To return to the physical properties of the material. In its peculiarities of solution it acted more like copal; like that gum it is difficultly soluble, and further experiment may show still further likeness. One remarkable characteristic of copal is its power of becoming more soluble in alcohol after first melting it with as little heat as possible, when, upon resolidification, it is found much more easily soluble. We have not yet tried whether the kauri would act in a similar manner, but shall do so shortly. So far we have tried its solubility in alcohol, chloreform, benzole, and turpentine.

In alcohol it is quite insoluble after a week's digestion, a little coloring matter only being taken up. In chloreform it is soluble to a great extent—a small proportion, after repeated shakings during the course of a week's digestion, appearing to refuse to dissolve. In benzole it is partially soluble, though not nearly to the extent of the chloreform solution. In turpentine its solubility appears to lie between benzole and chloroform.

In all the three last cases a portion only of the gum dissolves, leading to the supposition that it may be composed of a series of different and distinct resins having preferential solubility in the various menstrua. Upon trying the varnishes thus produced upon negatives they all gave a beautiful glossy film, not easily scratched through so as to reach the glass, but very easily rubbed upon the surface, as though something of the nature of beeswax might be contained in the substance dissolved. The varnish with turpentine had a decided advantage over the others in tenacity.

Up to this point they are all, therefore, decidedly inferior to shellac as a photographic protective varnish; but further experiments are well worth trying, seeing this new substance can be bought at under one shilling a pound, while good shellac costs about three times the price. It is possible that treatment with an alkali may take from the kauri gum that principle which causes the surface gloss of the varnish to be so destructible. We may conclude our notice of this very interesting product by stating that all three of the varnishes give most excellent surfaces for retouching upon with black lead; indeed, we have met with no varnish superior to them for the purpose.—*British Journal of Photography.*

Communications.

Steam Economy Again.

To the Editor of the Scientific American:

Your correspondent, S. W. Robinson, in your issue of June 16, seems not to understand my language, in your issue of May 26, in regard to the loss due the clearance of an engine. In the process of calculation there referred to, and in all other processes in which the diagram is charged with the consumption indicated by its terminal pressure, and credited with the work performed as shown by its mean effective pressure, the loss occasioned by clearance through increased terminal pressure for a given load, or diminished mean effective pressure for a given consumption, is fully recognized, as the factors used in the calculation are the ones affected by clearance. It was the loss which is occasioned by "the expansion of the steam in the clearance space," when the exhaust or terminal pressure is greater than the return or counter pressure, which was referred to as restored when the compression pressure reached that of the exhaust.

I was not attempting to give the conditions necessary "for securing the highest percentage of useful effect from the steam used," but merely discussing a method of calculating the theoretical rate of water consumption indicated by any actual diagram, whether favorably or unfavorably conditioned. Hence there is no conflict between my statements and those of Rankine, either as given in his work or as ably illustrated by your correspondent; we are simply not talking about the same thing, as I am sure he will see if he gives my article a careful re-perusal.

Salem, Ohio. J. W. THOMPSON.

Casting of a Large Gun.

The heaviest gun ever cast in this country, with perhaps two exceptions, was successfully produced at the South Boston Iron Company's works, near the Broadway bridge, South Boston, May 30, in the presence of about 150 persons, several of whom were ladies. Colonel Crispin, Colonel Bayler, Captain Phipps, Captain Bryant, Lieutenant Smith, and Lieutenant Whipple, of the Ordnance Corps: Colonel Randall, Major Sanger, Captain White, Captain Andrews, Lieutenant Nichols, and Lieutenant Patterson of the First Artillery, were present. The material used was the ordinary charcoal iron. The gun, which will be a 12-inch rifled Rodman, carrying a 700 pound conical ball, when finished is expected to measure 263 inches, or about 22 feet in length. The diameter at the widest part will be 55 inches, and the casing will be 20 inches for a depth of 232 inches. At the muzzle the outside diameter will be about 29 inches. The weight when finished will be 89,530 lbs., and when cast was about 162,000 lbs. There was 90 tons of metal in the three furnaces. The gun is expected to be completed in November. It is estimated that the mass will cool in about 150 hours.

Three large furnaces were used for the melting. The flask, which was some 29 feet long, was sunk all but about six feet into the ground, muzzle up. From the furnaces were runners, a sort of iron trough or spout, lined with clay, about 8 inches wide at the top, 4 inches at the bottom, and 6 inches deep, and each about 18 or 20 feet long. These led to a sort of central tank or pool within 6 or 8 feet of the point where the flask or mould was placed. In this was an opening which led into two runners like those coming from the furnaces, and the runners carried the material from the pool to the mould. The pool was for the purpose of equalizing the consistency of the iron before it entered into the composition of the gun. At about 4:50 the visitors were requested to preserve quiet; the word was given, and the deep red stream of molten iron was seen seen rolling through the runners, with the accompaniment of great quantities of beautiful golden stars scintillating over the fiery mass. From the pool the liquid, after being thoroughly amalgamated, passed through the shorter runners and dropped to the bottom of the mould, the material rising gradually until the level of the troughs was reached. This occupied about 15 minutes, and then it became necessary to pour in from the top, which was several feet above the troughs. This was done by filling ladles (great tubs of iron lined with clay), each holding several tons of melted iron, and swinging them by three enormous derricks around to a runner raised higher than the others, and which led to the top of the mould. The portion filled up with ladles was in addition to the length of the gun, which must be cut off some six feet. This is necessary in order to have the end perfectly solid. The gun was cast upon the Rodman principle of having the core, which is hollow, filled with water during the process of casting by means of a pipe to convey cold water to the bottom of the core, and another to carry off the water from the top when it becomes heated. This causes the cooling inside and outside to be much more uniform, and adds greatly to the strength of the gun. The casting was finally finished about 5:30 o'clock, without accident of any kind. The gun when finished will be forwarded to Sandy Hook for experiments by the United States authorities.—*Boston Journal.*

Strength of Metals.

Some experiments have recently been made, in the mechanical technical laboratory of the Royal Polytechnical School at Munich, upon the strength of different alloys made by L. A. Riedinger at Augsburg. The results may be tabulated as follows:

Alloy	Strength in lbs. per square inch.	Contraction of section, per cent.	Stretching of 1½ inch, per cent.	Appearance of the fracture.
Phosphorus bronze..	27,122	2·4	2·25	Fracture blue-gray, darker than in bell-metal; contained an air-bubble of $\frac{1}{10}$ inch in diameter.
Ditto	28,400	3·7	2·50	Fracture as before, with many little bubbles.
Bell metal.....	24,424	1·4	1·50	Fracture uniform, bluish gray.
Ditto	23,288	0	1·00	Fracture rougher than before; color somewhat lighter.
Common brass.....	20,448	14·2	4·50	Fracture dirty, yellow, dense, and quite fine.
Ditto	11,158	13·5	5·25	Fracture as before.
Fine brass.....	22,720	35·2	23·75	Fracture golden yellow, uniform, somewhat rougher than the other.
Ditto	20,306	34·5	15·25	Fracture as before, with orange yellow spots.
Common zinc	1,931	0	0	Fracture alternately bright and dull, coarsely crystalline.
Ditto	2,144	0	0	Fracture lighter, bright, and more uniform than before.
Belgian zinc.....	4,288	0	0	Fracture brilliant white, with fewer large crystals than before.
Ditto	3,209	0	0	Fracture as before; crystals rather larger.

Unfortunately the composition of the alloys tested is not accurately given in percentage. Nevertheless, the table is of interest as showing the superior strength of phosphorus bronze. It is quite surprising that, with the number of excellent testing machines in use in this city and country, so few results have been published here, our figures being mostly limited to iron and steel.

Turkey in America.

The largest single contract ever taken in this country from a foreign nation is the $17,000,000 one given to the Providence Tool Company by the Turkish Government. The Tool Company were three years in preparing to begin the work upon the contract, and now employ 2,500 men, who turn out 200,000 guns per year, or 600 finished guns in a day. These guns are the Martini-Henry rifles. One of the side businesses of magnitude which has grown principally out of this contract is that of the Excelsior Box Company of Providence, of which James A. L. Amoreux of this city and South Hadley Falls is treasurer. The Excelsior Box Company are now busy making 20,000 boxes per year for the Tool Company in which to ship their guns to Turkey. Each box is made to hold twenty of the guns, and with such accuracy are the groove pieces for the interior of the boxes made that they do not allow a play of even one two-hundredth part of an inch of the arms, when packed with the muzzle tip and shoulder piece resting in the grooves. No other precaution is needed or used in packing the guns for shipment to Turkey. The machinery for the manufacture of these boxes was perfected in invention for the purpose. The company have still two years in which to complete the number of these boxes that they contracted to make; by which time, also, the Tool Company will have completed their immense contract with the Turkish Government.—*Springfield Union.*

A Remarkable Map.

About the first of January, 1876, Professor Hitchcock, of the Geological Survey, and his assistants began the construction of a raised map of New Hampshire, the design of which was to combine all the present knowledge of the geography of the State which had been obtained in the geological survey made by Professor Hitchcock, Professor Huntington, and others. This map has just been completed, and placed in the State House.

The map is fourteen feet ten inches long, representing one hundred and seventy-eight miles in length (being constructed on a scale of one mile to the inch) and ninety-three miles in width, from the mouth of the Piscataqua river to the northwest corner of Hinsdale, showing the entire surface of the State, nine thousand three hundred and thirty-six square miles. It also shows all the rivers and brooks, ponds and lakes, hills and mountains, and the town and county lines, railroads, etc. The names of all cities and towns, rivers, and principal brooks, lakes and ponds, mountains and high elevations, are given conspicuously, so that any one can find at a glance what they desire to look up. The height of the hills and mountains is given on a scale of one inch to one thousand feet, and actual measurements are given when known.

The map is constructed of pine and bass wood, and the process of the work was this: A map was first drawn on paper of the same size as the raised map, with all the outlines of towns, streams, ponds, etc., and contour lines for each five hundred feet were drawn. Tracings of the contour lines were made on inch layers of pine and bass boards, maintaining as accurately as possible the relative size and shape. These are fastened upon each other, and the valleys are beveled out with chisels.—*Concord (N. H.) Monitor.*

Torpedo Balloons.

A correspondent suggests that torpedo balloons might prove a formidable means of offence, and proposes a plan of sending up a balloon, with a torpedo attached, to windward of an enemy, and then dropping the torpedo by bursting the balloon. It seems to us that this is a good idea, and one which might find useful application in the bombardment of cities, camps, and fortified places. It is of course not practicable against an enemy capable of moving about quickly. It is not a difficult matter to construct a balloon capable of lifting sufficient nitroglycerin for the purpose. This might be inclosed in a shell and suspended as a car under the air ship. A simple mechanical device could easily be provided for dropping the load; and this device might be controlled by a light wire through which an electric current could be sent. The besiegers have only to wait for a fair wind, and then start their balloon from a point far beyond the range of the most powerful guns. It would be easy by the aid of instruments to tell just when the balloon had arrived over the desired point, and the pressure of the key would transmit the current and drop the mass of explosive. The effect of a quantity of nitroglycerin blowing up in a city or fort would be terrific. The balloon could be permitted to rise to a height beyond the reach of artillery, so that the besieged would be totally destitute of any means of directly preventing the dropping of the unwelcome visitor in their midst.

Some well meaning philanthropists in England are just now protesting against the use of the torpedo in modern warfare, as being too cruel a resort, and one which should be classed with poisoned wells and explosive bullets, which are proscribed among civilized belligerents. Probably the torpedo balloon will to them seem exceptionally barbarous. The fact is, however, that such philanthropy is a mistaken sentiment. War itself is a frightful calamity; and it is for the benefit of all that it should be as quickly ended as possible. This result can only be reached by making weapons so effective either that people will not face them, and thus fighting may be stopped in that way, or else that they will produce such wholesale destruction as to secure victory for one side or the other in the quickest possible period. The most destructive weapons are therefore the most merciful; and in this light the torpedo should be regarded.

Russian Gold and Silver Production.

The following statistics of the yield of the Russian gold fields for the year 1876 show that this source of wealth is considerable in that cold northern clime. The amount of gold mined in 1876 was 1,617 pouds, equal to 71,503 lbs. troy, having a value of 22,086,662 roubles = $17,669,329.60. The silver amounted to only 156 pouds, or 5,616 lbs. avoirdupois, worth 142,360 roubles = $113,888.

NICHOL'S RAILROAD JOINT AND NUT LOCK.—In our recent illustrated article on this subject, the statement that the joint would be safe without any bolts "on the same section of rail" should read "on some sections of rail." Also for "requires no spikes in the flange of the rail," read "slots or notches" for "spikes."