TABLE of the Results of Experiments on the Deflection of Battens, &c., (Continued).

MATERIAL AND SECTION.	Length of bearing.	Breadth.	Depth.	Depth of opening.	Weight.	Deflection.	Value for general use.
							$\frac{l^3 w}{16 b d^3 D} = V.$
Metals (Continued.)	Ft. Ins.	Inch.	Inch.	Inch.	lbs.	Inch.
Flanches, 9 × 16 ins., Angle iron, 4 ×	40 5	75	24	—	35000	1.250†	11196
Tubes, thickness ·03 in.	3 9	1.9	3	—	448	·100	287
“ “ ·1325 in.	7 6	3.9	6	—	4376	·240	570
“ “ ·124 in.	30	15	24	—	5685	·490	96
“ “ ·250 in.	30	15.5	23.75	—	5685	·210	220
“ “ ·525 in.	30	15.5	24	—	5685	·120	372
“ top, ·437 in.	30	15.75	23.75	—	33685	·850	316
“ bottom, ·272 in.
“ ·037 in.	17	12	12	11.925	2755	·650*	62
“ “ ·0954 in.	31	24	24	23.81	10236	·630*	91
Box girder with angle iron at angles. top plates ·375 bot. & sides ·125	9	6	6	—	7000	·250	984
Corrugated plates,							
31 6	31 6	3.1	8	—	4480	·62	8893
Tubes, thickness, ·0416 in.	17	9.25	14.62	13.535	2262	·620*	38
“ “ ·143 in.	17 5	9.75	15	14.714	16800	1.390*	123
Steel, Cast. Soft,	3 2	·23	·52	—	22	·331	4245
Razor,	2 2	·30	·57	—	22	·083	2984
Brass. Cast,	1	·7	·45	—	60	·040†	1469
GUN METAL.							
Copper 8. Tin 1,	1	·7	·5	—	100	·050†	1428

* Breaking weight.

† Elasticity perfect.

‡ Permanent set, ·625.

(To be Continued.)

On a new Alkali-Metal. By MM. BUNSEN and KIRCHHOFF.

From the Lond. Chemical News, No. 51.

In a recent number of the *Philosophical Magazine* there is given an account of some researches by MM. Bunsen and Kirchhoff on the effect produced by various metals on the spectrum of a flame in which their chlorides are volatilized. That part of their investigation which is more particularly interesting consists of a method of photo-chemical analysis of exquisite delicacy, which the authors have specially studied in relation to the alkali-metals.

These metals have been employed in the form of chlorides, which

have been purified with the greatest care. When these are introduced into a jet of flame they volatilize to a greater or less extent, and then communicate to the flame the special character above alluded to, and which is observable when the spectrum produced by the flame is examined by a sufficient magnifying power.

The above-named memoir is accompanied by a colored plate which illustrates the spectra of the alkali-metals with their characteristic rays. These rays are the more visible in proportion as the flame is less luminous and its temperature higher. The ordinary Bunsen gas-burner answers admirably for these experiments. The rays shown by the chlorides of potassium, sodium, and lithium are perfectly well defined; those of barium, strontium, and calcium are more complicated, and require a somewhat experienced eye for their identification. They are, however, quite distinct enough to be easily recognised, even when salts of these metals are mixed together; for the great advantage of this method of analysis is, that foreign matters have no influence on the results, the authors being able to detect with certainty the different elements in a mixture containing the tenth of a milligramme of the metals mentioned above. Sodium, with its yellow ray, first appears; after that the well defined red ray of lithium; next is seen the paler rays indicating potassium; and, after these rays have disappeared, they are replaced by those of calcium and strontium, which remain visible for some time. The absence of one or other of these sets of rays shows the absence of the corresponding metals.

We are, then, by this method placed in possession of an analytical process of the most extraordinary delicacy. The researches of our authors prove that this sensibility almost approaches the infinite, the eye being able, by its means, to recognise the presence of the three-millionth part of a milligramme of chloride of sodium. It must not, therefore, be a matter of surprise to find sodium distributed almost everywhere, especially in the atmosphere, in which is almost always a sufficient quantity to show the sodium ray. The same may be said in great measure of lithium. In a room of a capacity of about 60 cubic metres was exploded a mixture of sugar-of-milk and chlorate of potassa, containing 9 milligrammes of carbonate of lithia. The lamp, being placed at some distance off, became quickly colored, so that the red ray could be distinctly visible in the spectrum. The authors estimated that this sensibility reached the nine-millionth part of the amount taken.

After this it must not be a matter of surprise to find that lithium is one of the widest-spread elements. The water of the Atlantic was found to contain it. It was also found in the ashes of plants grown on a granite soil, in the vine, in tobacco, and also in milk and in human blood. In the mother-liquors of tartaric acid manufactories, the lithia is found to be so concentrated as to be worth commercial extraction; and the same may be said of certain mother-liquors of saline springs.

With so delicate a reaction as the one just described, of an almost infinite sensibility, and applicable to all metals, the presence of ele-

ments, existing in so small quantities as to entirely escape ordinary analysis, may be rendered visible. Many observations tended to this point, and MM. Bunsen and Kirchhoff now announce definitely (*Annal. der Physik und Chemie*) that they have discovered a new alkali-metal, the fourth member of the group of potassium, sodium, and lithium. At present they have only found it in very small quantities in the mineral water of Kreuznach, in the saline water of Dureckeim, and in one of the sources of the Bade—the Umgemach.

The chloride of the new metal differs from those of sodium and lithium by the yellow precipitate which it produces in the presence of bichloride of platinum. It is distinguished from potassium by its nitrate being soluble in alcohol. Introduced into a flame, and examined with a prism, the vapors of the new chloride show a very interesting spectrum, consisting of two blue lines, one of which, the fainter, almost corresponds with the blue of strontium; the other, also a well defined blue line, is situated a little further towards the violet extremity of the spectrum, and rivals the lithium line in brightness and distinctness of outline.

On the Surface-Condensation of Steam. By J. P. JOULE, LL.D.,
F. R. S.

From the Lond. Artizan, Feb., 1861.

In the author's experiments steam was passed into a tube, to the outside of which a stream of water was applied, by passing it along the concentric space between the steam tube and a wider tube in which the steam tube was placed. The steam tube was connected at its lower end with a receiver to hold the condensed water. A mercury gauge indicated the pressure within the apparatus. The principal object of the author was to ascertain the conductivity of the tube under varied circumstances, by applying the formula suggested by Professor Thomson,

$$c = \frac{w}{a} \log \frac{v}{v'}$$

where a is the area of the tube in square feet, w the quantity of water in pounds transmitted per hour, v and v' the differences of temperature between the inside of the steam tube, and the refrigerating water at its entrance and its exit. The following are some of the author's most important conclusions.

1. The pressure in the vacuous space is sensibly the same in all parts.
2. It is a matter of indifference in which direction the refrigerating water flows in reference to the direction of the steam and condensed water.
3. The temperature of the vacuous space is sensibly equal in all its parts.
4. The resistance to conductivity must be attributed almost entirely

to the film of water in immediate contact with the inside and outside surfaces of the tube, and is little influenced by the kind of metal of which the tube is composed, or by its thickness up to the limits of that of ordinary tubes.

5. The conductivity increases up to a limit as the rapidity of the stream of water is augmented.

6. By the use of a spiral of wire to give a rotary motion of the water in the concentric space, the conductivity is increased for the same head of water.

The author, in conclusion, gives an account of experiments with atmospheric air, as the refrigerating agent; the conductivity is very small in this case, and will probably prevent air being employed for the condensation of steam except in very peculiar circumstances.

Incrustation in Steam Boilers. By HENRY RANSFORD.

From the Journal of the Society of Arts, No. 424.

All the world knows that the incrustation in steam boilers is deposited from the water, and that, in tubular boilers, it is very difficult to get rid of; but few are aware that "blowing out" a boiler, to get rid of the sediment on the bottom, hardens the sediment that adheres to the tubes, converting it into a calcareous shell, requiring a smart blow of a hammer to dislodge it.

Will you oblige me by giving to the world, through the columns of your *Journal*, a very simple and efficacious remedy?

I tried the experiment on a 30-horse tubular boiler. In addition to the blow-off cock at the bottom another was fitted over the fire-pan, at the usual level of the water, and to the end of it, inside the boiler, was screwed on a funnel of sheet iron, partly flattened, so that, on the cock being opened, anything floating within eight or ten inches on each side was drawn through.

The engine-driver had directions to open the lower cock once a day, and the upper one when he saw the water in the glass gauge was thick, and keep them open until the water ran clear, but never to blow out the boiler as formerly. Three or four gallons from the lower, and half that quantity from the upper cock was sufficient to carry off all thick and dirty water.

At the end of *three months*, first allowing the water to get nearly cold, the boiler was emptied; a stream of water was then introduced by the man-hole, and the tubes thoroughly washed. On examination the under half of the tubes was as clean as the day they were made, the upper half discolored, but no scale, and the sides of the boiler in a similar state; on the bottom was about a half bushel of thin scale, broken up into small pieces, that apparently had fallen or been washed from the tubes; thus, after three months' work, there was nothing to do but to get up steam again.

The secret consists in never blowing out the boiler when hot, the usual custom, as the result is—the heat of the tubes and sides instan-