended for the night, therefore no opportunity was presented for a practical test. It was stated that the cages were fitted with safety appliances, the invention and patent of Messrs. Osborne and Mitchell, a local firm of engineers. The Board examined the cages, and, as far as was practicable, made an estimate of their utility in actual practice.

The Board returned to Sandhurst at seven o’clock p.m., and arrangements were then made for a sitting on the following morning, at which the attendance of the various inventors and others interested would be secured.

Sitting of the Board held in the Shamrock Hotel, Sandhurst, on Friday the 7th day of June 1878.

The following members were present:—Messrs. R. Clark, G. R. Fincham, and H. R. Williams, M.I.A.’s.

In the absence of Mr. A. K. Smith, M.I.A. (the Chairman of the Board), Mr. R. Clark was elected Chairman pro tem.

Before the Board proceeded with the examination of witnesses an inspection was made at the claim of the Great Extended Hunter’s Company, of an invention for a safety-cage, known as Williams’ patent. Mr. Williams, a resident of Stawell, was in attendance, and personally conducted the experiment. The appliance resembled, in matter of principle, the inventions inspected on the previous day, with the single exception of Nancarrow’s patent. The cage was hoisted to about 60 feet from the mouth of the shaft (covered up as a precautionary measure), but when the rope was suddenly detached the grippers refused to act, and the cage, with a full load, descended with great force on to the timbers placed across the mouth of the shaft. The experiment was a total failure; and a second trial (at the instance of the inventor) gave no better result. The grippers would not hold the cage, either with or without a load; and the Board then returned to the Shamrock Hotel, and heard the following evidence:—

J. H. Seymour, blacksmith, deposed.—I am the inventor of an appliance for ensuring the stoppage of a cage when a rope breaks in the shaft. It was patented in August 1876. One of these safety appliances has been in use since September 1876, in the shaft of the Londonderry Company. It was subjected to a very severe test, and more than a season it answered perfectly. The rope had been cut when the cage was far down in the shaft with four men in it, and the grippers acted and stopped the cage on the instant. On one occasion, at the 50-foot level, the break was thrown off while I was in the cage, but by means of a lever which is fixed within easy reach of the hand, the cage was checked in its descent. I consider the lever is just as important as the other details of my invention, as it gives the men inside control over the cage—a principle not embodied in any other invention at present in use. My cage hung idle for six months in one shaft without the usefulness of the invention being impaired thereby. I am perfectly satisfied of the safety of my own invention. I am willing to go into one of the cages, in a proper shaft, and allow the rope to be cut at any level. I reckon the cost of the invention, cage, &c., complete, together with my royalty, would not exceed £22; or the invention could be applied to any new cage for about £11. My primary object in the invention was to obtain the maximum resistance against the side of the shaft.

To the Chairman.—There were four of us in the cage when the rope was cut at the drum; I mean when the break was thrown off. The result was perfectly satisfactory.

To Mr. Williams.—I am aware that the dimensions of the runners are not equal in every shaft, they vary considerably in size. In my invention there is no possibility of the skids being damaged by the action of the grippers catching. In the event of the skids breaking, the catches would go out three inches, and the cage could not then pass the bearers or centre pieces in the shaft.
At this stage the Chairman pointed out to those present that the Board were actuated by the desire to elicit as much information on the subject under investigation as possible. There were a large number of practical men present, who were possessed of certain information only known to them. Their daily occupation brought them into close contact with miners and the various inventions applied to mining. Many points that might occur to them would perhaps be overlooked by the Board, and it was therefore desirable that every facility should be afforded them of criticising the inventions brought forward that day. Certain points would be brought out that might otherwise remain undiscovered, if a subject involving a close attention to technicalities as well as to the broader question of practical utility in actual mining.

In reply to Mr. Carolin (patentee), witness stated that the cage could be checked when descending into a well or flooded shaft, by means of the lover inside the cage, and that the action of the grippers would not be affected by the water.

James Davidson, blacksmith, in the employ of the Gentry Gully United Company, produced a model of his invention. He deposed—I have not obtained a patent for my invention, as it is recent and has never been practically tested. It is only slightly different to other cages, the leading principle being a multiplication of grippers for catching the skids. It is my intention to have the invention practically tested as soon as possible.

To Mr. Seymour (inventor).—In the event of the cage being suddenly checked the grippers would be at once brought into action, and would penetrate into wood ordinarily used for skids about one inch and a half.

To Mr. Carolin (patentee).—The only originality I claim for my invention is the multiplication of grippers and their mechanical application. I would apply the improvement to yours, or any other cage in use.

To the Chairman.—The cost of applying my invention to an old cage would be about £7; but if a new cage were to be made, the cost would be very trifling.

William Piates, the inventor of an apparatus for the prevention of accidents in cases where ropes broke in the shaft, here entered into an explanation of its principles; but the model was imperfect in construction, and failed to convey to the Board an impression of the advantages claimed by the inventor. No working model had ever been prepared, neither had the principle been reduced to actual practice.

J. P. Carolin, commission and general agent of Sandilast, deposed.—I am the joint patentee of the invention known as "Nanacrom's Patent Safety-Cage," which, I contend, is a purely original invention, and quite different to every other cage at present in use in the colony—[Model here exhibited]. It has only one spring, upon which the weight is always the same. In no case does the weight ever vary. There is a skeleton frame outside the actual cage applied by the spring, and on which the grippers are fastened. Any falling of the inner cage would instantly bring the grippers into action. Instead of the catches closing when the cage descends into water, they are kept open, and the cage with the buckets descends into the well. I estimate the cost of fixing the invention to an old cage would be about £20, with a proportionate reduction if the cage was made specially. The number of grippers (or catches) can be increased ad libitum. Several satisfactory trials have taken place.

Mr. Geatinger, inspector of mines, pointed out that there was a certain amount of danger of the invention falling in consequence of the fact that dirt might accumulate between the bottom of the cage and its outside frame, thereby preventing the inner cage from falling the distance required to bring the grippers into play.

Witness.—This danger could be overcome by making the bottom of the outside cage of angle-iron; dirt, or other accumulation, would thereby be prevented from interfering with the working of the cage in any form.

To Mr. Pocham.—The weight of the track is not thrown on the spring, which is therefore comparatively free from derangement.

To the Chairman.—The motion of the cage when in actual work, with the exercise of only moderate care, would always keep the appliance in order and ready for any emergency.

John S. Delbridge, iron founder, deposed.—I am not interested in any particular cage, neither am I specially predisposed in any of the inventions I have seen. Certainly, I like the invention of Carolin's, now before the Board, better, on account of its being a perfectly original invention—that is, so far as I know. At the same time, it is an invention that would be rather difficult of application to old cages. I have listened to the evidence already given, and consider that the objections urged against the cage becoming incapacitated through an accumulation of dirt between the outer and inner cages would not be sustained by actual practice. By decreasing the bearing surface the chances of an accumulation of dirt would be reduced to a minimum. The cage does not take up more room in the shaft than any other I have seen in use. Springs are always liable to corrosion, but as safety appliances have always depended on springs to supply the motive power in cases of accident, the best remedy would be careful supervision and frequent changing. I would, myself, change springs every three or four months, as the cost would be very trifling. With ordinary care the other portions of the appliance would last 18 or 20 years.

To Mr. Seymour (inventor).—Steel springs, when called upon to perform the action of that used in Carolin's patent (Nanacrom's), are liable to derangement; they are continually exposed to pressure, and lose their elasticity and temper; springs refuse to work under too much pressure. Known to Mr. Pocham.—If the spring was fractured or did not otherwise work, the catches would not come into operation, and the appliance would be useless. I am of opinion that if the rope broke at the drum, the length and weight of the back rope would prevent the springs from acting on the grippers, and nothing would therefore prevent the cage from going to the bottom.

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springs are supposed to pull 800 tons and the rope weighs 900 tons, the rope would prevent the safety appliances working.

To Mr. Carolin (Inventor).—Although I like your invention as well as any other I have seen, I will not express a decided opinion as to its practical utility until I have seen it in working order in a shaft. I consider your cage is original, for the following reasons: it has no indiarubber "buffers," the number of springs is reduced to a minimum, and it has a duplicate cage.

To the Inspector of Mines.—In all my experience I have not seen any cages constructed on a perfectly safe model. No inventions have yet overcome the difficulty presented by the excessive weight of the back rope.

John Vance deposited.—I am the inventor of a safety-cage for which a patent was refused on the ground that it was no better than others in use. I estimate the cost of attaching the invention to be about £25; if to a new cage, not more than one-half.

Mr. Lewis, manager of Koch's Pioneer Company, deposed that he had officiated as judge at various agricultural shows. At one of the shows held in Sandhurst, Mr. Vance showed a model of his cage; several other models were shown; they were roughly tested, and Mr. Vance's invention was awarded the prize.

Mr. Corrie, the manager of the City of Sandhurst Company, informed the Board that the invention of Mr. Vance had not been fairly tested on the previous day. The cage had been hanging idle for a number of weeks, and the result was a failure; the cage was out of order, axles and joints being rusted, and the elasticity of the indiarubber being also destroyed.

To Mr. Carolin (patentee).—I have examined your model of Norcross's cage, but I would not like to express an opinion as to the utility of your cage, or safety-cages in general, until I had an opportunity of seeing them in actual work, and testing them with half a ton or so of back rope. I have not had much experience with these safety-cages; the inventions are all of modern date. I do not condemn them, as in my opinion, they have not had a fair trial.

Joseph Williams, of Stawell, deposed.—I am the inventor of a safety-cage, for which I obtained a patent in February 1875. My cage was the first of the kind when I brought it out, but since then the principle has been copied by others. Its cost is comparatively trifling. For a cage already in use, I reckon £5 would make it safe, according to my model. The trial this morning before the Board was not a fair one, as I had not an opportunity of showing what the cage could readily accomplish. The cage was too small for the shaft by at least a couple of inches, and the grapples did not therefore reach the sides of the shaft. My cages have been in use in the Magdalain mine, at Stawell, and also at Maldon, where they have been subjected to severe tests, and in the latter with satisfactory results. The rope gave way at the drum, and the cage, instead of descending, clung to the shaft instantaneously.

William Middleton (Messrs. Middleton and Jackson) deposed that the firm of which he was a member had obtained the patent for a safety-cage at present working in the shaft of the Shamashilah Company. With regard to the invention of Williams, the last witness, I can corroborate his statement about the satisfactory test at Maldon, as I was at Maldon myself, and heard all about it. The cost of my invention I reckon to be about £8 when applied to an old cage; but, when a new one is made, with all improvements complete, I believe the cost would be about £18 or £20; or about twice as much as the common cage at present in use. To construct an efficient cage I believe that there must be sufficient spring-power to counteract the effect of the back rope; and the real difficulty then presented is to regulate the catch so that the cage will work easily up and down the shaft. Not long since the cage of our firm was hauled, right up to the pulley-wheel of the Shamashilah Company, and it held all right. It is my opinion that no safety-cage can be considered worthy of the name until it has stood a thorough test, such as the rope being suddenly cut while the cage is rapidly ascending or descending the shaft.

H. Mitchell (of Messrs. Mitchell and Osborne, founders) deposed.—The firm of which I am a member have invented a safety-cage, which may be seen at work at the Catherine United Company's mine. We have not secured a patent for the invention, but it has given every satisfaction to the men employed in the mine.

Mr. Grismer, mining inspector, here stated that the mining manager of the company had discussed the cage in question, and had issued positive instructions to the men that the cage was not to be used, as he did not consider it to be safe.

Mr. Boulton, manager of the Acadian Company, was called by the witness to bear testimony as to the efficiency of the cage, two of which had been in use at that mine for sixteen months. He stated that he had witnessed a satisfactory experiment with the cage at the shaft of the Catherine United Company, and personally he had no doubt that the adoption of safety-cages would be advantageous. The cages would be just as likely to get out of repair without being attended to as any other delicate machinery. Safety-cages should be thoroughly cleaned at least once a week, with benzene and other oil; and the grapples and catchers should be closely inspected otherwise.

To Mr. Williams.—I do not think that the springs of the cages in question have lost their elasticity.

Witnesses.—There are four grapples or catchers, each one of which is worked by a separate spring. The cost of applying the invention to a new cage would be about £8; if to an old worn cage, the cost would be greater, say £12 to £15.

This terminated the examination of witnesses.

The Chairman thanked the inventors and others present for their attendance, and stated that the Board were anxious, not only to personally inspect the various inventions that had been brought under the notice of the Mining Department, but also to elicit all the information possible
on the subject. It was a question which closely affected the interests of the mining community, and the Board fully recognised its importance. They would hold another sitting in the same place as early as possible, when the affected miners and mining managers an opportunity for expressing their views, as they were the class who were most directly concerned in the question at issue. He regretted that severe indisposition had prevented the Chairman, Mr. A. R. Smith, M.L.A., from attending, but he, in common with the other members of the Board, trusted that on the next occasion they would take the advantage of his presence. With regard to the inventions already inspected, the Board would consider several requests that had been made for further trials, as it was extremely desirable that the safety appliances should be thoroughly tested before the Board decided in the matter.

The Board then proceeded to the mine of the Albion United Company, at Kangaroo Flat, where a trial of Seymour's patent safety-cage was witnessed. The experiment was altogether unsatisfactory; the appliances attached to the cage for preventing its descent, in the event of a breakage of the rope, refusing to act. The inventor was afforded two opportunities for testing the utility of his invention, but they both failed. The failure was attributed, by Mr. Seymour, to the fact that the shaft was very much out of repair, the skids being some inches out of their proper place in the shaft, and also worn and twisted from long use and exposure.

The Board returned to Sandhurst at six o'clock p.m., and arrangements were made for another sitting in the same place, at eleven o’clock on the following Tuesday morning.

Sitting of the Board held in the Shamrock Hotel, Sandhurst, on Tuesday the 11th day of June 1878, at eleven o’clock.

The following members were present:--Messrs. R. Clark (in the chair), and G. R. Fincham, M.L.A.'s.

Thirty-three mining managers and others interested in the question under consideration were in attendance when the proceedings opened.

The Chairman expressed gratification at the large attendance of witnesses, most of whom possessed the advantage of many years' practical experience in mining. The Board would be glad to hear an expression of opinion from all the miners and managers present, as the result of the recent experiments had not been at all satisfactory. The 16th subsection of the Act clearly specified that "every cage used in a mine should be fitted with special and suitable appliances to prevent its sudden fall down a shaft, and also to prevent its coming into contact with the poppet-heads." This clause had not been enforced, and the Board were virtually expected to recommend either for or against its retention in the Regulations. The miners, as a body, were directly interested, and it was to gain from them an expression of opinion, unrestrained, that the present sitting had been arranged.

Mr. Corrie, manager of the City of Sandhurst Company, was the first witness called, deposed.--I consider that some benefit has already been derived from the use of safety-cages, but they are by no means perfect. I saw Nance's cage tested some time since, and I also witnessed the experiment in the presence of the Board last Thursday. On the latter occasion I do not consider the cage had a fair trial. To my mind the only thorough test is to let the cage descend or ascend at full speed and then to suddenly cut the rope at the drum; the back rope would then have an opportunity of coming into play. If the cage caught wide in full descent, with 600 or 600 feet of back rope attached, then I should say it was a safe invention.

To Mr. Fincham.--On all our mines we are bound to have the best and safest gear, quite independent of safety-cages. There is a doubt in my mind as to their efficiency. They are condemned out here on account of their having failed in practice at home; but the climatic conditions are widely different, and there is not much analogy. I believe that safety-cages induce a greater feeling of confidence in the minds of those using them. The men in our claim reposed confidence in Nance's invention when in use in the shaft, and so did I, but my confidence has been somewhat shaken by the last experiment. Although a good safety-cage would be an immense boon to the mining community, I have not sufficient confidence in any of the inventions I have yet seen to recommend the adoption of any particular cage. The trials have not been exhaustive, and yet there are good points in Nancarrow's, Williams', Seymour's, and Nance's. I have regarded them all favorably, and now consider that if the principle of each invention could be depended upon to act in cases of emergency, that the presence of a safety-cage in a shaft would be a good thing.

Mr. Thomas Eyre, manager of the Catherine Reef United Company, deposed.--I have only witnessed one experiment with a safety-cage, Messrs. Mitchell and Osborne being the inventors. The rope was cut at the drum, but the cages did not act and the cage went down the shaft. In my opinion the Board ought to be very careful before recommending the adoption of safety-cages. I have seen a good many models of safety-cages—all those produced here this morning—but I would not care about trusting my life to any of them in the event of the rope becoming detached in the shaft.

To Mr. Fincham.—The presence of a safety-cage in a mine is, to my mind, calculated to induce a false security, and to render miners somewhat careless with regard to their winding gear. I believe that the only safety appliances yet invented are the man-engines which are in use in many of the Cornwall mines and English collieries. They are, no doubt, expensive, and best adapted for large mines, but I am not in a position to estimate their cost. I have had 35 years' experience in mining in the Sandhurst district, and I cannot say that I would adopt any of the
inventions I have yet seen. The men would, I believe, prefer riding in the ordinary cage with good tackle, or descending by ladders only.

Richard Williams, manager of the Johnson’s Reef Gold Mining Company, deposed.—Up to the present time I have not had anything to do with safety-cages, but I am only awaiting the result of the investigations of the Board to confirm an order for one of Nance’s cages, which I intend placing in the main shaft. For twenty years I have been employed in this district, having occupied my present position for the last twelve or thirteen years. I have doubts as to whether the enforcement of the clause relating to safety-cages would be advantageous to the mining community. I have always carefully attended to the ropes, chains, and attachments in my mines, and I am rather of opinion that the presence of a safety-cage might lead me to pay a little less attention to the gear. I have descended shafts by means of man-engines in England, but consider that they are just as liable to get out of order as any other kind of machinery. I do not think they are very expensive, and in deep mines they could be used with advantage. Accidents do not usually occur where there is ordinary care. I believe that the miners of the district would prefer a good strong rope to anything in the shape of a safety-cage. In cases of over winding the safety-hooks are likely to be of service; the safety-hook is of no use without a safety-cage. I have seen “umbrella” cages, and think they are useful. I do not advocate safety-cages, and I would not trust myself in any one yet invented. If I adopted any, it would be the invention known as Nance’s.

To Mr. Corrie (mining manager).—The men-engines could be worked easily enough in some shafts in this district; where there is room for ladders and pumps there would be sufficient space for the man-engine to work; it would require about 3 ft. by 14 ft., simply a space on either side for men descending and ascending. The expense would, I am afraid, prove a very grave objection.

To Mr. Fincham.—The question of the cost is a matter of no consequence to the various companies, although the putting up of such an invention as the man-engine would be a serious tax. As a pure question of safety, I would recommend the man-engine. I do not believe that any public trial of safety-cages would be a thorough test of their utility; as, in actual practice, they are likely to become inoperative through dirt, &c., interfering with the springs and catches. I have not seen the Nuncarrow cage at work.

The Chairman here dwelt upon the desirability of subjecting all the inventions brought under the notice of the Board to a thorough trial, under conditions as nearly as possible similar to the test of actual working. It was, in his opinion, highly desirable that a public exhibition should be held of all the inventions, in one central shaft.

Witness continued.—The cost of the safety-cages would not, I am certain, weigh with the mining companies; they are always willing to incur any expense in securing the safety of their men. I have quite recently paid as much as £20 per ton for wire ropes, in order to ensure perfect safety in our shaft. I see no use for safety-hooks without safety-cages, or other appliances for preventing the backward fall down the shaft.

George Marshall, underground mining manager of the Catherine United Company, deposed.—I have not had much experience with safety-cages. There is one of Messrs. Mitchell and Osborne’s cages at present working in our mine, but I have not seen an actual test of its capabilities, and I would not recommend its adoption. In my opinion, if there was a great tension on the rope the safety appliance would be more likely to act; in other words, the less tension the less likely would be the chance of catching. For my own part, I would prefer using an ordinary cage with a good rope before any of the patent cages I have yet seen, as men, when they imagine they have more security, are apt to become over-confident. The companies have always been liberal in the matter of providing for the safety of their miners, and I am confident that they would not object to adopting any recommendation this Board may make.

To Mr. Fincham.—I think the tendency of such a clause in the Mining Act as that relating to the provision of safety-cages is rather to cramp than to encourage; it ought to be expunged until some satisfactory appliance should be forthcoming. I have seen safety-cages in use at home, but they were discarded by many large mine owners in consequence of being pronounced unworkable.

At this stage the Chairman received the following letter from Mr. G. Thurren, which was read:

7 Victoria Chambers, Sandhurst, 11th June 1878.

Sin.—I beg to offer a few remarks on the above subject now engaging your attention, and which I had many opportunities of judging in the deep mines of the States, of California, and especially Nevada, U.S.A., where I observed many different kinds of safety-gees in raising both men and mineral from below, or lowering same, nice verse. I also had a synopsis of reports shown me of certain resolutions arrived at by American and European mining engineers, which were to the following effect, viz.:

"That all safety apparatus must be of a resisting strength to carry a rope of any size, at a velocity of from 20 to 25 feet per second.

"That all ‘grips’ act on the sides of the skids, and not from the centre of cages, to the long section of the shafts.

"That all ‘grips’ should be of sufficient length so as to touch each other, even when no skids are present.

"The catch of the falling cage, &c., must be effected without jerk or concussion.

"Automatically acting catches should have the preference.

"All springs or buffers are to be arranged so as to act only in cases of breakage, and they are not to be subjected to any load whatever.

"Inducibler, or other elastic substances, are to be dispensed with unrelieved in cold weather or extreme heat of subterraneous temperature.

"All cages to be furnished with covers so as to carry the falling ropes when broken."

Description of various Safety-Cages.


The description of the above would perhaps take up too much room here, and occupy more time than you could probably bestow on this important subject at this sitting; but I may mention that Nos. 3 and 4 are now preferred to the
The Chairman of the Board of Investigation

Late Delegate to California under the auspices of the Board of School of Mines.

William Anthony, manager of the Arcadia Catharine Company, deposed.—Many years ago I saw safety-cages at work in a Durham colliery (England), where they were, however, discarded, on account of the springs being too strong, and interfering with the ascent and descent of the cages. I have had two of Mitchell and Osborne's safety-cages in my shaft for the last fifteen months, and am satisfied with them. I tested one of the cages yesterday, at stand-still, and the catch gripped almost instantaneously. I feel myself safer in a safety-cage, even with a good rope, than in a cage of ordinary construction. I believe that a good safety-cage would be an immense boon to the mining community. I have always taken an interest in such appliances, and look after those under my care. The springs, &c., are carefully cleaned and oiled at least once a week, and the chance of their being found out of repair when suddenly required are thereby reduced. The tinsers employed in our workings feel themselves safe in the safety-cages than in the ordinary cages in use.

To Mr. Fincham.—My shaft is entirely at the disposal of the Board and Mr. Mitchell, for the purpose of any experiments thought desirable; but any test to be practical must be as severe as the ordinary conditions of working, the rope must be cut at the drums while the cage was in motion.

Mr. Mitchell (of Mitchell and Osborne) intimated his willingness to submit their invention to any test suggested.

James Cordingley, miner, residing at Castlemaine, deposed.—I have had many years' experience in mining in this colony. I was for some time in charge of the Ajax Company's engine, at Castlemaine, and had, on one occasion, the misfortune to overwind, whereby the crown-wheel was broken at the potted-heads; the accident suggested a remedy to my mind, and I obtained permission to work out my idea. Suppose a cage should go 6 or 7 feet above the landing, it would then, by a simple piece of mechanism, cause the application of a powerful break to the fly-wheel, which would stop the ascending motion almost immediately. The invention is not an expensive one, the cost to the Ajax Company having only been about $5, exclusive of labor. Very few persons had seen the invention, as the company had stopped working, and there was no opportunity for adapting it to other engines.

Robert Carr, manager of the Great Extended Hunter's Company, deposed.—I have not had much experience with safety-cages in actual practice, but have seen some of the recent tests. I witnessed the trial of Williams's cage last week in presence of this Board, but I do not consider this was at all satisfactory, as there was plenty of room for the grippers on both sides and yet they failed signally to act. I saw the trial of "Nancarrow's" cage this morning, the conditions being similar to those under which Williams's cage was tried. Nancarrow's cage answered admirably, and I consider it the most successful trial I have yet witnessed. Although I would like to see a really good safety-cage in use, yet I have not seen any safety appliance that would warrant me in recommending it for general use. I have not the slightest doubt that a good safety-cage would be of great advantage. The miners have always said that the best guarantee for safety was good ropes and tackle, and a steady man as driver. Further security might be engendered by safety-cages. I think that there is a possibility of safety-cages being productive of good results, but at present there is no cage which the community would be safe in adopting. I do not consider any of the trials have been satisfactory, as none of the cages have been tested in actual work.

To Mr. Fincham.—I would not recommend the Government to adopt any of the inventions I have seen; the principle in all of them might be improved, and I would therefore suggest that the 10th section of the Act should be allowed to remain in abeyance pro tem. For my own part, I frankly admit that I would prefer going on with present appliances—simply, an ordinary cage, with the best rope and tackle—to adopting any of the safety appliances that I have yet seen.

Mr. Mitchell (of Mitchell and Osborne) here requested leave to explain that their cage had not been discarded by the manager of the Catherine United Company, as previously alleged before the Board. Inquiries had proved that the cage in question had been discarded temporarily in consequence of repairs to the shaft and machinery; the men were forbidden to use any cage pending the alterations, hence the misunderstanding.

After some explanations as to the authority for the assertion, the examination continued.

J. C. March, manager of the Elginmore Co. (New China United Company), deposed.—I have not had much experience with safety-cages, but have witnessed several trials recently. To my mind the greatest difficulty to be overcome is the back rope, the tension of which would effectually prevent the springs being brought into action. On one occasion, with Mr. Nicholas, the inspector of mines, I endeavored to solve the question: Which travels faster—the cage or the rope? but we could not arrive at a satisfactory conclusion. Our experiments were with Middleton and Jackson's safety-cage. All the safety designs I have yet seen contain the same leading principle, springs being, in nearly every instance, depended upon to supply the necessary action. Springs, it is well known, are not reliable in mixing; as the moisture of the shaft affects the steel
and causes sudden fractures. The runners in the shaft are often out of place, or are not true, and consequently the cage would set—another objection. Only superficial tests have been applied, it being recognized that everything depended entirely on the tension. All safety-cages appear to be constructed on one principle. To my mind there is nothing equal to a good rope and gear; and I question whether, if I had safety-cages, I would be a little less careful. I recently overhauled a new wire rope and found it apparently quite safe, but next day it broke, and on careful examination I found that the wire was badly crimped and had snapped in consequence. I consider that the desiderum of mining would be found in the invention of an apparatus for the increased safety of life. None of the inventions have, to my mind, been afforded a sufficient test. All the cages should be made to fit one full-sized shaft, and a systematic trial given them; until this is done, and the Board are in a position to give the analysis of the result, the clause in the Act should be kept in abeyance. At present I would not risk my life or that of a single miner in any of the safety-cages, and any one else would be mad who did so. I have asked many miners what they thought of safety-cages, and their general opinion has been that none of the inventions are up to the mark. Safety-books are admirable in themselves, and combined with "umbrella catches," such as are in use at the Shanendoah Company's shaft, are exceedingly useful in cases of over-working.

John Keen, manager of the Garden Gully United Company, deposed.—I have been engaged in practical mining for the last forty-three years, but so little have I thought of safety-cages that up to the present time I have not obtained any for the mine of which I am manager. Although safety-cages are not generally used in England, I am inclined to believe that they could be used with much advantage in the deep mines of Sundhurst and other parts of the colony, the chances of the miners being thereby improved. At present there are 147 miners employed by our company, and anything done to promote their safety would not be objected to in the score of cost; that would be a purely secondary consideration with the directors. If the catchs of all the cages I have seen did not grip almost immediately, or before the cage fell 6 or 7 feet, nothing could prevent its rapid descent to the bottom, the velocity of the fall being accelerated as it went down. Without a safety-cage a safety-book would be worse than useless, the chances of a fall down the shaft being increased rather than otherwise.

To Mr. Fincham.—Unless the 16th sub-section of the Act is made compulsory I do not think I am likely to adopt any of the cages I have seen. The inventions look well enough as models, but mining shafts are sometimes very rough, the timber being often disarranged and twisted by moisture and constant usage. In our claim we use inch swivel, with 4-inch bolts, which go nearly through 3-inch latine shakes. The miners in our claim have never complained to me of the want of safety-cages in the shaft.

In reply to Mr. Masterton (chairman of the Sundhurst Mining Board), witness stated that the shafts were usually conted over with a fibrous greasy substance—something of a fungoid—from the moisture and dripping of water down the shaft; this growth or excrescence would, doubtless, militate against the chances of the grippers of a safety-cage clutching the shakes, and unless the action was almost instantaneous the safety apparatus would be useless.

David Park, manager of the Shanendoah Company, deposed.—In the mine of which I am manager there is one of Middleton and Jackson's safety-cages at work; it has been in almost constant use for the past ten months, and I think very highly of its utility in case of accident. I have tested it on several occasions, and once it underwent a very severe trial in actual working. The cage had been pulled right up to the poppet-heads by the engine-driver, and before he could stop the engine the pulley-wheel and bearings were smashed, and fell on top of the cage, which was, however, held fast. Had there been no safety apparatus on the cage, nothing could have saved its rapid descent to the bottom. The safety-book made by the same firm was a capital invention, and I intend to adopt one of them in conjunction with our cage. I believe that even if the cage were ascending at the rate of not less than 800 feet a minute, and the rope suddenly gave way at the drum, that the safety-cage would act properly. It is my opinion that the clause in the Act stipulating for the provision of safety-cages is a highly useful one, as it is an additional guarantee of safety to the miners. New ropes are almost as liable to breakage as ropes for some time in use. Three instances of new ropes breaking a day or two after being placed in the shaft have occurred within my own experience. A good safety-cage is what is required as much as anything I know of, for it is impossible to predict when a rope might break. Personally I have no hesitation in recommending the adoption by our company of the cage invented by Messrs. Middleon and Jackson, at present in use.

Carl Rockier, manager of the Londoenderry Company, deposed.—I am not in favor of the adoption of any of the cages I have yet seen, as I consider that they are all open to further improvement, the same principle being recognised in each. Mining managers have already a great amount of responsibility, and I consider that the clause in the Act relative to safety-cages increases their responsibility considerably, therefore it would be impolitic to insist on its enforcement. I am, nevertheless, of opinion that a good safety-cage would give miners a chance for their lives in the event of the rope breaking in the shaft.

To Mr. Fincham.—The tests hitherto applied have not served to test the various appliances thoroughly. The best, to my mind, would be to cut the rope at the drum when the cage was in rapid motion, about 300 feet from the surface. That would be a good test. I think that at present the enforcement of the 16th sub-section should be deferred, pending the result of the investigation by the Board.

Richard Collins, manager of the Londonderry Company, deposed.—I have seen an experiment with Seavon's safety-cage in the Londonderry Tribune shaft, and on that occasion I was
well satisfied with the result. The trial was made with four men in the cage, close to the poppet-heads, and on being let go the catchers prevented the fall of the cage. In my opinion the best provision in a good cage and a steady driver. If safety-cages were generally used, I am afraid that miners and engine-drivers would become more careless than at present. I think it would be as well to suspend the 10th sub-section until some really good cage is discovered; but I would not recommend the clause to be struck out altogether. Meanwhile, a fair chance ought to be given to all the inventors to prove the efficiency of their cages.

Mr. Fincham here informed the witness and others present that the 16th sub-section of the Act was actually in force. Although the Mining Department had not inspected the inspectors to take action in the matter, the clause could be used against any company in the event of accident. It had been in force ever since the 1st day of January 1878, and the fact that the department had not insisted on compliance with the provisions of the clause did not in the least alter the fact that it was the law of the land. If a miner was injured or killed in consequence of the fall down the shaft of a cage, or from any other cause that might have been prevented by a safety-cage, the company, failing to prove that safety appliances had been used, would be held responsible in any civil proceedings that might be taken, while the manager himself would be liable to be indicted for manslaughter. The clause stood in the statute-book of the colony and could not be ignored, although no doubt it was most unsatisfactory.

A lengthy discussion ensued, in the course of which several mining managers declared that they had rested under the impression that the 16th sub-section was inoperative. They also expressed an opinion that it was unjust to retain such a clause in the Act pending the result of the investigations of the Board of Inquiry.

Mr. Fincham considered that the expression of opinion at the sitting ought to be taken as evidence in favor of the expulsion of the clause in question, but the Chairman protested against the removal of those present being taken, and ruled accordingly. The Chairman promised, however, that inquiries would be instituted with the view to determining the actual position of managers and companies under the 16th sub-section, and the examination of witnesses was then proceeded with.

J. A. Lewis, manager of Koch's Pioneer Company, deposed.—I am of opinion that the matter of providing safety-cages ought to be left to the discretion of mining managers only, as they are in the best position to judge what is really required for the safety of the men. I have seen numerous models of safety-cages, but until they have all been subjected to a severe practical test I would hesitate about adopting any one of them. The application of the necessary power to the springs controlling the catch is very difficult of adjustment; nothing but a practical test of the supporting power of the rope over the pulley, in the event of a breakage, would afford a correct estimate. In a certain mine in Cornwall, dependence had been placed on a safety-cage—at least one of them was in use; but, when the rope did break, the cage went smash to the bottom, and nine men were killed. In my opinion the cage falls faster than the rope, hence there would always be a strain on the rope, which would be kept taut, and the springs could not therefore act. It would be far better just to allow the matter to rest, until the best cage is definitely ascertained.

W. H. Oranget, Government inspector of mines for the Sandhurst district, deposed.—I have seen a good many safety-cages at work, but the best, to my mind, is one that has been invented by Mr. Ramsay Thompson, of Walhalla. This cage is at present in use in the Long Tunnel Company's mine, at Walhalla, and of all that I have seen, I like it the best. I saw Nancarrow's cage tested in the foundry yard, in the presence of this Board last week, but I consider that it was not a test at all, the most essential conditions of a practical trial having been wanting. I have also witnessed all the other trials made by the Board, and consider they were in every instance failures. I would urge upon this Board the institution of a series of systematic trials, which would finally demonstrate the value of all the inventions brought forward. I do not believe that the question of cost will ever prove an obstacle to the general adoption of any cage which may prove to be perfectly safe. In the course of my experience I have conversed with a large number of miners, and, as a rule, they have declared in favor of safety-cages. It is nonsense to suppose that the presence of a safety-cage in the shaft would have habits of carelessness on the part of miners and engine-drivers; the same amount of attention to ropes and gear would always be enforced, while another guarantee of safety in case of accident would be given. With regard to the mode of testing the cages, I believe that the rope ought to be cut when the cage is in motion, and at least 390 feet from the surface. Many of the inventors have been already put to considerable expense in perfecting their cages, and it would only be fair—considering that the Board do not bind themselves to recommend any particular cage—to take measures to relieve them of the heavy outlay that will be necessary in the event of another public trial being decided upon. Cages will have to be specially constructed to work in one shaft, in order to secure uniformity of trials, and it will hardly be fair to expect any company to give up a shaft and machinery for the purpose without a guarantee of indemnification for any damage that may be caused. I think, therefore, that the Board ought to give this matter of expense their careful consideration, as the arrangements for any further trial will thereby be facilitated. Until this trial has taken place, I think it would be useless to venture an opinion as to the utility of any of the inventions I have seen in Sandhurst.

Mrlee, Beattie (manager of the Acraria Catherine Company) and R. Williams (manager of the Johnson's Reef Company) here stated that they would be glad to afford the Board the use of their respective shafts in order to thoroughly test certain of the cages brought under their notice.

The Chairman expressed the thanks of the Board to those present for the information they had tendered. The result of the sitting had been highly satisfactory, and in coming to any
decision on the matter the Board would carefully consider the many valuable points suggested by the evidence heard that day. All the witnesses examined were possessed of many years' practical experience, and this fact would give their testimony additional weight. For the members, directors, and others, the Board had received the greatest amount of courtesy, and all had displayed anxiety to assist in the investigation by every means in their power. He again regretted the absence of the Chairman and the other members of the Board then absent, but he trusted that at the next sitting held in Sandhurst, every member would be in attendance, as the question at issue was of grave importance to the whole of the mining community. The suggestions with regard to holding a public trial of all the cages, in one central shaft, would receive consideration when the Board met in Melbourne, and the earliest possible action would be taken in the event of such a course being determined upon.

_The sitting then terminated._

On the following morning the Board were invited to witness a trial of Nainarow's safety-cage in the shaft of the Great Extended Hunter's Company. In addition to the members of the Board, Messrs. Cooper and Lengridge, M.L.A.'s, and a number of mining managers and others interested in the subject of safety-cages, were in attendance. The cage was first tested without any weight being added; the gripping apparatus caught instantaneously while the cage was in motion, between the mouth of the shaft and the poppet-heads, the cage being held fast at the point of detachment from the chain. A second trial was made, the cage being freighted with 10 cwt. of old iron—bars, &c. It was run out rapidly to within a couple of feet of the poppet-heads and then detached from the chain. The safety appliance again acted instantaneously, the cage being firmly held between the skids.

The Board then returned to the city, and the sittings were adjourned sine die.

**Sitting of the Board held at Lester's Hotel, Ballarat, on Wednesday the 26th day of June 1878.**

The following members were in attendance:—Messrs. R. Clark (in the chair), G. R. Fincham, and R. Richardson, M.L.A.'s. Thirty-two mining managers and others interested in the subject under investigation were present when the proceedings commenced.

The Chairman explained that the object of the Board in sitting at Ballarat that day was to obtain a free expression of opinion as to the utility or otherwise of safety-cages. A series of trials had been recently witnessed at Sandhurst, but the members of the Board did not consider they were of a satisfactory nature. Arrangements would, however, be made for further experiments, when all the safety-cages in use in the colony would, if possible, be subjected to a severe trial. In the meantime the Board were desirous of eliciting all the information to be obtained on the subject, and consequently the large attendance of practical men was extremely gratifying, as showing the deep interest taken in the proceedings of the Board. As several inventors were present he would request them to represent the value of their respective appliances.

**Robert Allan,** millwright, Cieswick road, Ballarat, deceased.—The model produced before the Board is my own invention; it is the result of five years' study and experimenting. I have made a number of experiments, but they have all been practically on one principle. My first attempt was with a kerosene tin, having a girdle that caught the skids, and a lever attached, with a spring to throw the lever clear of the skids. This invention worked very well, but I found the pressure was wasteful, and the catches did not grip the skids firmly enough to support the weight of the cage. A second invention was a box with springs and levers, to be attached to the cage by screws, without any connection with the rope. The cage, of which you see the model, is the outcome of all my experiments. It has been tested in actual practice in the No. 6 shaft of the Bond and Allison Consols, Ballarat. The cage was loaded at the bottom of the shaft, and run up to the brake where it was disconnected, the rope going over the pulley-wheel. It held fast, and again it was tested. Myself and son entered the cage, which was run up to the poppet-heads and suddenly detached; the cage did not drop an inch; the experiment being, to my mind, a perfect success. I could show the invention in actual working to-morrow, if the Board desire to see it. I obtained a patent for the invention in December 1875.

_To the Chairman.—_The principle is what I term the "dissolving fulcrum." In the experiments I have mentioned the cage could not go very fast, a tail-rope being attached to prevent it going over the pulley. I do not think that an increase of speed would militate in the slightest against the success of the invention. In the experiments I have always detached the rope without cutting it. I am aware that many so-called safety-cages have been lately patented, but it is my opinion that they will grant a patent for anything in Melbourne, if you pay for it; that is, if it does not infringe on any other person's invention. I have the most perfect faith in my own invention, which is the only one in use in this district.—[Witness here explained the action of the springs in the event of the rope breaking or becoming otherwise detached.]

To _Mr. Richardson.—_I consider the spring is placed perfectly right, on sound mechanical principles; I have had forty years' practical experience in such matters. The force of the spring will not be destroyed in its present position; it has always been found efficient when in actual work. The cage is fitted with levers which are within easy reach of the men inside the cage; the cage can be stopped by these levers instantaneously. With regard to the position of the springs, I may state that they do not expend their greatest force when least required.
To Mr. Fincham.—No grease is allowed to be used on the spring and catches, as, in my opinion, grease clogs their action; the constant working of the cage will ward off corrosion for twenty years, so that grease is not actually required; the mineral water in shafts would naturally affect the ironwork of the cage, as it would other cages.

To the Chairman.—The spring will not wear out or lose its elasticity in its present position. I estimate the cost of applying my invention to any ordinary cage at from £10 to £14, not more.

At this stage Mr. Burnard, an intending witness, desired to ask Mr. Allan a question relative to the action of mineral water on the springs, but Mr. Richardson objected to the proceeding, on the ground that it was derogatory to permit any cross-examination beyond that which emanated from the Board. The members of the Board were in a position to elicit all the information that was necessary, and he protested against such an innovation on the established rule.

The Chairman pointed out that by affording the witnesses an opportunity for cross-examining inventors, &c., the Board were merely following out the course which had been adopted at Sandhurst during the sitting recently held there. Valuable information had been elicited by the adoption of a free cross-examination, most of the witnesses present being men of extensive practical experience, who were guided by the sole desire of making the investigation as complete and exhaustive as possible.

Mr. Fincham supported the view taken by the Chairman, and stated that in his opinion the plan had worked admirably at Sandhurst, where many valuable items had been elicited by the examination of inventors and others at the hands of practical men, who sometimes discovered points left untouched by the Board. The Board simply desired to obtain the maximum amount of information.

Mr. Richardson still objecting, the room was cleared, and the Board considered the point raised. After some discussion it was resolved to proceed with the investigation as before, any person in the room being permitted to put any question to the witness after his examination by the Board was concluded.

The decision of the Board having been made known, the examination was continued.

In reply to questions put by mining managers, witness (Mr. Allan) stated that, in the event of the rope breaking, the lever and catch would not act on the skids before the cage fell three inches. Intense cold might affect springs and occasionally render them so brittle as to be liable to fracture, but the spring attached to his cage was in leaves—on the principle of carriage springs. One leaf might break, but the others would still be effective. He was not aware of springs having been used in the first safety-cage invented. He had made a safety-hook, but it was a subsequent invention to the cage. The point of resistance was the four grippers at the skids; the grippers can be increased at will. Even in the event of the spring breaking and rendering one set of grippers inoperative, the remaining grippers on the other side would be sufficient to check the descent of the cage.—[Witness illustrated this assertion by disconnecting the grippers on one side of the model and standing on the cage, which bore his weight.]

Mr. J. P. Smith here produced a model of the Narrow safety-cage, which had arrived the day before from Sandhurst. He stated that the model had simply been assigned to his care, and that he was not before the Board to explain the invention in any way.—[Model placed on the table.]

T. H. Thompson, manager of the City of Ballarat Company, deposed.—I have been mining manager of the company for some years, my experience in mining extending over the last twenty years. I have seen a number of models of safety-cages in the old country, but never saw any of the inventions in actual work. The safety-cages have been given up as unsafe at home, and I have not a very high opinion of their utility. I do not like the safety-hook attached to Allan's invention, as there is nothing to prevent the rope becoming entangled round the hook, and there are other defects.—[Witness illustrated his objections by means of the model produced.] With regard to the cages themselves, thousands of models might answer and appear to meet every objection, but they could not be reduced to practice. The cages would probably fail all attempts if the rope broke while they were coming up the shaft, but not while going down. The patents were good enough on paper, but in practice would not answer. Say one was descending a shaft at a velocity (often arrived at about half-way down the shaft) of 20 feet a second, and stopped suddenly; the cage might be safe enough, but the momentum of the descent would kill a man in it by dashing him with a shock against the cage and smashing him to pieces. The same rule obtained in the case of a railway collision. When a train dashed against another and stopped suddenly, even at a speed of 25 miles an hour, passengers were injured and often killed by being dashed against the side of the carriage opposite to that upon which they had been sitting. If a man were driving a buggy which stopped unexpectedly, he would be thrown out over the horse and probably be killed, the speed not being more than ten miles an hour, while the greater velocity of the cage would produce far more disastrous results. Then, again, the cages descend a shaft with immense velocity, far more than that of an ordinary falling body, and if a rope broke near the drum the weight of rope that the cage would have to draw after it would offer such resistance that the descent would be some little time at least before the patent catches would be freed to clutch the skids. A heavy body falling, with an initial velocity of 30 feet a second, would most probably reach the bottom of the shaft before that time, or, if the catches did work, so great would be the force of the fall that the shaft would be all broken up, the timbering being at least displaced.

To Mr. Richardson.—The clutches might hold, but the men in the cage would most certainly be killed—crushed to pieces in the cage. The danger would be increased by the skids
breathing, although the capitals might be strengthened. A falling body of nearly a ton weight would tear away everything before it in the shape of timbering. The cage and its contents would travel up at the same pace, but supposing the contents to be moveable—men, for instance—the shock of a sudden check would be the same as a collision, and the men or men, being moveable, would be propelled upwards in a vertical direction.

Mr. Richardson.—But would not the men cease to ascend the instant the cage stopped. The objection you urge, if correct, would effectually destroy any advantage accruing from the use of safety-cages—the men being killed by the sudden stopping just as much if he were precipitated to the bottom. What then, in your opinion, gives the man his velocity?

Witness.—The cage. All the danger, to my mind, is in the cage being suddenly checked while in rapid ascent.

Mr. Richardson.—I can assure you that I have been in a cage when it was travelling at the rate of 20 feet per second, and you are greatly out. There is more danger in going down than coming up.

To Mr. Fincham.—I would not like to travel in safety-cages, as no skids could stand the tremendous boring pressure suddenly applied. Besides, safety-cages have been tried for over twenty years in England, and they have been shown up as now, the miners resisting all attempts to use them.

To the Chairman.—I would not care to use any of the safety-cages I have seen, they are all such gimmick affairs! I would rather rely on an ordinary cage; no cage has yet been made that is a safety cage. I do not admit that they are safe, except perhaps in descending. Take a shaft in actual work—the skids are often covered with alway moss which would effectually prevent the catches from gripping. For my own part, I would much rather prefer travelling with a good rope and strong cage than by the best safety-cage I have yet seen.

To Mr. Fincham.—I have never heard any miners complain that there were no safety-cages provided by their respective companies. I have never found any desire on the part of the companies to expend money on inventions for increasing the safety of their men; I do not think the question of expense would ever be considered.

To Mr. Richardson.—I am aware that there is a section of the Act stipulating for the provision of safety-cages. I consider the cage at present in my shaft more safe than either of those shown by the models, and I therefore comply with the Act. I contend that, independent of all the objections, the more effectual the working of the principle, the greater chance there would be of the skids being cut out by the teeth of the grippers, or otherwise broken. In my opinion this objection would apply more particularly to Nancarrow's patent, where the gripping power is more direct; this invention is, to my mind, worse than useless.

G. F. Newton, mechanical engineer, Ballarat, depose.—I have had 24 years' practical experience in machinery, and have had many opportunities for judging the value of safety-cages. Ten years ago I used safety-cages at Avoca, and discarded them as useless; they had the objection which I can see in Nancarrow's patent, i.e., that the teeth of the grippers would destroy the skids. To use this cage a company would have to outlay the expense of providing new skids. I think it would be an unfair tax on mining companies to provide skids of sufficient strength to ensure the working of the invention, even if assurance were possible.

To Mr. Clark.—I do not consider that skids 8 x 4 would be capable of bearing the sudden strain and boring pressure of Nancarrow's invention.

To Mr. Richardson.—In many shafts the safety-cages would not be worth the price of the old iron. I have seen some shafts so crooked that you could not see the top from the bottom, 250 ft. deep. The cages I mentioned were of English construction, and were employed in the Clunes and Avoca, New Deep Lead, and other companies at Avoca. They were worked by means of spiral springs and quadrant clutches; but in consequence of some idea of insecurity the miners entertain a prejudice against them. The cages caused a lot of trouble, and the miners finally refused to work under them. The spiral springs broke frequently, and it took a good deal of money and trouble to replace them, and the quadrant also broke and tore the shaft; the expense was endless.

Mr. Richardson suggested that, in considering any plan or invention for saving life, the question of money should be left out entirely. In the present instance the Board did not desire to know anything about the cost; they were simply anxious to discover whether the principle of safety-cages was efficacious or otherwise.

Witness continued.—I do not consider that any new-fangled notions of inventors should be thrust upon the mining community. I think too much care cannot be bestowed upon the safety of our miners, but I do not consider it is the duty of the Government to insist on the adoption of this or that cage. The Government inspectors should perform their duty by closely supervising the ropes and cages; there would then be little to fear from such accidents as the Safety-Cages Commission desire to guard against. The shafts in the Ballarat district are nearly all first-class; many of them are equal to any shafts in the world; but the sudden shock of a cage being checked in the shaft would tear away the skids from the centre-pieces, and smash everything in their way.

To Mr. Richardson.—No doubt the Government have been actuated by the better motives throughout their treatment of the subject. They have already done much good by the appointment of inspectors, but I think it would be very hard on the companies to insist on their providing special skids and apparatus in shafts 1,200 or 1,500 feet deep; the tax would be too great.

To Mr. Fincham.—It is my opinion that the danger to life would be actually increased by the general adoption of so-called safety-cages. Miners would become careless, trusting too much to the working of a mechanical contrivance. I have always found companies willing to incur any expense in providing for the safety of their men. I am satisfied that the expense of providing safety-cages is not an obstacle in the way to their adoption.
To the Chairman.—My evidence on the subject is without prejudice. I am an applicant for a patent myself, and am always glad to hear of any new invention.

To Mr. Richardson.—In my opinion safety-cages ought to be recommended, but their adoption should not be made compulsory.

E. W. Stephens, director of the Magdala Company, at Stawell, deposed.—I have had considerable experience in mining, having been engaged in that pursuit ever since the year 1832. Ten years ago I saw safety-cages at work. The cage with which I had the most experience was Bell and Grant’s, a Scotch invention; it worked with elliptic springs; but it was a failure, and before long it was thrown aside as worthless. Our company was desirous of obtaining a perfect safety-cage, and went to great trouble and expense to find out an invention that would answer. Not long since the patent of Williams, a Stawell inventor, was adopted; and in order to obtain the best result, two cages were constructed quite regardless of cost. The two cages cost the company £185; this heavy expenditure being necessitated by remedying certain defects from time to time discovered. The cages were suspended in the shaft, and worked in the tramway. About nine months after their suspension one of the cages was wound up to the popeet-ends; on coming into contact with the wheel the patent hook gave, but the cage, instead of catching, slipped down to the door, where it was caught. It was found that certain pin-holes had been rusted, but nothing else seemed to be the matter.

To the Chairman.—We examined the cage closely afterwards, but could not detect any disarrangement of the apparatus beyond a slight enlargement of the holes in which some of the bolts went through; nothing else appeared to be wrong with the apparatus.

To Mr. Richardson.—I have arrived at the conclusion that the best cage and only safety is a good rope and careful driver. The cages I have mentioned were made of the very best material; when wanted, they failed; and my faith in them has been destroyed. We did everything in our power to render the cages perfectly safe, and expended £12 on providing them with indiarubber buffers. I am convinced that the failure was not attributable to the springs, but solely to the deterioration caused by the wear and tear of actual work. My company never objected to the expense in any way, but they had come to the conclusion that in new rope by the best safety of the miners; the question of expense was not considered; but as yet I have not heard of a single safety-cage, like as well as an ordinary cage, and the cage that has proved a failure, was the best I have seen. I would suggest that the Commission, if they discover what they consider a perfect cage, have it tried in some shaft for a couple of years, and if it did not fail in that time to enforce its use generally.

Duncan Campbell, director of the City of Ballarat Company, deposed.—I have had twenty years’ experience in mining. It is my opinion that the fewer complications and the more simple mining-cage appliances are the better. I would far rather trust my life to an ordinary cage, provided the rope was good, than to any patent safety-cage; the risk is in the patent, and I do not think that the inventors or patentees would care to trust their life to it. Money would be no object to a company where the purchase of a cage which would absolutely ensure safety to miners and those using it was concerned. I think that the Government should leave to the mining community the task of looking to their own safety. All the working miners I have spoken to prefer the ordinary cages, with good ropes and winding-gear, to all the patent cages yet invented.

To Mr. Fincham.—It is my belief that men become more careless and neglect supervision of their gear. Expense is not any consideration. The safety-hook is somewhat complicated. If I have to trust my life to a patent solely, I would not feel so safe as with the knowledge that all behind was in good order. Up to the present time I have not seen an invention which I would recommend to the adoption of any company. In the event of a man being injured, the company would have to pay more than the cost of half-a-dozen cages, consequently they are only too anxious to secure a genuine safety-cage.

To Mr. Richardson.—The spring at the top of Allan’s cage is an objection, the spring might be snapped suddenly, and when least expected, from the influence of cold weather.

Mr. Selwyn, Secretary deposed.—I have been mining in this district many years. I have been in the Abbot Consolidates for the last ten years, and altogether I have had thirty years’ experience in mining. I have not had much experience in this district with safety-cages, but I have examined all the inventions from time to time brought under my notice. In all the cages I have seen the superincumbent weight is thrown on the lever. I do not like Newcomen’s cage, in which the gear starts from a framework around the cage itself. If a pebble, a piece of wood, or a collection of dirt got between the upper and lower portions, the action of the gears would at once be stopped. I would not have one of these cages in my shaft if the cage were given for nothing. I have seen Williams’ patent, and consider it is open to many objections; the springs or buffers on which the action depended did not possess sufficient elasticity, hence the failure of the invention. The cage in question had a spiral spring upon the bolt affixed to the top, and every time the cage was tried the spring snapped, and it was finally replaced by indiarubber buffers. These were not elastic enough, and it was this fault in them that prevented the gears not working on the occasion of a recent accident. The working men are prejudiced against the cages, because they do not know much about them. The same prejudice since existed against the use of covers, but it has died out. I do not think any miner would object to use a cage that was really a safety to him. Allan’s is the best cage I know. I have seen Mr. Allan and his son carried in this cage to the popeet-ends, and when the rope became disconnected there, the cage stopped instantly. Other subsequent experiments were equally satisfactory. I have had no experience of cages at home. As a matter of fact, the danger to miners while in the cage is of being carried to the popeet-ends, as was the case in the Magdala accident; this danger, however, could be got over without a special
hook. A good simple apparatus would be of great service; and, should any invention be proved to answer all requirements, in the event of the rope breaking, the gain to the mining community would be very great. With regard to the main slinger, I am not a great supporter of the plan of a very simple invention which I am certain would be found efficacious in cases of emergency.

—I Witness have exhibited the plan referred to, which illustrated the mode of checking the descent of an over-mound cage previously witnessed by the Board at the Shannonbrook Company's mine, at Sandbach, there known as "umbrella cages." I cannot recommend any of the patent cages for general use, but I must say I like Allen's invention better than any I have yet seen. I believe in this cage to such an extent that I would have no hesitation in using Allen's cage and allowing the rope to be cut at any place in the shaft, for a man in this cage could stop it by a touch of his fingers. The only thing I do not like about it is the hook. A double hook was shown at the Juvenile Industrial Exhibition, and if this were affixed to Allen's cage I would not hesitate to enter it and allow the rope to be cut. The working miners have a prejudice against safety patent cages, and small co-operative parties could not afford to buy them; the cages would cost about £25 each. With these small companies it would be merely a question of expense.

To Mr. Clark.—The presence of such a cage as Allen's in a good shaft would certainly not detract from the safety of the men.

Mr. Richardson.—Several winding ropes have broken in our shaft, the breakage having generally occurred near the connection, owing, as I believe, to the fact of the rope being doubled up close to the cage whenever there is any slack in the shaft.

Mr. Roper.—I have been managing the mine of our company for five years, and altogether I have had twenty-three years' experience in the business. I am of opinion that no sufficient test has been applied to safety-cages up to the present time. If the rope were severed at the pulley the rope and cage would travel at the same rate of speed to the bottom, but if the rope should be cut when the cage was between the sheves and the pigtails-heads no doubt the safety appliances would act, yet the cage could scarcely help sticking. The tests should be applied when the cage was near the bottom, and it should be ascertained if when the rope was broken the weight of the broken rope and its resistance while falling was sufficient to prevent the gripping apparatus from working. The cages should be tried by practice, and it is of little use until that is done to take the individual opinions of mining men. If a cage proves itself equal to any test imposed upon it, the Government would be justified in insisting that mining companies should use that cage, but not otherwise. The majority of companies would require new skills, and to alter their trucks. I have repeatedly spoken to the men of safety-cages, but they invariably expressed their faith in good ropes and good gear over any safety-cages. I do not think that Allen's cage would increase danger to men, but I do not like the hook. If they adopted Mr. Seignet's scheme, or that of one of the Trunk Lead Company's engine-drivers, to prevent over-winding, I think that Allen's cage could not but lessen danger. It does not pay mining companies to neglect the safety of their men, as one accident would probably entail more expense than the cost of a dozen safety-cages. In our shaft I reckon it would cost £200 to place a safety-cage in working order, but this heavy expenditure would not be allowed to remain an obstacle to its being provided in the event of a thoroughly safe invention being discovered.

To Mr. Richardson.—I have heard all the evidence given with regard to the failure of Williams' cage at Stowell, but I am more hopeful than most of the witnesses, and believe that something can yet be invented which will approach as nearly as possible to a perfectly safe cage.

To Mr. Richardson.—The prevailing opinion amongst miners is that it is better to do without a safety-cage, as they are apprehensive that the adoption of one would lead to neglect of ropes and tackle. I do not, myself, see that the danger to men would be increased by the employment of a good safety-cage.

Robert Henderson deposed.—I have had fifty-three years' experience in mining, and at various times I have devoted considerable attention to the subject of safety-cages. I remember when they were first brought out in England in the year 1848. It was, if I recollect aright, the invention of a Mr. Pindoeone, and was tested in a cellery at Mount Wavguth. This invention was well thought of, and it worked well for a time, but then the springs got out of order. Bell and Grant's cage was subject to the same objection. In 1849, at Ludworth colliery, the use of Bell and Grant's cage did not prevent the death of five men. Mr. Allan's cage was a good one and I would not object to using it if a drum was placed over the hook to prevent the rope coming around it and preventing it working. I do not think the workmen, as a rule, know sufficient about safety-cages to object to them on scientific grounds. I consider that the Government should not enforce the clause of the Act concerning safety-cages, because that would be shifting the responsibility of accident from the company to the Government. I may state that at the Exhibition of 1881, I saw a number of experiments with safety-cages; the experiments being witnessed by Stephenson, Vivian, and many other eminent engineers. The cages then answered well enough. I believe that in deep mines they could be trusted to work satisfactorily. Safety-cages ought to have a thorough overhauling at least once a week.
To Mr. Fincham.—I would not advocate the enforcement of the safety-cage clause in the Act, but I would rather leave it to the option of adopting appliances or otherwise.

To Mr. Richardson.—The men do not consider the utility of these cages; they do not know sufficient about them.

To the Chairman.—A good deal of carelessness is, in my opinion, wrongly attributed to miners, who are, as a rule, quite as careful and competent to look after themselves as any other class.

To Mr. Fincham.—The miners have the courage of their opinions; they are not subject to intimidation, and they always speak out when they see that anything is wrong.

To the Chairman.—I have known some men to run risks by overloading cages. Generally at the end of the shift the men are in a hurry to ascend the shaft, and are not very particular as to how they get to the top. In England there is a rule that when a cage is overloaded the last man who got in should be liable to a fine; it would not be difficult to introduce such a rule here; the man at the bottom and the bosswoman could see that it was carried out.

To Mr. Richardson.—The frequent breakdown of ropes at the colliery workings became deeper, caused attention to be directed to the subject of safety-cages in England. Inspectors were appointed and other precautionary measures were taken, and by these means the number of accidents was somewhat reduced; the inspectors looked very sharply after the interests of the miners.

I do not remember the verdict passed at the inquest on the bodies of the five men who lost their lives in the Ludworth colliery, but I heard that the widows of the men were strongly recommended by Mr. Thomas Wood, the manager of the mine, to bring an action for damages against the patentees of the safety-cage, which court to have saved the lives of the men who were in it at the time the rope broke. Personally, I would have no objection to using Alba's safety-cage, and would trust myself to it, because it appears perfect in construction and simple in action. I never saw it before today, but I believe it is perfect in its adaptability to the purpose for which it is intended.

G. F. Smith, legal manager of the Black Hill and Salters Companies (at Blackwood), deposes that he has had twenty years' experience as a mining manager. I believe that safety-cages are excellent in theory, but they cannot be reduced to practice. Most of the inventions I have seen depend for their action on springs, which is well known are always subject to corrosion and loss of elasticity. I might mention that in the Black Hill Company's shaft there is mineral water; this would crystallise the iron and affect the efficiency of the machinery. A break of a galvanised iron was destroyed in three months, and similarly the pins of the gripping machinery might be destroyed. I have had no experience of safety-cages. They should have a fair trial in some shaft for a couple of years, and then, if any were found to act well, its use should be enforced. Even in that case, engineers and others would grow careless from the lessening of danger. Again, the cost of altering many shafts would be ruinous to small or struggling companies. Still, the opposition to the safety-cages is mainly due, in my opinion, to the belief that they would not answer in actual practice; certainly their cost is no consideration.

R. W. Newman, manager of the Parade and Cominas Companies, deposes— I have been connected with mining for the last eighteen years, but I have not had any experience with safety-cages. I do not think their adoption would tend to render the lives of the miners more safe. Some years ago I had an idea for a patent automatic break for railways; the idea was good, but an eminent engineer, Mr. Clarke, said there was an objection to its employment, because managers found that their employes became imperceptibly careless by the use of a self-acting break. I believe that the effect of a safety-cage would be exactly similar. The use of the cages shown would necessitate also the alteration of skids in nine out of ten claims in Ballarat, and this would ruin many of them. Tribunals and working miners are not less careful of their lives, and are as intelligent as other men. I have never heard any complaints about being no safety-cages, and I am sure the miners would be more the less careful whether they were adopted or not. I have always found the miners, as a class, singularly careful of their own lives, quite as much as any other.

William Benson, legal manager, deposes— I have had twenty years' experience in mining, but have had no experience with safety-cages, and I am certain that their adoption would inflict an immense expense on all the companies in the district. Many quartz mines in Ballarat are totally deficient in the strength necessary to apply these inventions. The skids are sufficiently well adapted for ordinary purposes; but such inventions, if insisted on, would be tantamount to closing up all the shafts. I never had an accident with the cage or rope, although the men are often careless in not sufficiently gripping the workings. As a rule, in timbering they are reckless, but especially careful in the matter of ropes. Two men were killed in our mine by a fall is, although only ten hours before I was down with them and pointed out that the place wanted propping; they neglected to follow my instructions, and they lost their lives. Miners are indifferent rather than reckless.

The following communication was handed to the Chairman, and duly received as evidence—

My time not being my own, I am unable to remain this morning, and have therefore put in writing the substance of the evidence I intended to give.

In 1865 I adopted the safety-cage invented by Mr. Peter Dunlop, engineer to the late Cosmopolitan Company, of which company I was manager. The cage was made by him on the plans I gave, and continued in constant use until the company's operations were finally suspended in 1868.

After the cage had been in use about two years an accident occurred which proved the soundness of the principle, and also the necessity to continue it, which it is an efficient one.

On that occasion a case of over-working occurred. The cage, containing a full truck, was drawn at full speed towards the puppels-ha, the catch, acting upon the pin in the chuckle, released the chain, allowing it to glide harmlessly over
At five o'clock the Board adjourned until the following morning, for the purpose of hearing the opinions held by practical miners on the subject of safety-cages.

Sitting held in Lester's Hotel, Ballarat, at nine o'clock on the morning of Thursday, the 27th day of June 1878.

The following members were in attendance:—Messrs. R. Clark (in the chair), G. R. Fincham, and R. Richardson, M.L.A.'s.

About twenty persons, chiefly miners, were present.

The Board heard the following evidence:—

Edward Groth deposed.—I have been mining for twenty-four years with the pick and shovel, and am now a tribunter working with some others. I do not personally believe in safety-cages. I have worked in nothing but a good rope and perfect tackle, with a good steady driver. I have never seen an accident from rope breaking. I have given the matter of safety-cages consideration, but I have never seen any trials with them. I have always thought that the use of a safety-cage tended to make men careless with regard to other parts of the winding plant than the cage. I am of opinion that the miners are capable of looking after themselves without Government interference.

To Mr. Richardson.—I am a practical miner, but I have never seen an accident in the shaft. I prefer a good rope to any cage. Miners are quite able and competent to take care of themselves. Between forty and sixty men are employed with me, but I do not speak for them, only for myself. I have been talking a good deal with them, but do not know what they think about these cages.

To Mr. Fincham.—Mining is very different now to what it was fifteen years ago; then large companies provided everything—all that was necessary to work their mines; but now the tributers have to pay all expenses, and the heavy royalty does not leave them much to spare. It would require a lot of money to supply a safety-cage, and I think many of us would simply be unable to do so. I will, however, admit that anything providing additional safety to life is good. The majority of the miners in Ballarat are tributers, and earning upon an average not much more than £1 a week, and they could not afford to buy safety-cages. Of course, if the cages were proved to prevent accidents, no expense would be too great to buy them.

The Chairman pointed out that on the previous day a number of mining managers had asserted that the cost of providing safety-cages was no obstacle to their general adoption.

Witnesse.—The directors of the companies have very little to do with mining here now; nearly everything is managed by the tributers themselves.

To Mr. Richardson.—Notwithstanding all care and caution, accidents will happen. After twenty-three years' mining, I met with an accident twelve months ago, and I have always been careful.

P. Bennett, manager of the Countess Tribute Company, deposed.—I have had twenty-five years' experience in mining. I have seen various models of safety-cages; they appeared to work well enough, but I have doubts as to their efficiency in actual work. They should be properly tested, and if that were done, and they proved themselves equal to any test, they should be used universally. Most miners are opposed to safety-cages, and I think that if the latter were used, miners would get careless with regard to the ropes. I am not in favor of the “cage” section being expropriated from the Act if some cage was proved to be a “safety” one. In my company there have been three breakages, which cost them about £20. The question of cost ought not for a moment to be considered; it is a silly objection, as one breakage would entail more damage than half-a-dozen cages would cost. Three ropes have broken in our shaft, and in no instance did they give any sign of weakness before snapping. Wire ropes are, to my mind, uncertain, and I condemn their use.

To Mr. Fincham.—I do not consider that a just clause in the Act which relates to safety-cages being provided in every shaft. Providing that it were possible to give a correct definition of what “safety and suitable appliances” are, then the clause would be right enough. We have a consulting engineer and adopt his recommendations.

To Mr. Richardson.—The mining community will, no doubt, accept the decision of this Board with very confidence.

To Mr. Allan (inventor).—Three ropes broke in our shaft, and the cage, on each occasion, descended to the bottom. The first breakage caused a delay of three days, and the cage was also smashed. Had there seen a safety-cage, and it had acted, of course the loss would not have been experienced.
John Sharp, mining engineer.—I have had thirty years' experience with mining machinery, &c., and for a considerable time I worked with one of Grant's patent cages in Scotland. In the year 1828 I worked with this cage, and found it answered well enough when not in actual practice. It was on the double eccentric principle, and certainly the best appliance I have seen. It was working in a pit of 150 fathoms, and usually carried four trucks—rather a heavy load. On one occasion the rope broke when passing over the pulley, and the safety appliance failed to act, the cage going down with terrific velocity. Fibrous ropes generally become weakened in those places where they come into frequent contact with iron; the pulley-wheel especially oxidizes the rope, and it is where the rope rests when not in motion that the greatest danger of breakage lies. I have always used the best Russian hemp rope; the same description was used in the pit of which I am speaking. When the rope broke on the occasion referred to, it was thought that the grippers would clutch the side of the pit, but they failed to act, and the cage crashed through a couple of stages across the shaft. The skids were first-class, and well adapted for the purpose of sustaining the cage. To my mind the greatest objection to safety-cages lies in the form of the back of the back rope would prevent the catches from acting. I will assume that the breakage occurs between the pulley-wheel and the drum, when 200 or 300 feet of rope is out; the cage, being a heavy body, will descend rapidly, the rope being dragged after it; the momentum of the cage once attained will necessarily prevent the grippers acting, the rope being kept taut all the way down; anything behind the pulley will operate to prevent the grips working. At a trial of the model I attached a little parcel to the rope, and the cage dropped like a shot; thus the slightest retention of the rope when broken between the pulley and the winding gear will prevent the grippers from working, and let the cage drop to the bottom.

I have since written to gentlemen connected with the Chiltern Valley Gold Mines, in both of which a decided success was claimed for an invention that had been subjected to severe practical tests. He requested the Secretary to read these letters, as follows:—

Dear Sir,

I notice in the reports of trials of safety-cages in the presence of the Commission appointed to report thereon, that several failures have occurred. Your special attention is therefore directed to those in use in the main winding shaft at the Chiltern Valley Gold Mines, said safety-cages having been in use at Chiltern, for several years, during which time several tests have been made daily, and their efficiency proved beyond doubt. The cages alluded to are double cages; that is to say, two trucks of wash-dirt can be placed therein on the same level. The reason why I direct your special attention to this mine is on the subject of an invention attached to these cages has never failed to do its duty in any part of the shafts when the rope has given way, and it is practiced working alone which demonstrates the value of any invention.

I am, dear Sir, yours very truly,

Thomas Cowper, Esq., Secretary for Mines, Mining Department.

John A. Wallace.

Dear Sir,

Chiltern, 19th June 1878.

I see that you, in your capacity as a member of the Safety-cage Board, are taking great interest in the trials of the various safety-cages experimented on in the presence of that Board; and, knowing the interest you have always taken in everything tending to the welfare and safety of the miner, I feel it my duty to draw your attention to a safety-cage that has been in use for the last nine years at the mines of the Chiltern Valley Gold Mines Company; for simplicity of construction, its easy adaptation to any form of cage, its inexpensiveness, and its effectiveness, it excels by far any cage you have ever tried, at all events on Sandhurst. And, taking all its merits into consideration, I have not the slightest hesitation in saying that neither Seymour's, Runcorn's, or Jackson's (which in some points resemble) are equal to it. The following are the particulars of a practical test it received seven years ago. But I must first let you know that the cages here are double plank, and carry two trucks standing and not; this necessarily requires the cages to be very strong, and therefore heavier than they are used about Sandhurst. At the time it received the test it had been running many months, and therefore no special preparation made. It was being raised at the rate of about 450 feet per minute, and when at 170 feet from the surface, the rope, a flat wire one, parted near the winding-drum; the cage at once gripped the skids, and held them, notwithstanding the great weight it had to carry, which, cages, 16 cwt.; two full trucks of wash-dirt, 12 cwt.; 200 feet wire rope, 15 cwt.; making a total of 241 cwt. To this has to be added the velocity of the falling rope, so that you will see it was a most severe test.

The man who went down to clear the rope away from it, and several others who were there, are still in the employment of the company, and express themselves as so certain of its action that they are perfectly willing to go on the cage and allow the rope to be cut at any part of the shaft. The cage is in daily use at this mine, and Mr. John Dyer, the manager (who is taking great interest in the proceedings of the Board), would be most happy to allow any experiments desired, should the Board visit this locality, which I, in common with many others, hope they will do.

I am, dear Mr. Clark, yours sincerely,

John Small.

R. Clark, Esq., M.L.A.

Engineer Chiltern Valley Gold Mines Company.

Witness continued.—I am pleased to hear that such an invention has been found, but I would like to see it in actual practice before accepting it for general use. In Shropshire a new invention is at work for rapid winding. Owing to the greater depth at which mines are worked, increased attention has been given to facilities for rapid winding. So rapid is the ascent in the mine I refer to, that they bring a five-decker up 590 yards in 32 seconds; but I do not think that they ever bring men up at that speed; they wind men very fast, however. I have myself gone down a mine so fast that I have been sick at the bottom. I do not object to safety-cages; on the contrary, if I thought they could be made effective I would use them willingly. Expense would be no object. The simpler the cage the better, as springs get carbonised, hard, and brittle, from use in a cold-damp shaft. I believe that the action of springs would be unreliable after six months. Finally I would prefer going down in a naked cage than trusting entirely to a safety-cage. I might trust to the latter too much, although I admit the sense of security would be none the less if proper attention was paid to all details.

To Mr. Findlay.—I have not heard any complaints from miners on the subject of their companies failing to supply them with safety-cages; on the contrary, miners prefer the simple cage and good rope, not so much looking after being required to make them safe.
To Mr. Richardson.—The Scotch cages were found to be a nuisance one way and another; they always required overhauling, and never seemed right. The miners, at the time I am speaking of, formed a large organisation in England, and the safety of men was carefully considered. In my opinion ropes should receive the utmost attention. The company with which I was associated passed a resolution that all ropes should be discarded after having been used for twelve months, and some such rule, I believe, was laid down by other companies at the same time. The principle involved in Allan's cage is similar to that contained in Bell and Grant's. The average weight of the ropes used in our mines is 9 lbs. to the yard, and in many mines there is a weight of rope from the pulley to the drum of 014 lbs.; this weight would, in my opinion, effectually prevent the patent apparatus from working. There is not so much safety in these cages as is generally claimed, and my opinion is that cages on the safety principle would not be found effective.

James Cotter, legal and mining manager, deposed.—I have had twenty-five years' experience in mining, and from all that I have seen and heard I am not prepared to recommend the adoption of safety-cages. I would be very slow in recommending or adopting any of the inventions that have been brought under my notice. The grippers might act in case of accident to the rope, but I am afraid that the runners would open out a little, or be forced out of their places, and that the cages would go amuck down. It would be dangerous to force mining companies to adopt any of the inventions yet presented. It is not a question of expense, as all the companies I know are anxious to promote the safety of their men. I find no class so much opposed to safety-cages as miners themselves; they prefer the ordinary appliances. I was not aware of such a clause (the 16th sub-section of the Mining Act) being in existence. I am sure it would be a very great hardship to insist on its compliance. I have always taken an interest in such questions as that present under investigation, and when the matter of appointing this Board was before the Honourable the Minister of Mines, I wrote to him suggesting the addition of several gentlemen of practical experience. I advised him to appoint Messrs. A. K. Smith and R. Richardson, M.L.A.'s, and, if not too late, it would perhaps be as well to secure the appointment of Messrs. Shaw, Thompson, Palmer, Sharp, and others of similar standing.

To Mr. Richardson—I think the clause of the Mining Act relating to safety-cages ought to be repealed. Personally I would not trust my life to any of the inventions I have yet seen.

The Chairman stated that the Board were desirous of arranging for a series of experiments with all the safety-cages brought forward, and that as soon as possible the trial would take place. A number of the safety-cages were in use at Sandhurst, and in order to make the experiments as nearly as possible and under similar conditions, one central shaft would be obtained for the purpose—probably at Sandhurst. Everything would be done to ensure a satisfactory trial and conclusive result, so that the Board, in presenting their report, would be in a position to settle the question definitely. On behalf of the Board, he thanked the gentlemen present for the intelligent and exhaustive evidence they had tendered on the subject, and for the ready assistance they had rendered in placing the views held by the mining community of the district before them.

The sitting then terminated.

Sitting of the Board held in Parliament House, on Wednesday the 10th day of July 1878, at three o'clock.

The following members were present—Messrs. A. K. Smith (Chairman), R. Clark, G. R. Fincham, R. Richardson, and H. R. Williams, M.L.A.'s.

The Chairman thanked the members of the Board for the attention they had given to the subject during his recent illness. He regretted that he should have so long been unable to attend the sittings of the Board, but having recovered from his indisposition, he trusted that nothing would prevent his devoting close attention to the subject under investigation in the future.

Mr. Clark stated that, from the evidence he had heard at Sandhurst and Ballarat, as well as from the trials witnessed by the members of the Board, he was of opinion that something should be done to ensure a thoroughly practical test being applied to all the inventions brought under their notice. Arrangements ought to be made for a general test without delay, and he was certain the Minister of Mines would be glad to attend on the occasion. He would, therefore, suggest that the Chairman and Secretary should take the necessary steps to bring about a systematic trial of all the inventions, on some day—say on a Friday—that would be found mutually convenient.

Mr. Fincham said that, however desirable it would be to have a systematic course of experiments, yet it was questionable whether the Board were justified in incurring the expense that would be necessary. Damage would be almost certainly inflicted on any shaft chosen for the purpose, and there would be many other expenses inseparable from such a trial, for which the Board had no funds.

Mr. Williams was of opinion that, by affording inventors of safety-cages an opportunity for specially preparing their inventions, that the value of the experiments would be destroyed. Inventors would fit them up specially; and, without a test of two or three, or even six months' actual work, the result would be valueless. When at Sandhurst the Board had witnessed a number of experiments, all of which were utter failures, and, in his opinion, further trials would be waste of time and money. For his own part he had seen quite sufficient.
Mr. Clark pointed out that the Board at Sandhurst had not been afforded sufficient opportunity for judging of the merits of the different inventions; most of the trials had been made with cages that were out of order, and in shafts ill adapted for the purpose. None of the inventors considered that their cages had been properly tested, and the Board ought therefore to afford them every opportunity for demonstrating the utility of their respective inventions.

Mr. Richardson concurred with the view taken by Mr. Williams. He considered that the value of the inventions would best be estimated when the cages were seen in actual work and tested without special preparation. The visit of the Board had taken the inventors of the cages unawares, and in his opinion such trials as they had witnessed would be more likely to carry conviction than any other method adopted.

The Chairman said that he had not seen any of the trials in question, a fact which he regretted. He would not, however, recommend the adoption of any cage unless he was perfectly satisfied as to its adaptability for the purpose for which it was intended. Experiments were, he thought, absolutely necessary; but, to be satisfactory, they would have to be severe and practical. Mr. Richardson said that they had heard quite sufficient evidence, and all that remained was to institute a series of practical experiments. The Board should, without further delay, proceed to determine whether experiments were necessary, and under what conditions they were to take place. He would suggest that the Secretary be empowered to make all preliminary arrangements for a systematic series of trials at Sandhurst, and at Ballarat also, if necessary.

Mr. Fincham pointed out that there was a safety-cage in use at Ballarat, and another at Egerton, and it would therefore be advisable to obviate the expense and trouble of conveying these cages across to Sandhurst, by testing them at Ballarat.

Mr. Richardson said it was currently reported that the shafts at Ballarat were crooked, and therefore not well adapted for the purpose of testing safety-cages. Mr. Clark suggested that permission should be obtained from the City of Sandhurst Company to utilise their shaft for the purpose.

This suggestion was agreed to.

Mr. Richardson proposed that a series of experiments should be instituted for the purpose of arriving at a decision on the merits of the various safety-cages brought under the notice of the Board.

The motion was seconded by Mr. Clark, and agreed to.

It was then decided that the first experiment should be effected by over-winding the cage when at ordinary speed; no slackening from start to finish; ordinary speed to be taken at not less than 15 feet per second.

The Board also decided that a test should be applied when the cages were passing each other in the shaft, at ordinary rates of speed. If possible, a severance of the rope to be effected both in the ascent and descent of the cage while at the usual speed of working.

Mr. Clark pointed out that by the employment of a safety-book the severance could be easily effected at any given point in the shaft, while the cage was ascending; in descending, the rope could be simply cut or run off the drum.

The experiments were then fixed as follows:

Rope to be detached or severed at the shackles. Rope to be cut or run off at top. Cage to be run up to poppet-heads, as in cases of over-winding.

Mr. Clark gave a description of the shaft of the City of Sandhurst Company, and as operations had ceased in the mine he thought the machinery, &c., could probably be made available at any time.

The Secretary was instructed to communicate with the various inventors and others interested, and to forward all necessary particulars to the Mining Department.

The Board decided on leaving all the other arrangements in the hands of the Chairmen and Secretary.

At half-past four o'clock the Board adjourned sine die.

On Friday the 29th day of July 1878, the Chairman, accompanied by the Secretary, visited Sandhurst, for the purpose of conferring with safety-cage inventors and others interested, on the subject of the proposed series of experiments. At nine o'clock on the following morning (Saturday), the Chairman met Mr. W. H. Ovington, mining inspector for the Sandhurst district; Mr. Corrie, manager of the City of Sandhurst Company; and Messrs. Batten, Carolin, Vance, Davidson, Seymour, Mitchell, Osborne, Jackson, and Middleton, all inventors or patentees of safety-cages.

The Chairman, in explaining the object of his visit to Sandhurst, stated that he regarded the subject under investigation as one of the utmost importance to the mining community. The introduction of safety-cages was not a question of expense, but a matter of saving human life from possible danger. He might mention that the Board did not intend to undertake the responsibility of recommending any particular invention for general adoption. The Board would afford all the inventions a fair trial in one central shaft, and the object of their investigations was to see which of them could be expanded upon, so that their use might be enforced. The nature of the clause in the Regulation of Mines Statute was of such a character as to make these trials necessary, so that it might be enforced and not remain, as now, a dead letter. The City of Sandhurst Company's shaft would be placed at the disposal of the Board, subject to a guarantee by the Government against damage; but he thought it would scarcely be fair to expect that inventors should go to
further expense in fitting their cages to the gauge of that shaft, and he, therefore, thought that the Government should vote a sufficient sum to adapt the cages for trial. It had been suggested that the speed of the trials should be from 10 to 15 feet per second; the rope to be adjusted so as to wind off the drum to see the effect of the rope dragging over the pulley, whether it would keep the weight off the springs which throw the gripping apparatus into action or not.

Mr. Groening stated that considerable interest was manifested in the forthcoming trials. Mining managers would not be satisfied with superficial trials; the experiments would have to be thoroughly practical in their character. He was afraid it would be difficult to carry out the suggestions of the Chairman, as there were no means for cutting the rope at the drum owing to the velocity when in motion. Nothing short of the most severe trial likely to occur in actual practice would, however, be considered satisfactory.

Mr. Corrie was of opinion that the cages ought to be tested by running them up and down the shaft empty as well as with a load.

Mr. Groening said that since the last sitting of the Board in Sandhurst, he had conversed with a great many miners and managers on the subject. They were of opinion that the men would be ensured increased safety by the adoption of safety-cages, providing they were really safe.

After some further discussion the Chairman requested the inventors and others present to state their views with regard to what should be considered practical experiments. The Board had decided that all the trials should be made in one shaft under similar conditions, but he would do his utmost to have a sum of money granted by Government for the purpose of adapting the various inventions to the gauge of the shaft in which the trials should take place, so that inventors would be spared any further expense. Mr. Corrie, manager of the City of Sandhurst Company, informed him that the company's shaft had been placed at the disposal of the Board, on condition of the company indemnifying them for any damage done to it in the trials.

Mr. Carolus, representing the inventors present, presumed that the Board would have no objections to testing the various cages in the shafts in which they had been at work for some time, as if tried in one shaft an accident might occur to one which would prevent the trials being completed till such time as the damage done to the shaft was repaired.

The Chairman said that, in his opinion, all the cages ought to be tested in one shaft, otherwise it would be impossible to carry out the experiments under similar conditions, or with any degree of satisfaction.

Mr. Carolus then said it would be useless, as it would be unfair to insist upon experiments that were unreasonable. For instance, it had been suggested that the cages should be detached while in the act of ascending, but he had never heard of a single instance in which a rope gave way when being hauled up the shaft; any cage in ordinary work that would stop it when the rope broke was safe.

The Chairman stated that, when speaking on a recent occasion to the House of Commons, he had found the opinion that the department wanted to avoid incurring any expense in the matter. On his return to Melbourne, however, he would again see the Minister and urge upon him to provide sufficient funds for the purpose of thoroughly testing all the inventions. The cost of ten cages, say at £20 each, would be nothing when weighed with the result that would follow a systematic trial.

Mr. Corrie pointed out that many of the inventors were poor men, who had already impoverished themselves by their efforts to perfect their inventions. It would be unfair to ask them to entail further expense in providing special cages for a fresh trial, more especially when it was understood that no particular invention would be recommended for adoption. The inventors were perfectly willing to place their cages at the disposal of the Board; but it would be only fair to reimburse them for their actual expenditure, without reference to the loss of time involved.

In the course of a discussion that followed, the various inventors present agreed that £20 each would be accepted as a reimbursement for the expense to which they would be put in providing new cages for the City of Sandhurst shaft.

The Chairman said that he was present with them for the purpose of eliciting a free expression of opinion. Many of the inventions put forward as being safety-cages were, in the opinion of a great number, not what they were intended to be, and the subjecting them to very severe practical tests was an absolute necessity, so as to give confidence in them.

Mr. Groening asked if the inventors were satisfied with the City of Sandhurst shaft as the one where the trials should be made?

All the inventors present signified their perfect satisfaction with the choice made, the City of Sandhurst shaft, in their opinion, being the best in the district.

The Chairman pointed out that the inventors should state what they considered would be a fair test.

Mr. Seymour suggested, as one trial, that the cage should be lowered at the ordinary rate of speed while lowering men, and the rope run off the drum.

The Chairman asked what was the ordinary rate of speed while lowering men?

Mr. Jackson, manager of the New Churn and Victoria Company, replied that it was about 400 feet per minute; but that there was no necessity for such a trial being made, as it was on record of a rope breaking at the drum while the cage was descending the shaft.

The Chairman expressed his opinion that such an accident might at any time take place, consequently it would be as well to include such a test in the series of experiments to be made.

Mr. Jackson said that he possessed twenty years' experience in mining, and had never heard of a case where the rope parted at the drum; chains had often broken, and wire ropes parted at the pulley.
Mr. Grainger instanced a case of a cage having stuck in the shaft, and the engine-driver, not knowing it, continued to lower away the rope till 300 feet of it had fallen on the cage, when the weight of the rope caused the obstruction to give way. The cage then suddenly dropped down the 300 feet, and the rope was snapped like a thread.

Mr. Carolin thought that the rope should be run off the drum as the final test of the series.

The Chairman said that the Board would probably commence with those tests which were least trying, so as to prevent the trials being impeded through possible accident to the shaft. The safety-rope would also be tested at the same time. The inventors should form themselves into a sub-committee for the purpose of drawing up a programme of tests to be applied, and submit their suggestions to the Board, who would consider them. It should, however, be clearly understood that each cage must undergo the same tests under like conditions. Each cage must be made in a practical manner, not an elaborate model, skimped to save weight, but properly adapted to do the work it was intended to perform under ordinary circumstances.

Mr. Grainger objected to the inventors drawing up the conditions without reference being made to the miners, who, as a class, were the most interested.

The Chairman pointed out that there were only half-a-dozen or so inventors, and that no difficulty would arise in the way of obtaining the opinions of any number of miners. All that the Board wanted to ensure was a fair impartial trial of the inventions; and unless the tests were as severe as those which the cages would meet in ordinary everyday use, it would be impossible to express an opinion as to their adaptability or otherwise. Mr. Grainger could, no doubt, induce a number of practical men to act on the committee with the inventors, and they might rest assured that the Board would give every facility to them that was possible.

Mr. Carolin asked whether there would be any objection urged against inventors subjecting their cages to a preliminary trial in the shaft, say the day before, in order to assure themselves that everything was in working order? It would only be fair to the exhibitors, as they would not be likely to make a cage to order and deliver it before being certain that it was a perfect fit in the shaft.

The Chairman said he did not see that there could be any objection, providing the exhibitors gave the same guarantee with regard to leaving the shaft in the state they found it.

Mr. William Battle here exhibited a model of his invention for checking the sudden descent of a cage down the shaft. After explaining the principle of his invention at some length, the Chairman said that there was some merit in it, but that its introduction to general use would necessitate too much expense, and, with every desire to give Mr. Battle’s invention a trial, he could not conscientiously recommend that it should be tested at the expense of the Government.

After some discussion it was left to arrange the leave of a conference with Mr. Grainger.

At the request of the Chairman, the Secretary read the following letter from the Honorable J. A. Wallace, Postmaster at the subject under investigation:

To James Thomson, Esq., Secretary to the Safety-Cage Board, Parliament House, Melbourne.

Sirs,

I have just received your letter of yesterday’s date. You say my letter has been duly considered by the Board above-mentioned, and that in consequence of the vast uniformity in the conditions under which past experiments have been made, and being able to the fact that many cages have not been tested at all, the Board are now making arrangements for a series of crucial experiments at Sandhurst, on an early date. And you say that “all the inventors in the colony will be afforded an opportunity for demonstrating their (the cage’s) utility, the gauge of the shaft and all necessary particulars being furnished, in order that the inventor or proprietors may construct apparatus of such a size as to permit of their being tested in one central shaft.”

In the first place, the Board, in my opinion, have given themselves a great deal of trouble for want of better information, and consequent involving expense that might be obviated; and to continue the expense by another trial, after the information I have given, for the purpose of giving inventors an opportunity of testing the several apparatus, when I have already informed your Board, through the Secretary for Mines, that at present there is none in the shaft of the Government mine at Doctor’s Bridge, such as has been proved to be anything more than a cage when rope has been broken frequently, and the cage never dropped more than an inch, or at least any appreciable distance. The first time the rope broke by accident, there was in the cage two trunks filled with wash-dirt, and about 200 feet of wire rope, 1 in. x 2 in.; the whole would not weigh much less than two tons; and, after the rope broke, the cage stuck fast in the shaft as it had been resting on the bottom. The rope has frequently broken under similar circumstances, and with like results. I may mention that the reason the ropes in question have frequently broken is that we use up all the old ropes for winding up wash-dirt, and always keep and use a new rope for conveying the men up and down. I think your Board will infer from this information that the safety-cage in question is just what they are in search of, it is not patented, and the owners have no desire to do so, but leave it free to be used and adopted by any one who thinks proper. It is not my intention to send it for trial at Sandhurst, as we are satisfied with it.

Yours faithfully,

John A. Wallace

The Chairman thanked the gentlemen present for their attendance, and stated that he would, on his return to Melbourne, put a question to the House on the subject of granting a sum of money for defraying the cost of the trials, and felt satisfied that he would get sufficient support from the mining members to get it granted. This was the first meeting at which he had been able to attend on account of ill health, but he felt the importance of the subject, and had it so much at heart, although not interested in mining himself, in the interests of humanity he would subscribe a sum of £20 out of his own pocket towards the trials, in the event of the Government refusing their aid. He regretted to say that a section of the press had deprecated the appointment of the Commission, on the ground that the object in view could not be accomplished; that no safety-cages were required; and that none answering the purpose for which they were intended had been invented.

The sitting then terminated.
MEETING of the Board held in Parliament House, on Thursday the 21st day of November 1878, at half-past 11 o’clock a.m.

The following members were in attendance:—Moors, A. K. Smith (Chairman), R. Clark, and H. R. Williams, M.L.A.’s.

The Chairman stated that, in order to carry out the proposed series of practical experiments with safety mining-cages, the Honorable the Minister of Mines had consented to grant the sum of two hundred pounds. The Honorable the Treasurer had approved of the expenditure, and the money was then available for the purpose.

After a discussion, the Board decided to make the necessary arrangements for an early trial of all the inventions brought under their notice, the same of the experiments to be at Sandhurst. In order to afford the Board an opportunity for inspecting the cage at work in the shaft of the Chiltern Valley Gold Mines Company it was arranged to make a visit to that mine on Tuesday the 3rd day of December, and on the 17th of the same month to hold the series of experiments at Sandhurst, in the City of Sandhurst Company’s shaft.

It was resolved to grant a subsidy to all inventors of safety-cages desirous of exhibiting their inventions, such subsidy not to exceed £10 in any one instance. Each person claiming a subsidy would be required to prove to the satisfaction of the Board that the full amount had been actually expended on the adaptation of the invention for which the subsidy was claimed; and each cage opined would have to undergo one or more of the tests determined on by the Board, in order to demonstrate its utility for actual work.

The Board then discussed the nature of the trials to be applied, but the matter was deferred pending further information; and eventually the Secretary was instructed to insert an advertisement in the leading journals of Melbourne, Ballarat, and Sandhurst, inviting inventors of safety-cages to take part in the series of experiments, and detailing the conditions under which the subsidy would be granted. The following form of advertisement was adopted:—

SAFETY MINING-CAGES COMMISSION, 1878.

It is the object of the commission to determine the utility of various inventors of safety mining-cages brought under their notice, the commission appointed to deal with the subject have decided on holding a series of practical trials in the shaft of the City of Sandhurst Company, at Sandhurst, on Tuesday, the 17th day of December 1878. The commission will contribute a sum not exceeding ten pounds towards the expenses incurred by each inventor taking part in the experiments; but vouchers must be produced to show the actual amounts expended on the adaptations of the several inventions. All inventors desirous of taking part in the proposed trials must announce their intention of doing so not later than Monday the 3rd day of December.

The commission reserve the option of excluding from the competition any cage which may not embrace an original invention. All information relative to the gauge of shaft, &c., will be supplied on application to the Secretary.

Correspondence was read from the Mining Department; the Inspector of Mines, Sandhurst; and from a number of inventors; after which the Board adjourned sine die.

The projected inspection of the safety-cage at work in the Chiltern Valley Gold Mines Company was postponed, owing to the inability of the members of the Board to absent themselves from their parliamentary duties, both Houses being in session on the day appointed for the visit.
During the interregnum all the necessary arrangements for carrying out the series of experiments at Sandhurst were pushed forward. The City of Sandhurst Company's shaft, which was granted by the directors of the company free of charges, had not been in use for some months, and the water had risen over 500 feet in the interior, filling all the workings, and necessitating constant pumping for nearly a fortnight before the date fixed for the experiments. Mr. W. H. Grainger, the Inspector of Mines for the Sandhurst district, manifested great interest in the proceedings of the Board, and, with the consent of the Mining Department, undertook the supervision of all the necessary work. In the space of a few days the water was reduced to the 400-foot level, and at 550 feet a strong pent-house was constructed, in order to check the descent of any cages below the plat at that level. From the keen interest displayed by managers and others at various centres of the mining industry, and from the numerous applications received for facilities to witness the experiments, steps were taken to secure the completion of reduced railway fares to and from Sandhurst during the period the tests lasted. The Commissioner of Railways willingly met the wishes of the Board in the matter, and return tickets at reduced rates were freely issued. Eight inventions were duly entered within the time specified by the Board, and three inventions for safety-hooks were also submitted for trial. In order to afford all witnesses who had tendered evidence before the Board, and other persons interested, an opportunity for attending, the following circular was printed and freely distributed several days before the trials were to take place:

Sir,  
Melbourne, 15th December 1878.

I have the honor, by direction of the Chairman, to state that the Board of Inquiry appointed by Order-in-Council, for the purpose of dealing with the subject of safety-cages, propose holding a series of crucial experiments with safety mining appliances at Sandhurst, on Tuesday the 17th day of December. The trials will take place in the shaft of the City of Sandhurst Company, Camp Reserve, Sandhurst, the use of which has been kindly granted by the directors of the company. Eight safety-cages will be subjected to a series of tests, which will afford exhibitors ample opportunity for demonstrating the utility claimed for their respective inventions.

The following inventions will be tested:

- Carolin's (Nanarrow's patent),
- Williams's (patent),
- Symmet's (patent),
- Jackson and Cockle's (patent),
- Saloon's,
- Allano's (patent),
- Ballarat,
- Fryer's (patent),
- Harris's,
- Bylesford.

The first cage will be placed in the shaft at half-past ten o'clock.

I have the honor to be, sir, your obedient servant,

JAMES THOMSON, Secretary to the Board.

The final meeting of the Board was held in Parliament House, on Wednesday the 14th day of May 1879, the following members being in attendance:—Messrs A. K. Smith (Chairman), Robert Clark (Sandhurst), G. R. Fincham, and H. R. Williams, M.L.A.'s.

The printed report of the proceedings of the Board was submitted by the Secretary, and, after some discussion, was adopted.

The Chairman submitted a series of resolutions embodying the views of the Board, which were discussed seriatim, and adopted with amendments.

On the motion of Mr. Clark, seconded by Mr. Fincham, a vote of thanks was passed to Mr. James Thomson for the satisfactory manner in which he had discharged the duties of Secretary to the Board.

A vote of thanks was also passed to Mr. A. K. Smith, M.L.A., Chairman of the Board.

The Secretary was instructed to obtain printed copies of the report for circulation amongst the mining managers and others interested, and the Board then adjourned.
APPENDIX A.

Return of the Number of Fatal Accidents in Victoria from the Fall of Mining Cages down Shafts, and Accidents resulting from Overwindings, &c., from 1st January 1860 to 31st December 1878.— (Compiled from the Records of Inquests in the Registrar-General's Department.)

<table>
<thead>
<tr>
<th>Total No.</th>
<th>Year</th>
<th>Fall of a Cage down shaft.</th>
<th>Overwindings</th>
<th>Cage Accident otherwise described.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1869</td>
<td>...</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>1861</td>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>1862</td>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1863</td>
<td>1</td>
<td>1</td>
<td>1. Crushed between cage and shaft.</td>
</tr>
<tr>
<td>2</td>
<td>1864</td>
<td>1</td>
<td>...</td>
<td>2. Crushed in cage by fall of chain.</td>
</tr>
<tr>
<td>...</td>
<td>1865</td>
<td>...</td>
<td></td>
<td>3. Killed by cage in ascending (mistaken signal).</td>
</tr>
<tr>
<td>1</td>
<td>1866</td>
<td>...</td>
<td>1</td>
<td>4. Struck by descending cage.</td>
</tr>
<tr>
<td>3</td>
<td>1867</td>
<td>1</td>
<td>1</td>
<td>5. Crushed by descending cage.</td>
</tr>
<tr>
<td>4</td>
<td>1868</td>
<td>3</td>
<td>...</td>
<td>6. Crushed by ascending cage.</td>
</tr>
<tr>
<td>6</td>
<td>1869</td>
<td>...</td>
<td></td>
<td>7. Killed by riding of cage.</td>
</tr>
<tr>
<td>2</td>
<td>1870</td>
<td>...</td>
<td></td>
<td>8. Caught by slack rope whilst entering cage.</td>
</tr>
<tr>
<td>1</td>
<td>1871</td>
<td>...</td>
<td></td>
<td>9. By tiling of cage 12 feet through slack rope.</td>
</tr>
<tr>
<td>2</td>
<td>1872</td>
<td>...</td>
<td></td>
<td>10. By entering cage whilst ascending.</td>
</tr>
<tr>
<td>1</td>
<td>1873</td>
<td>...</td>
<td></td>
<td>11. Fall down shaft; trying to stop on cage whilst moving.</td>
</tr>
</tbody>
</table>

26 lives lost in 14 years

* Caused by breaking of chain and rope, and gave out of order.

Return of the Number of Mining Cage Accidents in Victoria, fatal and otherwise, recorded from the 1st day of January 1874 to the 31st December 1878, during which period the Regulation of Mines Statue has been in operation.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall of Cage down shaft.</th>
<th>Overwindings</th>
<th>Crushed by Cage in Shaft.</th>
<th>Struck by Cage in shaft.</th>
<th>Total 1st Year.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1874</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>2</td>
</tr>
<tr>
<td>1875</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>1</td>
</tr>
<tr>
<td>1876</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>1</td>
</tr>
<tr>
<td>1877</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>2</td>
</tr>
<tr>
<td>1878</td>
<td>4</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>...</td>
</tr>
</tbody>
</table>

APPENDIX B.

Reports of the Mining Inspectors for the Castlemaine, Ballarat, and Sandhurst Mining Districts, on the Series of Trials conducted by the Board of Inquiry on Safety Mining Cages, at Sandhurst.

To Massey, 1834.

I have not been in a position to make an appointment with Messrs. Stewart and Grainger to prepare a report on the trials of the safety cages at Castlemaine by the Commission appointed to investigate and report upon the several safety-cage appliances; but having in view the fact that a report from the Commission will shortly be published, I would profit that you should be in possession of my opinion upon the tests of the safety appliances of the various cages prior to the results of the trials of the Commission being made.

DETECTING-BOOBS.

I will first deal with the detached books. The detecting principles in each case was the same—the remeasure of a pin of soft metal of of wood starting into action the clashing gearing; and, as detecting books, they were not suitable for that purpose. For strength and simplicity of construction, I think Seymour's was the most noteworthy.

BATTERY-CAVES.

The common basis of the strain of suspension of the weight of the cages being borne by the springs and the rope, and that the breaking of the rope releases the steel springs and indicator hand or buffer from the strain, and changes the force of their motive-power in the direction of the grippers or catches, is applicable to the whole of the cages tested. In addition to this, Allen's and Seymour's cages are constructed so that, by means of band levers, miners, when descending in the cages, may put the safety appliance into operation. Omissions may arise when this property would be of importance.

Putting aside the more cumbersome and obstructive, I assume that in all cases the springs would be kept, by the necessary attention, always active and in working order.
My classification of the cages tested, in order of merit, is as follows:—

No. 1. This cage possesses four vertical serrated grippers, which act upon the sides of the guides or rails, and when in any one position for the upper shelf of the cage. The trial only was made with the cage as that was perfectly successful; and this I attribute to the area of the surface of the serrated grippers on the guides being so much greater than the surfaces of the serrated grippers on the guides being so much greater than that of the cage constructed with catch or eccentric grippers; and therefore I consider the safety appliances of this cage superior to any other exhibited. Also, the shaping of the end of the profile of the Anson's was determined to the greatest advantage, and in this direction lies the greatest strength of the timbers of the winding divisions of shafts.

No. 2. This cage was a thoroughly well-made cage, lighter than Anson's, and it went through the whole of the trials for which it was submitted very satisfactorily; but it was apparent that the safety appliance, i.e., the lateral thrust of the shafts, was to displace the guides. In tightly timbered shafts, this lateral thrust would become dangerous through the displacement of the timbers, and then become partly impracticable through the guides being driven out beyond the spread of the catch, to suit this cage special attention was paid to the ends of the timbering guides.

No. 3. This cage was suitable for close strongly timbered shafts. Because of the error in the measurements given for its construction, it could not be submitted to the severe trials. The safety appliance consists of four stone levers, which, when in safety action, by their own gravity fail, and the pointed ends project beyond the cage at each angle against or rather into the shaft timbers at the sides. This cage would not be a safety-cage in shafts of irregular width, or when only partly timbered at the sides, as it infrequently occurs in shafts which have been sunk through very hard ground.

No. 4. Nance, followed in order thus, by Williams, James, Jackson and Nancarrow—Of these cages, Nance's only passed through the full trials, and that was with a qualified success; the others were partial or complete failures. And of these cages it may be said generally—

1st. That the eccentric catchers or grippers have no sufficient gripping surfaces.

2nd. They are very liable, in falling away, to strip the guides, because of the very limited bearing of the point of impingement of the arched guide or the end of the catcher to the side of the guide. They are also liable to irregularity of setting of the eccentric, and consequent unequal action; and they are liable to be rendered entirely ineffectual through the rebound of the eccentrics as they come into contact with the guides.

I attribute to one or other of these objections the partial or complete failure of the last four named cages to sustain the tests to which they were submitted.

I have the honor to be,

Thos. Cowen, Esq.,
Chief Inspector of Mines.

H. B. Nicholas,
Senior Inspector of Mines.

Sun.,

17th March, 1879.

Referring to the trials of safety-cages which took place here, I have the honor to state I was induced by Mr. Stewart, Inspector of Mines, that it was your wish that I should forward a joint report. I may state, as I only supervised the tests on the surface,—Mr. Nicholas and Mr. Stewart, remaining underground to watch the results—I have no data to enable me to do other than assent in giving a joint report that would include all particulars, the other two officers having, I have no doubt, records of the results as to measurements, &c. As I have learned, however, that Mr. Nicholas has forwarded a separate report, I feel it my duty to give what information I can, and also my opinion of the respective merits of the cages tested from the observations I made and the opportunities afforded me to do so, and would classify them as follows:—

No. 1. Anson's—This cage, from all I saw, stood the severe tests to which it was subjected, and was, I consider, a great success, having, I believe, only fallen to me or so on being suddenly detached from the cage. It has an inconspicuous profile that would enable a man in the cage to stop it when descending rapidly. I may add, however, the construction of the cage is, in my opinion, complicated.

No. 2. Seymours—This cage stood the test well, in fact, a considerable distance more than Anson's, but was subjected (owing to an accident occurring) to severer tests than Anson's. It is right, however, to point out the testing of the cage displaced about 30 feet of centre in the shaft. This may be explained from the fact that the pressure of the safety appliance was insufficient, or against the face of the shaft or of the sides. Thus, I consider, a very great objection, as many of our deep shafts are not close enough, and therefore the sides are not sufficiently strong to resist the force coming against them without being shifted or displaced. I may add, however, excepting this objection, it is an excellent cage, having stood the test very well; its special appliance also is simple and substantial. It has also an appliance for stopping the cage when descending rapidly.

No. 3. Nance's—This cage fell a considerable distance before it gripped, and did not, I consider, prove effective.

No. 4. Williams's—This cage did not stand the test; it gripped, however, before reaching the bottom after falling a great distance.

I have the honor to be,

Charles Stewart,
Inspector of Mines.

Southurst, 22nd March, 1879.

By Authority, John Farnes, Governor, Sydney.