plosion. The steam fan was about to be put in operation near Wakefield, and its simplicity of action recommended it to all who had seen it. Mr. Nasmyth explained the action of the fan by referring to a drawing which he had prepared. On the fan being made to revolve rapidly, the volumes of air contained between the vanes were forced out, while fresh air rushed in to supply its place. He recommended that the steam engine should be placed in direct communication with the fan, and that the engine should have a very short stroke. A speed of 300 revolutions per minute was thus very easily attained, and 20,000 cubic feet of fresh air per minute could be forced into a pit with a fan whose vanes were eight feet in diameter. A fan whose vanes were double the diameter would be amply sufficient to ventilate the largest mine in Britain. The whole apparatus, including steam engine, would cost about £160. With so efficient a means of ventilation, attainable at so small a cost, it would be a disgrace, in these times of civilization, if such wholesale destruction of human life were allowed to occur.

The second communication, being upon an apparatus for effecting the same important object, was read by Mr. Biram.

**DESCRIPTION OF THE FAN ERECTED FOR THE VENTILATION OF THE HEMINGFIELD PIT, BELONGING TO EARL FITZWILLIAM, AT ELSECAR.** BY B. BIRAM, ESQ.

This fan, which is eight feet diameter and nine inches wide, has eight vanes, which are so arranged that each forms the segment of a screw which revolves in the same plane. The angle of the extremity or outer edge of the vanes is about 23 degrees with the plane of rotation, making the pitch of the screw about 10 feet 10 inches. The area for the passage of air through the fan is about 47 superficial feet, which, multiplied by 10 feet 10 inches,—the pitch of the screw,—gives 509 cubic feet as the
theoretical quantity of air which would pass through the fan each revolution. The fan makes 110 revolutions per minute, and is worked by the pressure of a column of water 450 feet high, acting upon the piston of a small hydraulic engine, working in a cylinder four inches diameter and one foot stroke. The engine makes 20 double strokes, consuming $21\frac{1}{2}$ gallons of water per minute; so that the power expended to overcome the friction of the machinery and propel the air is equivalent to the weight of the above quantity of water, or 215 lbs. falling through 450 feet per minute, equal to three horses' power nearly. The engine is considered not sufficiently powerful, and it is intended to increase the power; but the passage of the air is also obstructed by a contraction between the fan and the upcast shaft, which will be remedied by a slant drift, nearly completed, for conveying the air direct from the fan into the upcast shaft. At present the circulation is increased by a fall of water issuing from an opening of five square inches area, and a head of three feet six inches from the top of the engine or downcast pit, which it is calculated discharges 120 gallons per minute. The combined effect of the waterfall and fan causes a circulation of 27,700 cubic feet of air per minute. When the fan is not at work, the waterfall alone circulates 12,700 feet per minute, which leaves 15,000 cubic feet due to the effect of the fan. A comparison of the performance of the water employed in each case, and the power necessary to raise it again to the height from which it falls, will be as follows:—

<table>
<thead>
<tr>
<th>Gallons</th>
<th>Feet</th>
<th>Horse power</th>
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</thead>
<tbody>
<tr>
<td>The fan uses per minute......</td>
<td>$21\frac{1}{2}$</td>
<td>falling 450</td>
</tr>
<tr>
<td>The waterfall ditto ......</td>
<td>120</td>
<td>,, 450</td>
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</tbody>
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Mr. Biram considered that this description of fan passed as large a quantity of air as any that he had seen. It might be fixed in any situation, and connected with any motive power, whether water or steam. Mr. Biram exhibited a beautiful working model of his fan, about a foot in diameter, the
experiments with which were perfectly successful. The quantity of air which passed through the fan was (approximately) indicated by an anemometer, and the number of cubic feet per minute was found to be very large.

In the course of the discussion which followed the communications of Mr. Nasmyth and Mr. Biram, the Chairman took occasion to express his opinion that the importance of this mode of working mines could not be too highly appreciated. There was one difficulty, however, connected with this mode of ventilation, which was, to regulate the velocity of the air which was made to pass through the mine so as to make it compatible with the working of the seam of coal. In case of accident in a mine, and the ventilation becoming suspended, the fan was calculated to be of great advantage, as considerable time must elapse before the furnaces could be lighted. He had been pleased with both the papers. They referred to a subject intimately connected with the commercial interest and prosperity of England. Our very existence as a commercial nation depended upon our mineral wealth, and every effort made to diminish the risks run by the miner ought to be received with gratitude and respect.

Mr. Nasmyth pointed out another advantage likely to accrue from this mode of ventilation, in diminishing the high temperature which was known to prevail at great depths; thus promoting the health and comfort of the miner and the productiveness of the mine.

Mr. Biram suggested the adoption of a lamp for use in mines, having an opaque back, with a reflector, for the purpose of throwing the light to the point where it was required.

Mr. Theodore West was glad to find the opinion gaining ground that the safety lamp was imperfect, and thought it desirable that this should be increasingly impressed on the miner, that every other precaution might
be taken. With respect to the ventilating fan, at the high speed at which it was intended to work, he thought some slight gearing might be necessary.

Mr. Nasmyth now proceeded with his last communication, which, like its predecessor, was illustrated by diagrams.

**DESCRIPTION OF AN IMPROVED SAFETY VALVE FOR STEAM BOILERS. BY JAMES NASMYTH, ESQ.**

Mr. Nasmyth gave a description of an improved safety valve for steam boilers, and referred to the calamitous boiler explosions which had been so frequent of late, and observed that, as a means of prevention, none was more efficient than a good safety valve. He proceeded to inquire what were the causes of the failure of the ordinary safety valve—wherein was it deficient? The function of a safety valve was to have some part of the boiler which would open and allow the steam to escape on a certain pressure being reached. This object was very simply attained by a valve of the ordinary construction, loaded either by a weight attached directly to the valve, or by a small weight increased in its efficiency by a system of levers. The ordinary safety valve (of which a model was shown) was liable to stick fast, owing to the muddy sediment of the water collecting round the spindle of the valve. In the common construction of valves the conical form was generally adopted. It was thus important that the internal and external cones should exactly coincide, and it was necessary to guide the spindle very correctly into the centre. This arrangement was subject to the inconvenience of the spindle sticking fast on the one hand, or if it were too slack, it would fail to perform its functions. It was highly probable that many accidents had arisen from the safety valve not having acted efficiently. His improved safety valve consisted in doing away with the spindle altogether, and employing the