In another experiment a heavier needle was suspended by a fine wire, and when heated by exposure to the sun its decrease of intensity was ascertained by torsion of the wire, and was found to correspond nearly with the author's previous determinations; but the terminal arc, after fifty vibrations made in the sun, was found always considerably less than after the same number in the shade, the initial arcs being the same in both cases. Other observations made in strong sunshine, and of which a detail is given, led to the same conclusions; the terminal arc in the shade, after forty vibrations, being 14°, and in the sun only $8\frac{1}{2}$, the initial arc being 90°.

That this effect does not arise from change of temperature and intensity in the needle is evident from the observations themselves. To show that it does not arise from change of temperature in the brass box, the author heated the box over a fire till its heat was barely supportable by the hand; and the needle being vibrated alternately in the box so heated, and in the cold box (but in neither case exposed to the sun), the effect of increased temperature was found decidedly and considerably the reverse of that of the solar radiation, the terminal arc being materially increased by the heat,—a circumstance, he thinks, indicative of a diminished capacity for magnetism in brass at an elevated temperature.

The author next tried the effect of an elevation of temperature in the needle itself, by dipping it in boiling water, but found no sensible effect on the terminal arc.

The small accelerations in the times of vibrations in the experiments first described, the author attributes to the diminution of the arcs. The first observations in which the peculiar effect was noticed were made June 4, 1824; and he regrets that his absence from home during the hot and clear weather of the summer of 1825, prevented his extending the inquiry by further and obvious experiments. Meanwhile he regards these observations as tending considerably to remove the doubts raised respecting the influence of the violet ray in Professor Morichini's experiments, arising from their repeated failures in the ablest hands.

On the mutual Action of Sulphuric Acid and Alcohol, with Observations on the Composition and Properties of the resulting Compound. By Mr. Henry Hennell, *Chemical Operator at Apothecaries' Hall. Communicated by* W. T. Brande, *Esq. Sec. R.S.* Read March 9, 1826. [*Phil. Trans.* 1826, Part III. *p.* 240.]

At the commencement of this paper Mr. Hennell describes certain peculiarities in the properties of oil of wine, which induced him to consider sulphuric acid as one of its proximate elements; and on following up his analytical experiments upon it he found that about 37 per cent. of that acid might be obtained during its decomposition, although in its original state it affords no indications of that acid by the tests of the soluble salts of baryta,—a circumstance which he refers to the presence of hydrocarbon exerting a peculiar saturating

influence upon the acid. Of this hydrocarbon he next determines the composition, and finds that its elements correspond in their relative proportions with those of olefiant gas.

When oil of wine is mixed with solution of muriate of baryta, and gently heated, the mixture becomes acid, reddening litmus paper, but yet does not precipitate the barytic salt. Several experiments are detailed illustrating the nature of this acid, from which it appears that it forms very soluble compounds with baryta and potassa; the latter is a crystallizable salt, which burns with flame when heated, and leaves a bisulphate of potassa. Its analysis, the details of which are given at length in the paper, shows it to consist of two proportionals of sulphuric acid, one of potassa, four of carbon, and four of hydrogen; and it is remarked that the latter elements, namely, the carbon and hydrogen, appear in the present instance to be equivalent to, or to exert a saturating power over, *one* of the proportionals of sulphuric acid. Some slight discrepancies between the experimental and theoretical results of these analyses are adverted to, which the author thinks himself justified in attributing to water of crystallization in the salt, which he could not succeed in obtaining in a perfectly anhydrous state.

Mr. Hennell next shows that the salts, called Sulphovinates, are not essentially different from those which he has just described, and that they are not, as some have supposed, hyposulphates, modified by the presence of essential oil. In preparing the sulphovinates he was struck with the singular change effected upon sulphuric acid, by mixing it with its weight of alcohol. A portion of sulphuric acid, adequate to the saturation of 555 grains of carbonate of soda, required only 398 grains for its saturation when previously mixed with alcohol; and again a quantity of sulphuric acid, which afforded 1313 grains of sulphate of lead, only produced 542 grains when it had been mixed with its weight of alcohol. These circumstances are referred to the combination of a portion of the sulphuric acid with hydrocarbon derived from the alcohol.

Some experiments are then detailed, having for their object the separation of the hydrocarbon from oil of wine. When this oil, as it is called, is heated with a little potash, the salt above described is formed, and the excess of hydrocarbon is liberated in the form of a thick oil, which crystallizes at low temperatures: it has an aromatic odour, sp. gr. 9, is insoluble in water, but soluble in alcohol and ether; decomposition by peroxide of copper showed it to consist of carbon and hydrogen in the proportions of 6 and 1,—analogous therefore, as far as its ultimate elements are concerned, to olefiant gas.

The author examined some sulphuric acid given to him by Mr. Faraday, which had been made to absorb about 80 volumes of olefiant gas; and this saturated with carbonate of potash, evaporated to dryness, and the residue, treated by alcohol, afforded a portion of the same salt as that obtained from the oil of wine. The author concludes, therefore, that hydrocarbon, composed of single proportionals of its elements, is capable of entering into a peculiar

neutral combination with sulphuric acid, and that the compound in its purest known form constitutes what has been called *oil of wine*; and that when in this state it is acted upon by certain salifiable bases, a portion of the hydrocarbon is thrown off, and a distinct set of neutral salts formed, which are resolvable by heat into bi-sulphates; and which therefore include *two* proportionals of the elements of sulphuric acid, *one* of proto-carburet of hydrogen, and one of base.

On a Method of expressing by Signs the Action of Machinery. By Charles Babbage, *Esq. F.R.S. Communicated January* 17, 1826. Read March 16, 1826. [*Phil. Trans.* 1826, *p.* 250.]

In the construction of an engine for calculating and printing mathematical tables, in which the author of this paper has been for some time occupied, he states himself to have met with considerable difficulty from the want of any method by which all those motions which take place in any machine at the same instant, may be easily perceived and referred to, and by which the movement of any part might readily be traced back, through all the intervening stages, up to the first mover of the machine. The usual modes of mechanical drawing he found quite insufficient for these purposes, except in machinery of the simplest construction; and, even if they had not altogether failed in more complicated cases, the time and expense required for their execution would have effectually prevented their employment.

The most important question was to contrive some method by which all the simultaneous movements, occurring at any moment, should be at once visible; and the history of the state of motion or rest of any given part should be apparent during the whole cycle of the action of the engine. The author had therefore recourse to a system of signs, which bear an analogy to those employed in algebra, whilst they differ from them by having a general resemblance to the things they are intended to represent. Having gradually found that this system, which he calls "mechanical notation," was readily susceptible of affording other information than that for which it was at first contrived, he was led to give to it additional extension.

In its present form it gives, almost at a glance of the eye, information relative to any of the following points.

The names of every part of any engine being written at the top of the paper:—

1. Its representations in all the drawings will be pointed out.
2. The number of teeth in any wheel, pinion, or sector will be seen.
3. The actual angular velocity will also appear.
4. The mean angular velocity will also appear.
5. The origin of the motion of each part will be seen, and thus the cause of its motion will be traced up to the first mover.
6. At each transfer of movement, the method by which it was