The following letter from Mr. Barker, of Whitehaven, regarding the performance of one of Mr. Fourness’s Machines for Ventilating Coal Pits, &c., was read:—

Whitehaven, May 22nd, 1844.

Mr. William Fourness,—Sir,—Your machine for ventilating mines having been in operation upon my new winning, at Wyndham Colliery, near this town, a sufficient length of time to test its efficiency, I have to make the following statement of its results:—The mine, before the machine was applied, was ventilated by a furnace consuming 45 cwt. of small coal in 24 hours, exhausting 5,700 cubic feet of air per minute. Since the machine has been applied, our ventilation is more than doubled, and, as the machine throws off 13,500 cubic feet per minute, it is our fault if we do not secure that quantity of air through the mine. The machine is driven by power taken from our pumping engine, and, by careful experiment, I have found the additional consumption of small coal to be 9 cwt. per 12 hours. This, therefore, is all the cost of working the machine. I have to add, that I am gratified with the performance of the machine in every respect. The Colliery kept me in continual fear of an accident before erecting the machine; whereas the ventilation is so much improved, we now work without danger, and I am happy to bear this testimony in its favor.

I remain, Sir, &c.,

Richard Barker.

At a preceding Meeting of the Society, Mr. Hartop read a communication from Mr. Fourness, describing the construction of the above machine, (for which a patent was obtained November 16th, 1837,) together with some remarks “On the Advantages of Mechanical Force over the Power of Rarefaction in Ventilating Mines and Buildings,” as exhibited by the efficiency of his apparatus, of which paper the following is an abstract:—

“The machine applied at the Wyndham Colliery consists of a drum made of sheet iron, one-eighth of an inch in thickness; the dimensions are five feet diameter, and 27 inches
broad; the inlets or passages for air are exactly one-third of its diameter; the interior of the drum contains six fans, extending from the extreme diameter of the inlet to the outer circumference of the drum; one-third of the space between each fan is left open for the delivery of air; the remaining two-thirds are closed by a plate, called a vacuum plate, which prevents the atmosphere from lodging behind the fan. This machine performs 230 revolutions per minute, is fixed over a Staple Pit, which is connected with the Back Pit or Engine Pit, and throws off exactly the same number of cubic feet at every revolution, which the drum contains. The inlets at the sides consist of a cast iron rim turned true on the face, revolving against a fast face of iron, also turned true, and screwed to a wood pipe, which I find answers well to be in breadth two-thirds the length, consequently in the form of a parallelogram; the depth of this pipe is discretionary, as circumstances require; I recommend six feet. The top of the pipe lifts off, to admit the drum and the shaft into their proper place; the plummer-blocks and brasses are outside of the pipes, and level with the parting in them. By constructing a machine as above you need no case, and avoid all clearances between the fan and the case,—a very great evil in the common fan. This machine runs without noise.”

The Author’s attention was first called to the subject by the Report from the Select Committee of the House of Commons “On Accidents in Mines,” which recommended greater care and caution to be used by all grades of individuals engaged in mining operations, and that nothing could be done which could be more effectual than the plans they had brought before them; and that with proper and careful use of the Safety Lamp, the painful calamities they had to investigate would, to a great extent, be avoided. Mr. Fourness, however, was of opinion that to prevent
explosions from carburetted hydrogen gas (fire-damp) in
mines altogether, the most efficient remedy would be to obtain
a more powerful ventilation in the place of the old plan of
using a furnace, or cupola, by causing a larger current of air
to pass through the workings, so that the whole of the
atmosphere should be sufficiently diluted below the "Firing
Point," and thus the materials for combustion and explosion
would be removed or rendered harmless, and no accidents
occur from that cause. With this view he constructed a
model of a machine to effect so desirable an object, in
October, 1835. Having succeeded thus far, he says "My
next business was to look out for a well which was sur­
charged with carbonic acid gas; I found one in Balloon
Street, Brewery Field, Leeds. I applied it to this well,
which was 27 yards deep, and four feet six inches in diameter.
The model cleared this well, which was at the commence­
ment entirely filled with foul air, in 25 minutes. A few
weeks afterwards, being in the immediate neighbourhood,
I was called upon to attend without loss of time, as there
were two men suffocating in the well. When I arrived, I
found this correct, and set the machine to work; the men
almost immediately recovered, and without any other assist­
ance came out of the well. The master well-sinker said it
was certainly a most capital invention, but that the well­
sinkers could not encourage it. I asked him his reason,
'Well,' he replied, 'you have deprived me of the profits
of my men's wages for one day, which time it would have
taken to fix the bellows.'" This model was twelve inches
in diameter by five inches broad, and could be carried on
the shoulder to any part of the town, and applied to a
well in one minute. Subsequently, in November, 1837,
a machine of larger dimensions, five feet in diameter by
two feet broad, was constructed and applied to a pit at
Osmondthorpe Colliery, near Leeds, in connexion with
which was a Water-level, which had been set on fire about 18 months previously by an explosion of carburetted hydrogen gas. "This place was immediately cleared of all the smoke, sulphur, &c., which could not be moved by the power of the cupola;" thus affording additional evidence of the superiority of Mechanical Force over the power of Rarefaction in promoting Ventilation, an increase of which, as the Author observes, would invigorate the pitmen, and enable them to go through their labour with greater comfort; in many cases with improved health; and the general working of the mine be greatly facilitated. "The present velocity with which wind travels through mines is at the rate of from three to four feet per second. This velocity suits the Safety Lamp, inasmuch as a wind travelling at a greater speed in a highly explosive medium, would cause the flame to pass the gauze of the lamp, and explode the mine. But were the current of air to be increased to double that velocity, there would be no necessity for the Safety Lamp at all."

In discussing the relative consumption of fuel, and the results to be obtained by his method of Ventilation and that of the plan in general use, Mr. Fourness gives the following calculations in support of his invention being more economical and efficient.

"I may here state how much fuel would be required for a furnace, either at the top or bottom of the shaft, to exhaust 10,180 cubic feet of air per minute. The answer is 46 cwt. of good coal in 24 hours, or rather better than 4½ lbs. of coal per minute; according to the rules for ascertaining the quantity of fuel required for an ordinary mine, say the depth of upcast 200 yards, as the length of shaft is not of so great importance for ventilation, when reaching above 60 or 70 yards; making a difference of 2½ lbs. of coal per minute, or 36 cwt. per 24 hours, for it appears plain that 10 cwt. of good coal, (where mechanical
force is used,) will cause as good a ventilation as 46 cwt. will do when consumed at a furnace. I take the above 200 yards as the average depth of mines generally.

"I might here observe, that where a fire is used in the bottom of a shaft, the temperature in the upcast decreases as the square of the distance from the fire. Therefore, I should not say that a deep mine is more difficult to ventilate than one of 60 or 70 yards. Suppose a furnace consumes 18 cwt. of coal in 24 hours, and exhausts 212 cubic yards of air per minute, if I wish to ascertain how much fuel it would require to exhaust double the quantity of air in the same given time? The following rule will give the answer:—The required quantity being 424, it must be cubed and multiplied by 18, the quantity of fuel known for 212 cubic yards. The product of the larger number must be divided by the lesser, which gives a quotient of 144; when divided by 2, the square of the increased quantity equals 72 cwt. for 24 hours. If we are desirous of knowing how much air 80 cwt. of good coal will cause to pass through a mine per minute, half the square root of 80 gives the answer, allowing the two first decimals in the root to be primes; the quotient is 447 cubic yards of air per minute. This question may also be answered thus:—Suppose air travels at the rate of five miles per hour through the workings of a mine, every object this air comes in contact with, it strikes with a given force equal to 0.123 of a pound on the square foot; but if caused to travel ten miles per hour, it will strike with four times the force, viz., 0.492 of a pound on the square foot. Therefore, if wind is required to travel at double the velocity through mines, there must be four times the quantity of fuel used to produce the force above specified. Allowing these observations to be correct, many evils would arise from the use of such extensive fires, such as destruction of the sides of the upcast shaft, ropes, guide rods, and, indeed, all substances that come within the limits of its power.
The dimensions of an ordinary furnace are 7 feet long and 5 feet wide on the grate bars. If four times the fuel were required to be consumed in the same time, (as is generally used,) the grate bars must be four times the area, that is, 14 feet long, by 10 feet broad. I am of opinion a greater evil would arise from the use of this furnace than what is generally anticipated. Bicarburetted hydrogen, or what is commonly termed 'fire damp,' reaches the explosive point at a temperature of 500° or 550° Fahrenheit; and having a surface of fire equal to double the length to pass over, must reach to a sufficient temperature for combination, and will instantly take fire."