TABLE B.

Experiments with Equal Arms of the Yoke at three Miles per hour.

Models compared.	Depth of Immersion in Inches.	Weight of Vessels with their Loads.	Difference.	
Flat Vessel, No. 1	4.91	256 lbs. }	32	No. 2 carries 1-8th more than No. 1.
Coaster, No. 2	8.5	288 — }		
No. 1	6.083	320 — }	72	No. 2 carries 2-9ths more than No. 1.
No. 2	10.083	392 — }		
Flat Vessel, No. 1	4.17	192 — }	42	No. 3 carries 2-9ths more than No. 1.
Schooner, No. 3	8.41	234 — }		
No. 1	5.75	320 — }	42	No. 3 carries 2-15ths more than No. 1.
No. 3	10.25	362 — }		
Flat Vessel, No. 1	4.17	256 — }	0	No difference at this rate of speed.
Twin do No. 4	4	256 — }		

N. B. The depth of immersion entered above, is that observed when the vessels were at rest, and which did not appear to alter when in motion.

TABLE C.

Experiments with equal Arms of the Yoke at six Miles per hour.

Models compared.	Immersion in inches.	Weight of Models when loaded	Difference.	
No. 1 Flat Vessel	4 2-12	192 lbs. }		
No. 2 Coaster	6 4-12	192 — }		
No. 1	4 11-12	256 — }	—	
No. 2	8 1-12	256 — }		
No. 1	4 2-12	192 — }	—	
No. 3 Schr. shape	7 9-12	192 — }		
No. 1	4 11-12	256 — }	—	
No. 3	9 2-12	256 — }		
No. 1	5 9-12	320 — }	—	
No. 4 Twin Boat	5 7-12	320 — }		

¶ *Account of the Depths of Mines.* By JOHN TAYLOR, F. R. S., &c.

Mr. Taylor exhibited a section, showing the depths of shafts of the deepest mines in the world, and their position in relation to the level of the sea.

The absolute depths of the principal ones were:

	Feet.
1. The shaft called Roehrobichel, at the Kitspühl mine in the Tyrol	2764
2. At the Sampson mine, at Andreasberg, in the Harz	2230

	Feet.
3. At the Valenciana mine, at Guanaxuato, Mexico	1770
4. Pearce's shaft, at the Consolidated mines, Cornwall	1464
5. At Wheal Abraham mine, Cornwall	1452
6. At Dolcoath mine, Cornwall	1410
7. At Ecton mine, Staffordshire	1380
8. Woolf's shaft, at the Consolidated mines	1350

These mines are, however, very differently situated with regard to their distance from the centre of the earth, as the last on the list, Woolf's shaft, at the Consolidated mines, has 1230 feet of its depth below the surface of the sea, while the bottom of the shaft of Valenciana, in Mexico, is near 6000 feet in absolute height above the tops of the shafts in Cornwall. The bottom of the shaft at the Sampson mine, in the Harz, is but a few fathoms under the level of the ocean; and this, and the deep mine of Kitspühl, form, therefore, intermediate links between those of Mexico and Cornwall.

Mr. Taylor stated, that taking the diameter of the earth at 8000 miles, and the greatest depth under the surface of the sea being 1230 feet, or about one-fourth of a mile, it follows that we have only penetrated to the extent of $\frac{1}{32000}$ th part of the earth's diameter.

Some account was then given of the mines to which the shafts referred to belong.

Of the deepest, at Kitspühl, as it has long ceased to work, we do not know much. Villefosse, in his great work on the *Richesse Minérale de l'Europe*, states that this was a copper mine, which passed for being the deepest in Europe; and that in 1759, it was reported on, amongst other mines, by MM. Jars and Duhamel, and it was then proposed to abandon the working, the water having been already suffered to rise near 200 fathoms.

The Sampson mine, in the Harz, is one of the most celebrated in that district: it has been working since the middle of the sixteenth century, and produces silver ores of superior quality. The principal shaft is sunk about six feet deeper every year, by which ground enough is drained for a regular extraction of the ores. The mine is one of the oldest in Germany, and has always been profitable: it employs from 400 to 500 men. It is the property of shareholders, who are very numerous, the interest having been much subdivided in the course of time.

The mine of Valenciana, at Guanaxuato, was one of the most renowned in Mexico. It produced annually, about the end of the last century, 360,000 ounces of silver, worth about £600,000 sterling, and then employed 3100 persons. The shaft referred to in the section, was commenced in 1791, the mine having been long previously worked by other shafts: it had attained its present depth in 1809, when the mine was stopped by the revolution. It is octagonal, and more than thirty feet in diameter, a great part of its depth being walled with beautiful masonry, and is probably the most magnificent work of the kind. The expense of forming this shaft is estimated by Humboldt at the enormous sum of £220,000. The mine was so little troubled with water, that it was considered almost a dry one:

during the suspension of the works, it, however, gradually filled. In 1825, one of the English companies undertook to drain it, which was, after great labour and expense, accomplished; but the mine has not been sufficiently productive since to make it worth while to continue the working.

The Consolidated mines form the most extensive concern in Cornwall, embracing what were formerly several distinct mines, which, as the name indicates, were connected in one undertaking.

This was arranged in 1818, and the mines which had remained unwrought for many years, were drained by very powerful steam engines, and were put into a state of active working. The management was confided to Mr. Taylor and the late Capt. William Davey: an outlay of £73,000 was incurred, which has since been repaid with ample profit. The present produce is 20,000 tons of ore a year, yielding about 1920 tons of fine copper, being one-seventh of the whole quantity raised in Great Britain. The mines employ about 2400 persons, of whom about 1400 are miners, working under ground. The water raised to the adit level is about 2000 gallons per minute: the height to which this is lifted is more than 220 fathoms, or 1320 feet; the aggregate weight of the columns of water in the pumps being 512,000 pounds, or about 230 tons, and the whole is put in motion by eight immense steam engines, four of which are the largest ever made.

The depth of the mines has been increased 100 fathoms since the period of the drainage being completed, being at the rate of about eight fathoms a year.

There are, in the whole concern, ninety-five shafts, besides other perpendicular communications from level to level underground, called winzes. The depths of the whole added together, make up about 22,000 fathoms, or twenty-five miles; and the levels, or galleries, will make up, in horizontal distance, a length of 38,000 fathoms, or about forty-three miles.

Wheal Abraham is an old copper mine, the working of which was abandoned a few years since, the vein having ceased to be productive in depth. It was, until very lately, the deepest mine from the surface in Cornwall, but is now surpassed by the Consolidated mines.

Dolcoath mine was formerly called Bullen Garden, and a section of it as it was at that time, will be found in Dr. Pryce's work, *Mineralogia Cornubiensis*, published in 1778. It was then rather more than ninety fathoms deep, and probably one of the deepest mines at that time. It has, therefore, been sunk 140 fathoms since; but, like all the great mines, it has not been in constant work. It has now been actively prosecuted for many years, and at present stands third in the list of copper mines in Cornwall, arranging them according to the value of their produce. That of Dolcoath, however, does not amount to one half of that of the Consolidated mines.

Ecton mine is celebrated in most books on mineralogy, as one of the principal copper mines in England; and it was so at one period, though the produce is now inconsiderable. It is situated in Staffordshire, on the borders of Derbyshire, and is very curious, from being

in limestone, and having no regular vein. The ore has been found in large masses, irregularly deposited, and is generally taken to be an example of contemporaneous formation. The mine has been regularly worked for a long series of years, and is now nearly exhausted. It is the property of the Duke of Devonshire, and very large profits were given by it in the latter part of the last century, some of which, it is said, were applied by the late Duke to the erection of the beautiful Crescent at Buxton. The mine is not far distant from this place, and is in a very picturesque situation on the banks of the river Manifold.

Mr. Taylor gave some account of the extent to which steam power is at present employed in Cornwall in draining the mines which penetrate so far beneath the level of the sea, showing the influence that the great improvements, which have from time to time been made, and many of them even recently, must have upon the production of some of the most useful metals.

The number of steam engines used in pumping water from the mines in Cornwall, in December, 1832, was altogether sixty-four.

Some of these are of immense size and power: there are five in the county, of which the diameter of the cylinder is ninety inches, the pistons making a stroke of ten feet. Four of these are at the Consolidated mines, and the first constructed of this size, was planned and erected there by Mr. Woolf. The beam of such an engine weighs twenty-seven tons; the pump rods are of mast timber, sixteen inches square, connected by iron strapping plates, of enormous weight. The column of water lifted, the rods and beam, make up a weight of more than 100 tons, and this is kept in motion at the rate of from five to ten strokes per minute.

The quantity of coal consumed in drawing water in the same month, in all the mines of Cornwall, was 84,034 bushels, and the quantity of water delivered, about 19,279 gallons per minute. The weight of water actually poised by all these engines to produce this effect, amounts to about 1137 tons.

From calculations carefully made in Mexico, as to horse power employed in draining mines, and deduced from a large scale of operations, it is found that the performance is equal to 19,000 pounds raised one foot high per minute for each horse.

According to this rate, the coal consumed in Cornwall in a month, being 84,000 bushels, or 2800 per day, and taking the duty of the engines at 55,000,000 pounds lifted one foot by each bushel, which is very nearly the fact, it will be found that the sixteenth part of a bushel does as much in raising water in Cornwall, as a horse does in Mexico, (working three hours out of twenty-four,) and that thus the number of horses required to drain the mines of Cornwall would be 44,800.

[*Rep. 3d Meeting Brit. Associa.*]

¶ *Remarks on the Protection of Copper Sheathing upon Ships' Bottoms.* By G. G. BOMPAS.

It is a well known fact, that when dissimilar metals are placed in