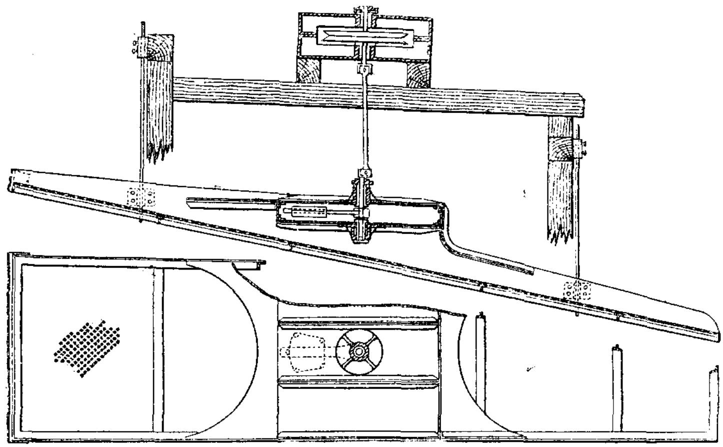
Discussion.

Mr. Wolfe Barry. Mr. J. WOLFE BARRY, C.B., President, thought both the Papers showed the importance of the consideration of details and the care necessary at collieries in order to arrive at satisfactory commercial results. The questions touched upon were of the greatest interest to a trade so valuable to the country as that of the colliery proprietor, and showed most clearly the necessity of the consideration of everything, not only in laying out a colliery, but also in the means of working it to the best advantage. He was sure the members would agree with him when he proposed a very hearty vote of thanks to Mr. Rigg and Mr. Gillott for their valuable contributions.

Mr. Rigg. Mr. JAMES RIGG observed, with regard to the relative merits of belts for picking coal and good methods of screening, that the use of the former had extended to such an extent during the past ten years that they seemed to be preferable. He considered, however, the screen was superior to the belt, because, under suitable circumstances, the refuse—he spoke more particularly of tender house-coal—could be removed if the screen was at rest, whereas it was impossible to remove it in sufficient quantity if it was travelling along a belt. The model on the table illustrated the method which had been described of tipping coal in its application to the narrow-gauge railway-truck, which could not be inverted. It was practically that shown in Fig. 16, Plate 4, except that the shoot was capable of being raised vertically, for the reason explained in the Paper, and, the machines being used for loading coasting vessels, for convenience in passing from hatch to hatch. End-door trucks were exclusively employed. There was a brake for the purpose of regulating the rate at which the loaded tip turned by its own weight to the angle of delivery—about 40°—and for regulating that at which it should return automatically, by a counterbalance weight at the back of the frame carrying the tip. The arrangement was simple, and gave a fair illustration of the advantage of employing the force of gravity instead of steam or hydraulic power. It had been found to work well in practice; coal had been saved from breakage in delivering it from the end of the railway truck, and, having a fall of about 10 feet, it was brought down, as shown in Fig. 16, Plate 4, directly into the hatch. The other model showed the ordinary form in which the machines had been made for a long time. It was an oscillating bonnet for a box tub, Fig. 2 or Fig. 3, Plate 4, the only difference being its size. The smaller was that principally used in Lancashire. The front plate was carried up to a sufficient height, depending upon the size of the tub, generally about 1 inch above the end of the tub, to ensure the load of coal not sliding from it until it had actually arrived upon and was in continuation of the screen. Consequently, those which had been made for the larger trams, Figs. 1, that had been used in South Wales were much higher than those for the small tubs employed in Lancashire, the difference being that between about 5 feet 6 inches and 7 feet in height. When the tipping machines were made high enough the coal left the mouth of the tip before it arrived on the screen, and, as illustrated in Figs. 4, considerable breakage took place. He had found that the angle of delivery from a plate of ordinary coal, mixed with a fair amount of slack and not particularly wet, was 40°. He had also found, with reference to a fair example in the screens, Figs. 29, 30, 31, that the angle at which coal could be rightly received on the upper portion of the screen was 23°. The angle of delivery after the coal had been picked on the nearly horizontal portion of the screen, Fig. 29, was greater than 23°, because it had to move from rest without any artificial assistance; and amounted to 28°. With tipping-machines delivering at an angle of 40° and screens receiving at 23° and delivering at 28°, the coal left as slowly as possible, which was what was desired, and avoided the serious breakage in the delivery of coal from the mouth of screens which were simply in continuation of their own bars. Another model illustrated the shaking riddle not worked by power—one of the jigger-screens. In other respects it fairly corresponded with that shown in Fig. 25, or very nearly with that of Fig. 26. It was for the purpose of separating coal into three kinds, small, nuts, and round coal. He had found that for ordinary coal and slack, fixed bars were preferable to screens, which required to be driven by power. The slack did its work by gravity instead of by steam-power. In connection with the fixing of tipping-machines and screens upon the new system, the greatest difficulty experienced in the different colliery districts had been insufficiency of height. Colliery proprietors now recognised that in laying out the plant it was a mistake to place the banks at too low a level. True economy lay in fixing them, in the first instance, at a sufficient height above the road to enable the coal to be effectually screened. Mr. Rigg.

Mr. Beaumont. Mr. W. Worby Beaumont referred to a new form of coal-screen, *Figs. 1*, which differed materially in the method of its working from any others that had preceded it. It was driven by a new mechanical motion [1] which gave to the screen a rapid gyratory movement instead of a reciprocating one, and made it possible to use an extremely short stroke at a high speed, so that the proper duty of a screen, namely, so to move the screen that a hole was presented as quickly as possible for the nearest piece of coal to fall through, was realized. In that way the smallest amount of work was expended upon every piece of coal which passed over the screen, in order that the separations might take place. The high speed was rendered possible by means of automatically

Figs. 1.



Scale, $\frac{3}{16}$ inch = 1 foot.

400-ton Vibromotor Coal-Screen.

self-balanced apparatus which caused a balanced displacement from the position which the screen would take when hanging at rest, but apart from the thing it worked, was of itself a mere out-of-balance weight. The whole of the work lodged in the weight was taken up by that which was moved, with the result that in cases where the screen was hung from suspenders of suitable length, no vibration was transmitted to the frame which carried it. The screens were employed chiefly for the smaller kinds of coal. It was possible by the new motion to work very

[1] Minutes of Proceedings Inst. C.E., vol. cxvi. p. 80.

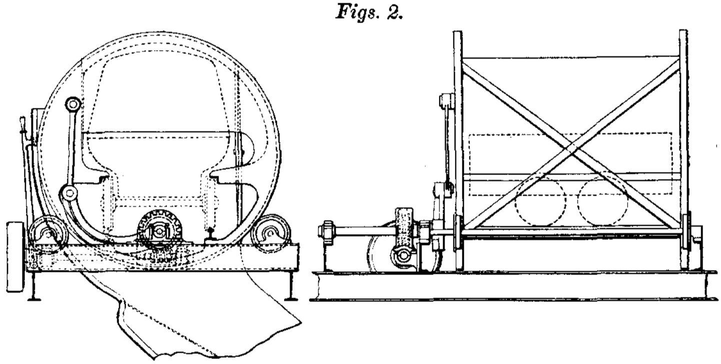
large screens at 380 revolutions per minute and an extremely short stroke. There was, therefore, only just enough movement to place the nearest holes under the pieces of coal. The screen shown in *Figs. 1* was about 20 feet in length and 5 feet in width, and 400 tons to 500 tons per day of ten hours passed over it, the speed being that he had mentioned and the stroke 1½ inch. It was built of plate- and sheet-steel, and the structure weighed 25 cwt. The whole of the power to drive it was sent through a vertical spindle about 1 inch in diameter. Referring to the form of the bars used in screens, Mr. Gillott had mentioned the use of round holes in perforated plates. The results obtained from the use of different forms of holes with the same coal would be of considerable interest. If bars were used a good many pieces of coal of flake form would pass through the screens which should not pass through, and on the other hand pieces that should be separated might slide along and carry with them (as was admitted in one of the Papers) a good deal of the small material. With regard to the form of holes and stroke used it appeared that with the ordinary long-stroke screen, if tender coal was very considerably damaged, as Mr. Gillott had admitted, the harder coal must be damaged to some extent. Mr. Rigg's remarks on the rotary screen, although he had said it offered considerable advantages, really put the screen out of court. He thought Mr. Rigg was to be congratulated upon the arrangement of his tippler, which certainly had many advantages of great importance, especially for tender coal. Mr. Beaumont.

Mr. R. Price-Williams thought the prevention of the breakage of coal at the pit's mouth the main feature of the Papers. The economy that underlay the great improvements described was a most important one; and it was impossible—he spoke as an old coal-miner—to over-estimate the saving resulting from the gentle handling of coal. Many years ago he had been asked to consider a proposal made by Mr. Samuel Plimsoll. The then General Manager of the Great Northern Railway Company had referred Mr. Plimsoll to him, remarking that he had some new-fangled idea about the enormous economy that would result from a better handling of coal. The idea, however, he had in his mind was the very subject now under discussion; and he maintained that the absolute loss from the breakage of coal falling from the trucks to the bottom of the coal-bins, a height of about 10 feet, represented more than 1*s.* a ton. Mr. Price-Williams had been authorized by the General Manager to carry out a series of careful experiments, and he found that the loss really amounted to 1*s.* 3*d.* per ton. The importance of not allowing the coal to fall, but to gravitate Mr. Price-Williams.

Mr. Price-Williams. into the bins—which had been so emphasized by both the Authors—greatly impressed the executive of the Great Northern Company, and the result had been the construction of the Plimsoll coal-drops at King's Cross on the same principle adopted by the Authors, which had been leased to, and for many years most successfully and economically worked by, Mr. Plimsoll, to whom great credit was due for originating the method. He was persuaded that if some such system was carried out by the method shown by the Authors, the saving would be very great. The importance of the question, he was persuaded, was not sufficiently estimated even by colliery owners. A saving of 6*d.* a ton in the large output of the colliery districts represented a large amount. He therefore welcomed the Papers, and congratulated the Authors and the Institution on contributions of so valuable a character.

Mr. Louis. Mr. D. A. Louis drew attention to a tippler designed by Mr. Everett which was well adapted for treating large quantities of

Figs. 2.



Scale, $\frac{3}{16}$ inch = 1 foot.

Everett Tippler.

coal, *Figs. 2.* It had not the hood which had been shown by Mr. Rigg, but it was adjusted in such a way that the coal, instead of being thrown suddenly, was tipped out gradually on to the screen, and it effected a gradual distribution instead of making a heap like that shown in Figs. 5 and 6, Plate 4. Attached to the driving-wheel there was an arm with a crank, and at the side of the frame there was a crank-pin. The two were connected by a link, and when regular motion was given from the driving-wheel the tippler acquired a variable motion illustrated in *Fig. 3*, in which the divisions indicated equal periods of time. It started at a moderate speed, which gradually slackened, and at the time of discharge became very slow; then, immediately the coal had been discharged, it recovered its position very rapidly. It was stated to act exceedingly well in allowing the coal to fall gradually and in saving time in the recovery. He believed there were many more effectual types of moving coal-screens than the revolving screen that had been described, amongst others that referred to by Mr. Beaumont. One of great interest, that he had seen working at collieries in Belgium and elsewhere on the Continent, was the Briart screen[1]: it had moving bars, the round coal being lifted on it from the upper end, where it was tipped, to the lower end, whence it dropped on the belt, the slack slipping out of the way in the meantime. The Belgian colliery owners were very careful in the treatment of their coal. They had tried various forms of bars, and the particular section they had adopted was not represented in *Figs. 20*, p. 172. It was somewhat like that lettered *h*, but the top of the bar was triangular, the objects being to facilitate the passage of the small pieces, to prevent their jamming, and at the same time to have bars strong enough to avoid, as far as possible, the screen assuming the distorted condition depicted in *Fig. 21*, p. 172. With regard to the question of belts and screens, they seemed to have distinctly different functions. In general the screen merely separated material of different sizes, whilst on the belt materials of different qualities were separated. The Coxe screen, however, separated shaley and slatey pieces from the lumpy pieces of coal; but nevertheless he thought the function of the screen was to separate particles of different size. In reference to combining the functions of the belt and the screen, Mr. Russell of Coltness Colliery had arranged the screens and the belt continuously. The device was not really a belt, but simply a long inclined tray of sheet-iron, in which the screens were placed at intervals, sloping at a steeper angle. The whole system was given a reciprocating motion. Across the screens the coal travelled

Mr. Louis.

Fig. 3.

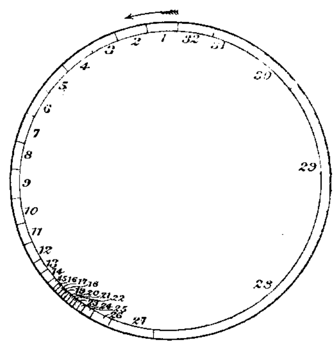


DIAGRAM OF VARIABLE MOTION OF EVERETT TIPPLER.

[1] "A Text-book of Coal-mining," H. W. Hughes, London, 1892, pp. 392, 398.

Mr. Louis. more rapidly than across the plates. The combination of the functions of screen and belt in one appliance, therefore, had been practically applied.

Mr. Jenkins. Mr. H. C. JENKINS observed, with regard to the relative advantages of the screen and belt, that coal, in the condition in which it came from some pits, was fairly uniform in quality, and the dressing, previous to its being sent into the trucks, was merely a matter of taking out the slack and separating the coal into different sizes, screens being all that was required. At other places, as for instance at the pit mentioned in the second Paper, the coal varied widely in quality in the same seam, and there would be two or three substances to be separated. Sometimes it was a matter of separating coal from shale, which could be effected by washing if the coal was not too large; in other cases it was a matter of separating hard coal and soft coal, and perhaps shale, and that surely was a problem that demanded the use of the belt for solution. Was not that the reason why the belt was coming so much into use? Upon the belt the material was spread out, and the slightly skilled labour could pick out the pieces of different quality, and, if necessary, separate them. The screening would only deal with differences in size. If any attempt were made to screen down such mixed coal, the product must suffer. The shale was much harder than even ordinary coal, to say nothing of tender coal. Excessive screening in such a case would merely reduce the tender coal to more or less fine dust, and let the shale pass across into the more valuable product and depreciate its quality. In the case of the belt he could hardly conceive, even when a valuable piece of coal had been passed by one pair of hands, why it should necessarily be passed by several other pairs of hands in succession. The tendency would be rather to pick out the exceptional piece as it passed down, for the quality was depreciated along the course of the belt.

He had seen a simple tip in South Lancashire which he did not observe amongst those illustrated in the Papers. The manager at this pit had taken an ordinary platform tippler and placed its pivots on the ground level at an angle of 45° to the centre-line of the truck, so as to introduce a kind of circular movement as it went over. It really tipped over the corner of the truck, and with the coal there it seemed to work very well.

Mr. Head. Mr. JEREMIAH HEAD estimated the value of coal on trucks at the collieries throughout the United Kingdom at about 8*s*. per ton. The same coal in the form of slack would probably be not worth more than 3*s*. per ton. Therefore the mere question of size reduced its value 60 per cent. The object of the first Paper was to show how to economize in that respect. It was curious that mere size should have such an effect on value; and Mr. Rigg appeared to attribute it to competition for the larger coal as compared with the smaller. That scarcely seemed an adequate explanation. He should rather think the great value of large coal as compared with small was due to the way in which it was customarily utilized. Houses or buildings were warmed by open fires, in which large coal burned better than small; and steam was raised by burning it on grates in a similar manner. Possibly the time might come when all the heat the coal contained would be secured by first turning it into gas, and then oxidizing completely everything that was combustible in it. But that opened a very wide field for discussion. For the present the fact that the principal public demand was for large, rather than for small coal must be faced. In working coal it was unfortunately turned from large into small from the very beginning. As it existed in the collieries it was all solid and large. The miner lay on his side and hacked away at the bottom of the seam, in order to be able to wedge it down; and in so doing he turned a considerable portion from large and valuable into small and comparatively valueless coal. It should be remembered that the coal which was turned into dust in the colliery was not to be included in the estimate of what was lost afterwards, because, as Mr. Rigg had said when referring to the corves in Figs. 1, Plate 4, they were purposely made open at the sides so as not to be able to hold coal-dust or slack and bring it out of the pit. He thought on the average 25 per cent. of the coal that was obtained was actually turned into slack, and a much larger quantity into intermediate sizes. More coal was turned into dust in every subsequent operation—in carrying by rail, in loading, unloading, carting, and discharging into cellars. He desired to ask, with regard to the screen bars, as it was so important they should be kept hard and bright on the surface, that they should not wear on the edges, and that they should be stiff and not easily forced apart, whether it would not be advantageous to make them of chilled cast-iron. That material was now so much used in some countries in other ways, such as for car-wheels, and even turning tools, that he could not but think it would be a suitable application. Turning to the second Paper, it was exceedingly gratifying to find the progress which was being made in substituting machinery for manual labour in working coal. He understood Mr. Gillott obtained 1,800 tons a day out of each of his shafts, working with two-decked Mr. Head.

Mr. Head. cages. In a previous Paper [1] an account had been given of shafts with four-decked cages, by which as much as 2,500 tons a day were drawn out of a single shaft, and he knew that was being done in certain places in the United States. Perhaps Mr. Gillott would say if outputs of that kind were not generally obtainable with suitable appliances. Great attention had been given throughout the country to improvements in colliery plant in the last ten or fifteen years. He thought this was due to some extent to the labour difficulties which had occurred during that period. The result had been to stimulate invention, and in such a way that for every man employed in the pits there was now probably a larger amount of coal raised with the aid of machinery than had ever been raised before. In England he believed the amount per man per annum was larger than in any other country.

Mr. Mills. Mr. M. H. MILLS remarked that the description of tub used depended upon the coal that was being worked. Hard coal was often filled by hand, while soft coal was sometimes filled with shovels; in other collieries riddles were used where the small coal was not of great value, and the slack thrown into the goaf. When open-ended or open-side tubs were used, as the slack and small dust of the coal was scattered about on the main roads of the colliery, by degrees thick deposits of dust collected on all parts of the roads. Explosions had occurred, caused perhaps, not entirely by the coal dust, but no doubt augmented by it to a very great extent. It was therefore important that, if possible, closed boxes should be used instead of the open tub. The Rigg tippler was undoubtedly very valuable, and he hoped it would be considerably used in the Midland Counties. With regard to the screening apparatus, shown in Fig. 19, Plate 4, he thought there were many objections to it. He had screens of the same character at a colliery with which he was connected near Barnsley. The belt E was an unnecessary one; it was better to have a hopper introduced so as to regulate the quantity of coal that passed on to the shaker G. From that point the coal passed on to the belt F, which was too short for properly cleaning coal where there was a good deal of dirt; it then passed over the roller at the end of the belt, where it had another awkward drop on to a spout which allowed the coal to pass into the wagon. That drop was very difficult to overcome. The worst drop of all was that from the spout into the wagon. The end of the spout

[1] "Colliery Surface Works," by E. B. Wain, Minutes of Proceedings Inst. C.E., vol. cxix. p. 123.

H should be sufficiently long to be lowered to the bottom of the wagon. The lowering apparatus at Ryland's Main Colliery was a Jacob's ladder, that caught the coal as it passed from the belt, took it down to the bottom of the wagon, and left it there. That again, however, was not a success, because the action of the Jacob's ladder appeared to crush the coal. With regard to the other descriptions of screens named, no doubt where the coal was not very dirty and only two kinds were wanted, they were economical. Unfortunately the men were not careful as to the way they sent the coal out of the pit. There was a great deal of dirt to deal with, and a long belt was required. Referring to the second Paper, he should like to ask the Author what boiler-power he used, and the pressure. He thought the time had now come when in deep collieries a considerably greater pressure of steam should be used; and more than that, he doubted whether the Lancashire boiler was the best that could be employed The screening arrangements at the colliery were most satisfactory for the description of coal that it had to deal with—a hard and not a tender coal. The difficulty in screening was with the more tender descriptions of coal. No doubt in Mr. Gillott's seam there was a great deal of dirt, and that was probably why he had made such a long picking-belt. He was afraid that legislation did not assist in the matter. The men were only too careless, as to the quantity of dirt sent out, to some extent to their advantage, but much to the disadvantage of the coal-owner. Mr. Mills.

Mr. S. J. Wilde observed that some years ago on the Bombay and Baroda Railway, great importance had been placed by the Government-Director on double-screening, because it was adopted by one of the neighbouring companies. There seemed theoretically, as it turned out practically, to be no advantage in double-screening coal. When sending out a considerable quantity, 20,000 tons or 40,000 tons, he had recommended two ship-loads to be double-screened, while the others went from the same colliery at the same time in other ships. The manager at Bombay had been told to observe the result, and the quantity of dust from the double-screened coal was found to be rather more than from the single-screened coal. In consequence double-screening had been discontinued. Mr. Wilde.

Mr. Rigg, in reply, believed it was acknowledged that a much larger quantity of slack would pass through a screen consisting of bars than would pass through perforations of the same width. He thought double the quantity of the same class of coal, particularly that in some of the Midland Counties, would pass 1½-inch Mr. Rigg.

Mr. Rigg. screen-bars than would pass 1½-inch perforations. But in certain coal districts, by mutual agreement between the employers and colliers, the area of the screen had been determined. As compared with a perforated screen having an area of 35 feet, a screen composed of bars having openings of double the area gave a much superior round coal, notwithstanding the mechanical perfection of such a screen as that shown by Mr. Beaumont. As to the economy resulting from the adoption either of the tipping-machine with which he had been associated or the screens he had recommended, he had been informed by the manager of a colliery in Lancashire that the saving resulting from the use of the tipping-machine was about 7½ per cent. Coal valued at 7*s.* 6*d.* per ton at the pit mouth in the tubs when reduced to slack would be worth about 1*s.* 6*d.*, so that the difference would be 6*s.*, and 7½ per cent. upon 6*s.* was as nearly as possible 5*d.* a ton. The screen shown in Figs. 29–31, Plate 4, was expressly constructed for the examination of the coal, and the separation of the band, slag or pyrites that it might contain. Fig. 29 represented the coal being received at the lower end of the screen. That coal did not pass beyond the bars, but at the point at which it was there shown it could be examined. The men upon the platform stepped into the screen, and there they saw the coal at rest, and were able to examine it and to separate anything that should be removed from it with greater care, than if it were travelling under their eyes on a belt, and the refuse was thrown out on to the platform before the brake or cataract was released, when the coal was allowed to pass into the truck. With regard to the Everett tippler, the variable motion was described as being for the purpose of distributing the coal over the screen and avoiding such an effect as shown in Figs. 5, Plate 4, where the coal was delivered in a mass upon the screen. Unquestionably it did distribute the coal extremely well, but it was a distribution which involved a fall and so prevented the protection of the larger pieces of coal obtained from the slack under the other system; he was therefore much afraid that the injury caused by the distribution would not be compensated for by the improved screening effect. The Heath-Woodworth tippler was driven by power; but gravity was the power which alone should be used in the working of coal under the circumstances dealt with, viz., in its transfer from the tub at the pit-shaft over the screens. He believed the Briart screen very closely followed the section *h, Figs. 20,* having a circular head. Diamond heads and circular heads were for leading the coal into the spaces, a purpose which was unnecessary if the method of flat bars shown in isometrical projection in *Fig. 24* were adopted in preference. Mr. Rigg. There was no risk of the piece of slack D failing to be entrapped between the bars, because it fell into an open space and could not travel to the round-coal truck. The coal was certainly too large for washing, which would not answer the purpose. The object of the machinery was not to deal with coal as it was dealt with when it was washed, but to deliver it free from slag, etc., into the trucks, and washing would not suffice because the coal must be cut open to remove the band, pyrites or other impurity. Although the screens shown in Figs. 29–31, Plate 4, had been designed to separate the coal effectually and clean it, the coal could also, with the screen in the position shown in Fig. 31, be divided into hard and soft, or more than two kinds. He did not think chilled cast-iron would be appropriate for the construction of screen-bars. Steel bars, when properly founded, were found of ample strength and extremely durable, and the character of this fibrous metal adapted it much better to the purpose of a screen than chilled cast-iron, because it was not so brittle. It was not a question of hardness, but rather of toughness. Many kinds of screens were used in different districts, and the objection raised by Mr. Mills to tubs with end-doors constituted a strong argument in favour of the adoption of a tipping-machine adapted to turn the corves through the arc of 130° necessary for their free delivery. With regard to lowering coal into the trucks, Fig. 19, to which Mr. Mills had also referred, he agreed that it was of the utmost importance that the coal should be delivered into the truck as near to its floor as possible. An effective method of delivering coal on to the floor of the truck, and at a suitable angle when the wagon was nearly loaded would be of great value, and would prevent an immense amount of breakage. With reference to the question of double screening, notwithstanding the experience he had mentioned, the abrasion of pieces of tender house-coal against each other in the truck as they travelled on the road was recognised by colliery proprietors as causing great injury; and that injury should not be ascribed to the loading at the pit.

Mr. Gillott, in reply, could not agree that the combined tippler, Mr. Gillott. screen, and shoot was preferable to the belt and its accessories. A single screen and loading-shoot would only serve to deliver one quality of coal into trucks; and in order to deal expeditiously with the produce of a large colliery the various qualities of coal would have to be filled separately in the pit. At one colliery with which he was connected the best and common coals were supposed to be filled separately, but, notwithstanding constant and daily

Mr. Gillott. trouble with the men in attempting to secure this result, the best coal, which formed more than 50 per cent. of the section, never exceeded 30 per cent. to 33 per cent. by the weights. Nor did the loading-shoot and screen preferred by Mr. Rigg appear to be capable of dealing satisfactorily with even one quality when the output was large, as, in the case of a colliery raising 1,200 tons per day, the rate of winding at the busiest part of the day would be at least one-third above the average rate, or say 3 tons per minute; and for every loaded tub arriving at the bank an empty one must be promptly sent down to keep the work going below ground. When an unusually dirty tub was tipped, 5 minutes would barely suffice to clean and pick it, during which time the tipping must be stopped and the man at the tip be idle. If the screens and shoots were multiplied, the siding arrangements became awkward, as, if one line of rails was kept for each of the two sizes of coal, there would be an alternation of loaded and half-filled trucks that would seriously interfere with the clearing of the loaded trucks. To step the shoots forward so that the end shoots delivered on to separate lines caused the small-coal trucks of one shoot to be mixed with the large-coal trucks of the adjacent one. He knew of no fairly thick seam in the Midland coal-field that did not contain at least two qualities which, for commercial reasons, it was necessary to separate, and he strongly retained the opinion that the sorting-belt was the best method at present in use for securing continuous unloading of the tubs, and at the same time providing for the picking, cleaning, and loading of the various qualities, and the larger sizes of each quality. If dirt on the belt should pass the first man, there was no reason why it should not be removed by the second, and the number of pickers and dressers was only limited by the length of the belt. An objection which might be urged against the picking-belt was that if all the best lumps were not removed the residue would be carried to a place among coal that was usually sold at a lower price, but the supervision to prevent this was easy.

The two screens, h_1 and h_2, Fig. 6, Plate 5, were first made of bars like the section *f*, *Figs. 20*, p. 172, but stayed with bolts and ferrules, 18 inches apart; and the irregular lumps projected below the surface of the screen-bars and were caught by the ferrules, so that an attendant was required to keep the screens clear; but by substituting the perforated plates this labour had been dispensed with. When coal was worked "on end," the lumps were more nearly cubical in shape and were better sized by the round holes than by the rectangular spaces in the bar-screens. He strongly objected to passing all the large coal along with the small over a vibrating screen, as the corners of the lumps were ground away and the lumps assumed more or less a boulder shape. At another colliery where banking machinery was adopted, the first screens that received the whole of the coal were placed at an angle of 12° and vibrated 70 double strokes to 80 double strokes per minute. The percentage of small coal was so much increased that hand-picked bright house-coal in large lumps tipped alone on the screen lost 15 per cent. in the small broken off which passed through the screens. This was alleviated, but not entirely prevented, by increasing the angle to 18° and reducing the number of vibrations to 45 per minute. In the output of coal per man employed per annum he had not found an increase, but the contrary. Taking the oldest pits for which he had records, the coal worked per shift per collier employed, which was 3 tons 12 cwt. in 1882, had now fallen to 2 tons 12 cwt.; and the increased output due to machinery was that on the roads below ground and on the surface, which was now about doubled; but the men employed in this connection amounted to only one-fifth of the total in number, and much less in respect of cost. The boilers were all adapted for a pressure of 80 lbs. per square inch; and, as the coal was found at a smaller depth than was expected when the dimensions of the winding-engines were fixed, a pressure of 50 lbs. per square inch was ample, and had the further advantage of not requiring feed-pumps. As to the effect of passing coal over one screen, or two screens in succession, the last screen having slightly wider spaces than the first; at Kirkby the practice was to hand-pick the lumps for locomotive coal and load it all from the picking-belt. In judging the efficiency of tipping- and screening-machinery regard must be had to the way in which the coal was worked, as the worst appliances which the Author had seen did not, with coal worked "on end," injure the coal so much as getting the coal "on board." Mr. Gillott.

Correspondence.

Mr. ALP. BRIART of Mariemont, Belgium, thought the chief interest in the Paper centred in the question of the tipplers. He had studied the matter for many years, and his views were fully reflected in a Paper,[1] by Mr. A. Godeaux, which he desired Mr. Briart.

[1] "Note sur le Triage Mécanique du Puits No. 5 de la Société Charbonnière de Bascoup." Par A. Godeaux. Liége, 1885. Excerpt *Revue Universelle des Mines, 1885.*