

vision, facility of access to the machines, the power of sustaining uniformity of temperature and moisture, the absence of currents of air which are so objectionable in other mills, the simplicity of the driving gear, and the excellent ventilation which is so desirable for the health of the workpeople.

The paper was illustrated by two drawings with a sheet of reference, and an appendix contained the result of some experiments upon the strain on the tie-bolts, the pressure on the arches, and the deflection of the bolts, &c.

Mr. Smith was much pleased to find this description of building Mr. Smith,
of Deanston brought before the Institution, as he had been the first to adopt it for a weaving shed of the extent of half an acre; the columns for carrying the arches were 30 feet 6 inches apart, and the skylights were 8 feet in diameter; some of the arches were of brick, with stone springers; others were entirely built with rubble stone well grouted, which latter mode of construction he found succeeded quite as well as brick: the settlement of the arches on striking the centres after standing four days was only $\frac{3}{4}$ ths of an inch: The arches were thickly plastered with common mortar and at first were only covered with a coating of boiled coal-tar pitch and lime $\frac{3}{4}$ ths of an inch thick, but as the wet penetrated, the thickness of coal-tar pitch was increased to $\frac{3}{4}$ ths of an inch, with a mixture of sharp sand, which had proved perfectly water-tight: for some months there was an appearance of moisture, which proceeded from the interior of the brickwork, as it could not escape outwards on account of the impermeable covering; after some time the copious ventilation carried off this moisture and the building became perfectly dry. Over the coal tar a thickness of earth is laid, which is cultivated, and has proved a prolific garden: in severe weather the frost has not reached above $1\frac{1}{2}$ inch deep in the soil, while it has penetrated to the extent of 12 inches in other situations.

The construction of the floor is peculiar: it is desirable in such weaving sheds to have a boarded floor, to prevent the small parts of the machinery from being broken by falls, and also on account of the health of the persons employed; but the vibration of an ordinary wood floor is objectionable. In order to meet these views, a bed of concrete was laid throughout the building, a series of small deal spars $1\frac{1}{2}$ inch deep by 1 inch wide were set flush into the concrete whilst it was wet, and the whole surface was smooth plastered: upon this bed, when it was perfectly dry, a floor of boards $1\frac{1}{4}$ th inch thick was nailed to the spars: it was found to combine the solidity of pavement

with all the advantages of a wood floor, and there had not been any symptoms of dry rot; which might be attributed to there being no cavities left beneath the boards, the whole being firmly bedded down.

The ventilation was effected by tunnels beneath the floor, the covers of which were pierced with a number of small holes to spread the air. The warming was accomplished by means of hot water circulating under the pressure of the atmosphere only, in "tubes of tin plate" 4 inches diameter; the temperature was very regular and perfectly under control. With one ton of coal per week the shed could be kept up to 70° during the winter.

The cost of this building was 30 shillings per square yard of area covered, which was less than the cost of Messrs. Marshall's mill, but building materials were much cheaper at Deanston than at Leeds. He expected that this mode of building would become more general as it combined many advantages, and whatever might be the first outlay in purchasing ground, the cost of which was the only inducement for constructing buildings of several stories in height, it would be fully compensated by the facility of superintendence alone, as in manufactories this was of the utmost importance.

These buildings would, he believed, be eventually used for agricultural purposes, and when engineering knowledge was more directed to the processes of agriculture good results might be anticipated: his attention had been particularly directed to the subject, and he was convinced of the necessity of concentrated superintendence which is not at present possible in the separate farm-steadings as they are now constructed: this might be apparently foreign to the subject before the meeting, but the range of engineering was so wide that it was difficult to say where it should stop.

Mr. Carnegie. Mr. Lindsay Carnegie as a landed proprietor could bear testimony to the importance of the connexion of engineering with agriculture and to the advantages already derived from the improvements which had been introduced by Mr. Smith, who might be justly termed the father of the improved system of agriculture in Scotland.

Mr. Marshall. Mr. Marshall explained that he was indebted to Mr. Smith for the suggestion of this mode of construction, which he had not hesitated to adopt although all the plans had been prepared for mills of several stories in height—he had been convinced of the superiority of the present plan and his expectations had been fully realized. There were of course some difficulties to be overcome and some experiments to try, all of which had not been successful, but in all the essential points this kind of building was superior to any other. An equality of

temperature and a facility of imparting a certain degree of moisture to the air which was indispensable for spinning yarn had been perfectly attained.

Mr. Braithwaite inquired whether the arches were found to be perfectly water-tight? On some of the railways which were laid upon arches it had been found that asphalt had failed in rendering them impervious, and they were consequently useless, even for store-houses. Mr. F. Braithwaite.

Mr. Marshall explained that a few leaks had occurred, particularly near the skylight-frames, but they had been easily repaired and were now water-tight. Mr. Marshall.

Mr. Combe found that a mixture of finely-sifted engine ashes with the coal-tar pitch was better than lime. The depth of soil above the arches should be sufficient to prevent the heat of the sun from penetrating through the cracks to the pitch and forcing it up. He had recently examined the roof carefully and could only discover six indications of moisture penetrating; these had been easily repaired and all was now perfectly sound. Mr. Combe.

Mr. Field agreed with Mr. Smith in his estimation of the advantages of carrying on all manufacturing processes as much as possible under one roof and on one floor—great economy of time and labour would result, especially where heavy masses such as parts of machinery required to be moved about—he would always adopt the system in constructing a manufactory. Mr. Field.

Mr. Smith observed that an arched roof would be found as cheap as one of wood and slates, and in the relative durability there could be no comparison. Mr. Smith.

Mr. Marshall desired it to be borne in mind that the cut stone front of the mill had greatly enhanced the cost, and that being the first building of the kind erected in the neighbourhood of Leeds it had naturally been more expensive than others would be. Mr. Marshall.

“Account of the Explosion of a Steam Boiler at the Penydarren Iron Works, South Wales.” By Adrian Stephens.

The boiler, the explosion of which is described in the paper, was one of a pair for furnishing steam to a high-pressure engine, with a cylinder of 26 inches diameter, working expansively, the steam being cut off at half the stroke; each of these boilers was 41 feet long, and 7 feet diameter, with a centre tube flue of 4 feet 2 inches diameter; the thickness of the plates throughout was $\frac{1}{2}$ inch; the ends were flat, Steam-boiler Explosion.