The more the memory is cultivated the more active it be comes. A second foreign language is learned more easily than the first, and so on.

This is the age of bald and barren speculation. Alongside of those who earnestly and patiently labor for the truth are those who tie a few stray facts together and deduce a string of paragraphs. As for Mr. Verdon's theory, it corresponds with his own name. ALIQUIS.

Coal Dust Fuel.

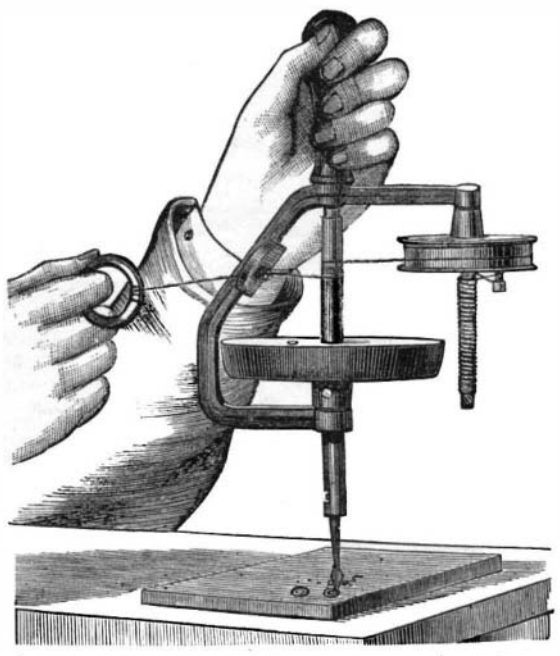
To the Editor of the Scientific American:

I notice your article of January 9, on burning coal dust with a blower, and wish to speak of the disadvantages of this method and its remedy. When a blast is used on fine coal dust, nothing can keep a large amount of fine particles of fuel from being blown out at the top of the chimney, and this has resulted in numerous cases of fire and the total destruction of mills and surrounding property. It makes an unnecessary waste of fuel by virtually melting the coal on the grates; again, it injures the boiler by having a steady blast on the same spot, and a boiler run with a blower will not last near as long as without it. It requires considerable power to run a blower, also more than the users suppose, as shown by indicating the engine on different parts of machinery. Coal dust, with small mixture of soft coal, is now being used as fuel, without the use of a blower, on boilers set with the Jarvis furnace, at Boston, Worcester, Providence, Brooklyn, Jersey City, New York, and other places. By this setting, the gases generated on the grate are utilized by hot air; the joining of the gases, carbonic oxide with the oxygen, makes an immense flame. The gas flame is formed on the principle of the blow-pipe. Three boilers set this way will make as much steam as five the old way.

Boston, Mass. A. F. UPTON.

QUICK-SPEED DRILL.

We extract from *Iron* the annexed engraving of a new quick-speed drill, which consists of a frame, a spindle with the socket for the drill, a pulley with a spiral spring, and a hollow casting which acts as a flywheel and also serves as a



QUICK-SPEED DRILL.

case to contain the ratchet and pawl necessary to prevent the possibility of the motion of the drill becoming reversed. The action is as follows: The workman on drawing his hand toward him actuates the drill, and at the same time tightens the spring attached to the pulley, which spring, on the tension of the hand being relaxed, reverses the motion of the pulley and takes up the slack of the cord; but the motion of the drill is not reversed, owing to the ratchet and pawl in the flywheel, and to the rotation of the flywheel itself. There is thus obtained for the drill a constant revolving motion, with a speed which can be regulated to suit any metal from the hardest to the softest, while the feed, which is effected by the hand, is at all times felt and controlled. These machines can be worked in any position, and, from the important fact that the motion is continually in the same direction and that there is consequently no pause in the cutting, the work can be got through in less time and with far less breakage of drills than by the older contrivances. They are as yet made only in a very small size, and are therefore serviceable chiefly to the makers of small machinery, such as clocks, sewing machines, etc.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the Chemical Section of the New York Academy of Sciences was held on Monday evening, January 14, at their rooms, 64 Madison avenue, Dr. Eggleston in the chair.

Mr. George F. Kunz exhibited a specimen of alexandrite from the Ural mountains. It is purple by night and deep green by day. He also showed a specimen of harmotone, a silicate of baryta and alumina, from a new locality in Brazil.

Mr. Chamberlin exhibited specimens of anchorite from the Phœnixville Tunnel, and of fulgurites from Carrol county, Ill. The latter are partially fused and vitrified tubes of sand produced by the action of lightning.

Professor D. S. Martin announced the appearance of the first number of the "Annals of the Academy."

NITRIC ACID IN HEALTHY URINE.

Professor Albert R. Leeds then read a paper on the presence of nitric acid in healthy urine, and a method for its quantitative determination.

Fig. 2.—WIRE TESTER.

In the course of some experiments to determine the relative amounts of oxidized and non-oxidized compounds existing in drinking water (described in the SCIENTIFIC AMERICAN of January 5), it became important to ascertain this relation in the case of urine, one of the organic impurities of some drinking waters. The Passaic water consumed by the inhabitants of Hoboken contains ten times as much nitric acid as of free and albuminoid ammonia. In passing through the system, the nitrates present in the water undergo reduction, and if they are not assimilated or voided as non-oxidized nitrogenous substances, may be expected to appear to some extent at least in the urine. Although no mention is made of the presence of nitric acid in healthy urine in any of the works to which the speaker had access, he determined to submit the question to the searching methods of inquiry which a recent discovery had placed in his hands.

A retort was freed from all traces of ammonia by distilling pure water in it; 1·023 grammes of fresh healthy urine were then added, and the distillation continued. The distillate was collected in portions of 50 or 100 c. c., pure water being added as was necessary. In each case the ammonia passing over was separately determined by means of the comparator previously described. The ammonia came over in continually decreasing amounts, the total amount evolved in 15 distillations being 1·725 milligramme. The decomposition of what remained was then accelerated by the addition of a gramme of sodium carbonate. The ammonia contained in 56 distillates amounted to 7·1525 milligrammes. In the next place 50 c. c. of a solution of potash and potassium permanganate were added to what remained in the retort. The first distillate then yielded 0·32 and the twenty-second 0·005 of a milligramme of ammonia.

Total for the 22 distillates.....	1·31	mgrm.
" with sodium carbonate	7·1525	"
" by simply boiling.....	1·725	"
	10·1875	

From the last result the conclusion was drawn that all the albuminoid ammonia had been obtained, and that reducing agents should now be used to decompose any oxidized nitrogenous substances which might be present.

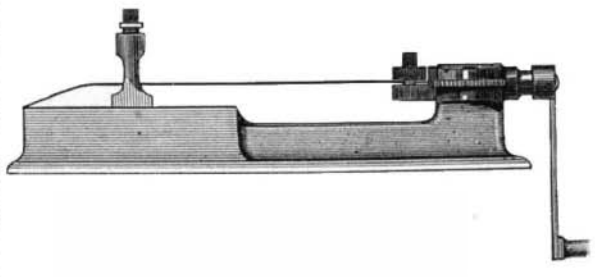


Fig. 3.—TWISTING WIRE TESTER.

Six grammes of zinc were digested with a slightly warmed solution of neutral cupric sulphate, and after careful washing the residue, together with freshly precipitated copper, was introduced into the retort. The following result was then had:

1.	100 c.c. = ...0·10	mgrm.	9.	100 c.c. = ...0·0575	mgrm.
2.	" ....0·03	"	10.	" ...0·0325	"
3.	" ....0·025	"	11.	" ...0·06	"
4.	" ....0·0125	"	12.	" ...0·065	"
5.	" ... 0·04	"	13.	" ...0·0225	"
6.	" ....0·16	"	14.	" ...0·0005	"
7.	" ....0·07	"	15.	" ...0·0000	"
8.	" ....0·12	"	16.	" ...0·0000	"
Total.....					...0·7955

From this result must be subtracted 0·29 mgrm., the amount of ammonia previously ascertained as existing in the form of an impurity in 50 c. c. of the permanganate solution used in the distillation.

This leaves 0·5055 mgrm. of ammonia due to the reduction of nitrates in the urine, and corresponds to 1·887 mgrm. of nitric acid or 0·18 of 1 per cent. Professor Leeds concluded by reading letters bearing upon the subject from Professor Theodore Wormly, Dr. Ezra M. Hunt, and Professor Robert O. Rogers.

Remarks were made by Drs. Ellsberg and Hopper, who expressed their belief that nitric acid might reasonably be expected to be a normal constituent of urine.

On motion of Dr. Ellsberg, a vote of thanks to the Rev. J. J. Robertson was passed for his donation of 37 volumes to the library of the Academy. Adjourned. C. F. K.

PAPER AND WIRE TESTERS.

We illustrate three testers for special materials. Fig. 1 shows a paper tester, which works with unvarying accuracy and absence of liability to derangement. As the paper is tested by the direct action of a weight, all the variations which arise in the use of springs for this purpose are entirely avoided, and continued working has no tendency whatever to cause the machine to give inaccurate tests. The machines are all graduated by the application of actual weight, in such a manner as to insure every one being perfectly accurate, and as all parts of the mechanism are fully open to view, it can without difficulty be kept clean and always ready for use. The machine is in use by many of the largest paper users. It is very portable, occupies but little space, and can be worked with considerable speed even by an inexperienced operator.

The wire testers, Figs. 2 and 3, are the invention of Mr. Carrington, of London, who having, as engineer of the Wire Tramways Company, found the want of a machine by which the wires composing the ropes used could be expeditiously and accurately tested, without the great expenditure of time required by the use of the ordinary forms of testing machines, designed the apparatus shown. By it a wire may be attached and tested both for tenacity and ductility in the space of one minute. The machine requires no foundation, when not in use occupies very little space, and can be used by one work-

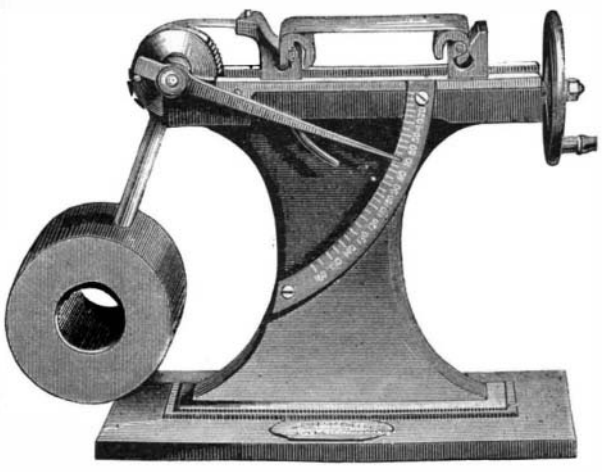


Fig. 1.—PAPER TESTER.

man of ordinary intelligence. As the strain is applied very gradually, and by the application of the same weight, all liability of erroneous tests from changing or moving of weights, as in ordinary machines, is avoided. The extension of the wire also is accurately measured, and a length of 50 inches can, if necessary, be tested, thus giving a much truer result than if a short piece were subjected to tensile strain. The smaller machine, Fig. 3, is used for testing the wire by twisting one end while the other is held firmly in the machine, the greater number of twists it will bear being the better evidence of its softness. These machines will test either up to 3,000 pounds or 5,000 pounds, as required.

We are indebted to the *British Trade Journal* for our engravings.

Soap-Bubble Lecture Experiment.

BY IRA REMSEN.

In setting fire to soap-bubbles filled with hydrogen or with oxyhydrogen gas, it is customary to make use of a taper at the end of a rod, which is managed by the assistant. Every one knows that the operation is apt to be a clumsy one, and, besides being annoying to the assistant, it is usually distracting to the audience and the lecturer. I have lately made use of a simple contrivance, which I am led to mention, as it is in every way more satisfactory than the usual arrangement, and works perfectly.

At a height of five or six feet or more above the center of the lecture table a glass funnel of the largest size is suspended by means of wires attached to the ceiling, or some other appropriate support, the broad part of the funnel being directed downward. A fish-tail gas burner is fixed horizontally at the center of the mouth of this funnel, so that, when the gas is lighted, the broad flame is spread out in a horizontal plane over as much of the space included in the mouth of the funnel as it will cover. The attachments may be made to suit the conditions of the room and table. It would be a simple matter to have a permanent gas jet arranged in an appropriate position for the experiment.