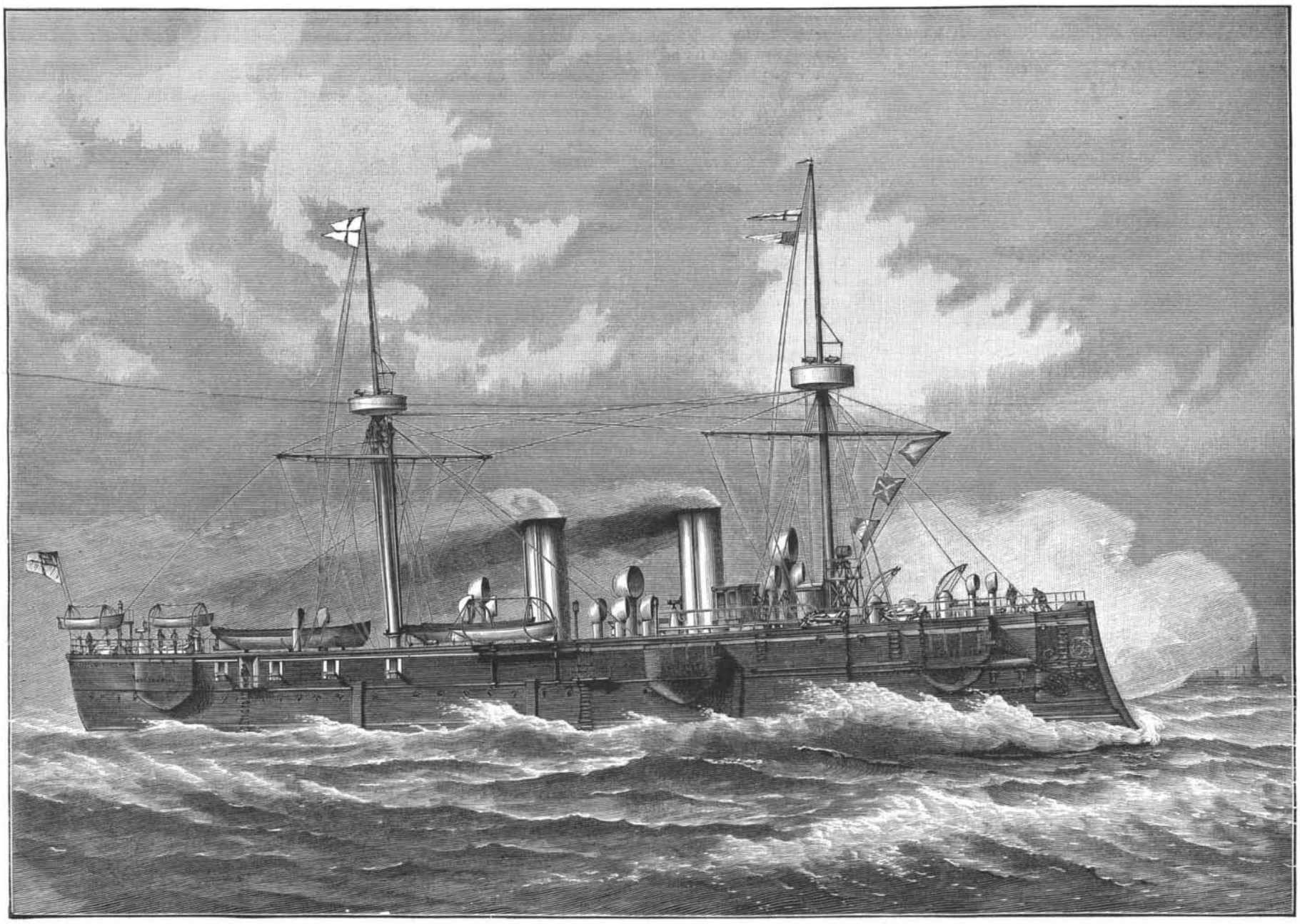
THE GERMAN CORVETTE CRUISER IRENE.

The corvette Irene belongs to a new type of vessel not heretofore used in the German navy, being provided with a strong, arched armor deck lying far below the water line. The lines of the Irene are beautiful, and its dimensions are as follows: The greatest length about 340 feet, greatest breadth about 46 feet, and the depth 25 feet. Its displacement is about 4,300 tons.

The vessel is driven by two screws, each having a diameter of 16 feet, and so placed as to be protected by the hull of the vessel. The engines for operating these screws can develop over 8,000 indicated horse power, giving the vessel a speed of 18½ knots an hour. Each engine is placed in a separate watertight compartment. The coal bunkers have a capacity of 900 tons.

The armament consists of fourteen guns, six of which are of the newest construction, being mounted on center pivots in projecting turrets. Four of these guns are so arranged that they can be fired in a line parallel to the line of the keel, or so that the line of fire will cross the extended middle line of the vessel.



THE GERMAN CORVETTE CRUISER IRENE.

The remaining eight guns are placed on the deck and fired through broadside ports, by which their range is, of course, limited. Torpedo tubes are provided in the proper places. A very large amount of ammunition can be carried by the Irene, so that she will not have to depend on ammunition transports during engagements.

No sails are provided to assist in the propulsion of the vessel, and, therefore, there is no rigging except what is required for the support of the masts and the signals. The mast tops are arranged for the reception of a limited number of revolving guns and search lights.

The construction of the vessel, including the equipment, but exclusive of the armament, will cost about $1,080,000, and the guns, torpedo arrangements, etc., will cost about $168,000.

The sister ship of the Irene, the Germania, was built at Gaarden, near Kiel, from the same plans, as was also the Prinzess Wilhelm, which was launched a short time ago.

We are indebted to the *Illustrirte Zeitung* for the accompanying illustration.

A GUN of 150 tons weight is now being constructed at Essen by Krupp. It is similar to the 120 ton gun, but is longer, and will have a much greater range.

Nitro-gelatine Experiments.

We learn from the *Royal Engineers' Journal* for April that "some very interesting experiments have recently been made in firing high explosive shells out of ordinary field guns at the Dardanelles, by Mr. Frederick H. Snyder. The experiments were conducted by the Turkish artillery, under the personal superintendence of General Asif Pasha, inspector-general of fortifications, and under the supervision of Mr. Snyder. The gun used was an American breech loading howitzer of 15 centimeters diameter. The explosive for the shells was prepared nitro-gelatine. The target was made of 12 iron plates welded together, of a total thickness of 12 inches, with very strong backing made of oak beams, of a thickness of 12 inches by 14 inches. The target weighed 20 tons, and was placed at a distance of 200 yards from the gun platform. The first two shots missed the target, but the third struck it, and so completely wrecked both the iron target and the wooden backing and supports that it could not be fired at again. Photographs have been forwarded showing the effect of the shot which struck the target. Mr. Snyder has proved effectually that shells charged with his prepared nitro-gelatine can be fired out of ordinary guns with perfect safety, which in itself is a very important discovery. If a 6 inch shell can produce such results on an iron plate target, it is not difficult to imagine the effect of the explosion of much larger shells on the plated sides of armorclad men of war. Mr. Snyder calculates that a 6 inch shell would strike the armor of a man of war without piercing it, but would produce an explosion capable of destroying the ship. A siege gun of 6 inches would easily carry a shell containing 40 pounds of nitro gelatine, and this gun would suffice to destroy any ship. Mr. Snyder did not expect his shell to pierce iron or steel armor plates, but he calculated that if he could fire a shell with safety out of a gun, on percussion on the side of an ironclad the tremendous explosive force of nitro-gelatine would assert itself, and either shatter the plates or drive them into the ship; the plates being bolted together, if the shell struck on a join or corner, more than one plate might give way. Nitro-gelatine is said not to explode unless subjected to a powerful shock, and it does not explode by contact with fire. Its force, compared with gunpowder, is beyond all ordinary comparison. If powder develops 10,000 feet of gas, dynamite containing 50 parts of nitro-gelatine could develop 100,000 feet. It is also impossible to measure its destructive force as the expanding force of gunpowder is measured. The mode of loading the gun is Mr. Snyder's secret, and prevents the shock caused by the gunpowder, which would shatter the gun to pieces."—*Broad Arrow.*

The Chinese Almanac.

The great value which the Chinese attach to their almanac is shown in many ways. Recently the Chinese residents at Lhassa, in Tibet, implored the Emperor to cause arrangements to be made which would enable them to receive their copies of the almanac at the earliest possible date in each year. A writer in a recent issue of the *Chinese Recorder* says that the most important book to the Chinese is the almanac. Its space is far too important to be occupied with the matter which fills western almanacs. It contains astronomical information which is useful, but its great mission is to give full and accurate information for selecting lucky places for performing all the acts, great and small, of every-day life. "And as every act of life, however trivial, depends for its success on the time in which and the direction (*i. e.*, the point of the compass) toward which it is done, it is of the utmost importance that every one should have correct information available at all times to enable him to so order his life as to avoid bad luck and calamity and secure good luck and prosperity. Consequently, the almanac is perhaps the most universally circulated book in China." The writer speaks of it as a terrible yoke of bondage. It is issued by the government, and the sale of all almanacs but the authorized one is prohibited. Quite recently the new Chinese minister to Germany refused to sail for his post on a day which the almanac declared to be unlucky, and the departure of the German mail steamer was consequently deferred at the request of the German minister to Pekin.

TO secure the flap of an envelope so that it may not be readily opened without betraying the fact that it had been tampered with, has been the ambition of a good many inventors. An envelope constructed as follows is the subject of a recent English patent: The flap is so cut and shaped as to bring the point of it to the top right hand corner of the front side of the envelope, where the gummed surface of the flap secures it to the front of the envelope. The postage stamp is then fixed over the flap so that the envelope cannot possibly be unfastened without destroying the stamp.

Importance of Small Quantities of Impurities in Metals.*

BY W. CHANDLER ROBERTS-AUSTEN, F.R.S.

The author points to the great industrial importance of the influence exerted by small quantities of metallic and other impurities on masses of metals in which they are hidden. He states that this is most marked in the case of iron, and that when Bergman discovered, in 1781, that the difference between wrought iron, steel, and cast iron depends on the presence or absence of a small amount of graphite, he was astonished at the smallness of the amount of matter which is capable of producing such singular changes in the properties of iron. The evidence as to the importance of small quantities of impurity is quite as strong in other directions at the present day, as is shown by the statement of Sir Hussey Vivian, that one thousandth part of antimony converts "best select" copper into the worst conceivable, and by the assertion of Mr. Preece, that "a submarine cable made of the copper of to-day," now that the necessity for employing pure copper is recognized, "will carry double the number of messages that a similar cable of copper would in 1858," when the influence of impurities in increasing the electrical resistance of copper was not understood.

Allusion is made to the effect of a small quantity of tellurium on bismuth. Commercially pure bismuth has a fracture showing brilliant mirror-like planes, but if the one thousandth part of tellurium be present, the fracture is minutely crystalline. Specimens of bismuth are submitted to the society. The author states that in his own experiments he has employed gold prepared by himself with great care, the purity of which has been recognized by no less an authority than M. Stas. A portion of this gold was recently used by Professor Thorpe in a determination of the atomic weight of gold. Gold was selected for the experiments for the following reasons: It can be prepared of a very high degree of purity, it possesses considerable tenacity and ductility, the accuracy of the results of the experiments is not likely to be disturbed by the oxidation of the metal or by the presence of occluded gases, and the amount of impurity added to the gold can be determined with rigorous accuracy. The influence of small quantities of metallic impurity in rendering gold brittle has long been known, and is frequently referred to by the older metallurgists, especially by Geber, Biringuccio, and Gellert, and by Robert Boyle. The first systematic experiments on the subject were made by Hatchett at the request of the Privy Council, and were communicated to the Royal Society in 1803. Hatchett concluded that certain metals, even when present in so small an amount as the one one-thousand-nine-hundredth part of the mass, will render gold brittle, and he stated that: "The different metallic substances which have been employed in these experiments appear to affect gold in the following decreasing order: 1. Bismuth. 2. Lead. 3. Antimony. 4. Arsenic. 5. Zinc. 6. Cobalt. 7. Manganese. 8. Nickel. 9. Tin. 10. Iron. 11. Platinum. 12. Copper. 13. Silver." Mr. Hatchett did not, however, employ pure gold, and in his time the importance of submitting metals to mechanical tests was not understood.

The author then proceeds to describe the results of his own experiments, and he states that in selecting tenacity as the test to which the metal should be submitted with a view to ascertain the effect of the added matter, the following considerations presented themselves. W. Spring has built up alloys by compressing the powders of the constituent metals, and by pointing to the evidence of molecular mobility in solid alloys he has done much to show the close connection which exists between cohesion and chemical affinity. Raoul Pictet considers that there is intimate relation between the points of metals and the lengths of their molecular oscillations, the length of the oscillation diminishing as the melting point increases, and, as Carnelley has pointed out, "We should expect that those metals which have the highest melting points would also be the most tenacious." It is known that the melting points of metals are altered by the presence of small quantities of foreign matter, and their cohesion is also thereby altered. The degree of cohesion may thus be investigated either by the aid of heat or by mechanical stress. It might have been well to ascertain the amount of change in the melting point of gold produced by the presence of the different elements in small quantity, but, unfortunately, slight variations in high melting points are very difficult to determine with even approximate accuracy, and it appeared to be better to ascertain the effect of metallic and other impurities on the cohesion of the gold, as indicated by the amount of force externally applied in an ordinary testing machine, and in that way to ascertain whether the effect of added metals is amenable to any known law.

The purest gold attainable has a tenacity of 7·0 tons per square inch, and an elongation of 30·8 per cent on 3 inches. Professor Kennedy found that a less pure sample, which contained 999·87 parts of gold in 1,000, broke with a load of 6·29 tons per square inch, it had an elastic limit of 2·12 tons per square inch, and elongated 18·5 per cent before breaking. In the following experiments only the purest gold that could be prepared was employed. The effect on the tenacity of gold produced by adding to it about 0·2 per cent of various metals and metalloids is shown in the following table, in which the results are arranged according to the tensile strengths:

Name of element added.	Tensile strength of test piece. Tons per sq. in.	Elongation. Per cent (on 3 inches).	Impurity. Per cent.	Atomic volume of impurity.
Potassium	Less than 0·5	Not perceptible.	Less than 0·2	45·1
Bismuth	0·5 (about)	"	0·210	20·9
Tellurium	3·88	"	0·186	20·5
Lead	4·17	4·9	0·240	18·0
Thallium	6·21	8·6	0·193	17·2
Tin	6·21	12·3	0·196	16·2
Antimony*	6·0 (about)	?	0·203	17·9
Cadmium	6·88	44·0	0·202	12·9
Silver	7·10	33·3	0·200	10·1
Palladium	7·10	32·6	0·205	9·4
Zinc	7·54	28·4	0·205	9·1
Rhodium	7·76	25·0	0·21 (about)	8·4
Manganese	7·99	29·7	0·207	6·8
Indium*	7·99	26·5	0·290	12·1
Copper	8·22	43·5	0·193	7·0
Lithium*	8·87	21·0	0·201	11·8
Aluminum*	8·87	25·5	0·186	10·1

Reasons are given for adding the comparatively large amounts of impurity (two-tenths per cent), notwithstanding that even "traces" of certain metals would have produced very marked effects upon gold, and evidence is adduced to show that exact concordance in the respective amounts of matter added to the gold is not of much importance.

The testing machine is of the form devised by Professor Gollner, and used by him at Prague. It is a double lever vertical machine working up to a stress of 20 tons.

The author points out that these results lead to the conclusion that the tenacity of gold is affected by the elements in the order of their atomic volumes, and he discusses the evidence in favor of this view at some length, pointing especially to the fact that while those elements the atomic volumes of which are higher than that of gold greatly diminish its tenacity, silver, which has nearly the same atomic volume as gold, hardly affects either its tenacity or its extensibility. He shows that so far as the experiments have been conducted, not a single metal or metalloid which occupies a position at the base of either of the loops of Lothar Meyer's curve (which is a graphical representation of the periodic law) diminishes the tenacity of gold, while, on the other hand, metals which render gold fragile all occupy higher positions on Meyer's curve than gold does, and he urges that the relations between these small quantities of the elements and the masses of metal in which they are hidden are under the control of Mendelejeff's law of periodicity, which, as originally expressed, states that "the properties of the elements are a periodic function of their atomic weights." Carnelley has given strong evidence in favor of supplementing the law as follows: "The properties of compounds of the elements are a periodic function of the atomic weights of their constituent elements," and the question arises, "May the law be so extended as to govern the relations between the constituent metals of alloys, in which, as is well known, the atomic properties are often far from simple?"

The effect on gold of small but varying quantities of metals, singly and in presence of other metals, demands examination, and their influence on the specific gravity of gold must be ascertained. Until this has been done no explanation as to the mode of action of elements with large atomic volumes will be attempted.

* Abstract of a paper read before the Royal Society, March 15, 1888.—*Chem. News.*

A Patent Symposium.

"I tell you, sir, the Patent Office ought to be reformed, every man of them turned out, from the least unto the greatest, and the law altered so that a patent would be good for something!" The speaker was one of those overgrown noisy men with bulbous form and bawling voice, loudly giving his opinions in one of the hotels on Union Square, where electricians do congregate. He said that he came from the State of Kansas, and some accident of hospitality had evidently brought him very nearly into another state—the penalty for which in Kansas is, we believe, death for the first offense and dissection for the second. The results were limited to making him slightly loquacious without further disabling his faculties.

A cool young man inquired if he was interested in any patents.

"Why, yes; that is my business. I am a professional patentee, Col. Grumpus Bloward, of Yates County, sir. I was the first inventor of the telephone. It was in the spring of '37. I didn't make one, but I said at the time that the telegraph was very good, but they ought to talk by telegraph. I conceived the idea and therefore made the mental effort, yet they would never have given me a patent. I was told two years ago that it was no use to apply for a patent—and see what this grasping monopoly of a telephone company now holds!" [The last in the best tones of his voice.]

"Did you fully recognize the value of such an invention accomplishing the electrical transmission of speech?" asked the young man.

"Certainly I did, and never lost sight of it, either. I knew that it was worth millions and millions."

"Ever buy any telephone stock?" was the next interrogatory.

"Now, young man, that has nothing to do with the question, and I don't wish you to try and dodge the subject in that manner! As I was going to say, I invented a perpetual motion, and put in my application for a patent; and what do you suppose they did? What do you suppose they did?" [Second time, voice *fortissimo crescendo.*] "They sent back papers and money with a letter written by an understrapper, and signed by some chief cook, saying that the office did not recognize that the subject was within natural laws, and that it was therefore beyond the scope of the office, and the application could not be entertained by them. It was an infringement of my rights as a citizen. They ought to give every one a patent and one that would be good for something, so that there would be no suing and infringing."

"Suppose that some one would apply for a patent on some invention for which you had received a patent?" asked the young man.

"Why, the office would have to throw it out," was the reply.

"Well," pursued the inquisitor, "what would you do if some one should 'make, vend, or use' your invention?"

"Shut him up at once!"

[Very savage this time, suggestive of retrogressive revolution. No scalping done, however.]

"Possibly without due process of law or bringing the action and proving the infringement?" asked the young man.

"I said once that the government ought to make a patent always good, without obliging people to go to law. Not half of the patents are good for anything in the courts."

"That matter has been looked up," said the young man, consulting a memorandum book, "and the records of the decisions of the United States courts on patent issues from 1776 to 1886, as given in Meyer's Federal Decisions, show that 73 per cent of the patents were sustained and 27 per cent of the patents were annulled. Of those which were sustained, 67 per cent were valid in their entirety and 33 per cent were sustained in part. In later years the percentage of valid patents is largely in excess of the average result, owing to the decisions which have established every phase of patent law, and also the higher class of men which have been engaged in the solicitation of patents.

"The majority of patents possess a stability of value which will compare favorably with that of personal property in stocks, but any lack of value in patents cannot be ascribed to defects in the legal status of the patents, but to the lack of skill in the patentees, whose inventions are either inoperative or not suited to any practical purpose to a degree superior to present methods.

"The art of inventing consists in finding out what is wanted, and then making something to fill that want. By reason of inventions protected by patents, I have been prosperous, receiving at thirty-five a larger annual income than the aggregate amount obtained by my father during a pastorate as long as my life.

"No one has been defrauded, no one has been made poorer, while labor has been made lighter and production increased, giving additional resources to those who would have lacked.

"If there had been no patents, I should not have thought. If I had not thought, I should not have invented, but would have been a laborer—a hewer of wood and drawer of water.

"The moderate pay and the defects of the civil service in regard to appointment and promotion render it a wonder that the vast deal of work imposed by law upon the Patent Office can be so well and so faithfully performed. It is but in the nature of things that there is opportunity, even need, of reform, but it must be the kind of reform which improves, and not the kind of reform which destroys.

"Concede everything alleged against the United States patent system, and then name the nation whose patent system you would take in exchange."

This gentleman, who had joined the group unannounced, departed unattended, while a young stenographer who had reported the discussion without being observed, wrote it out and submitted the foregoing credentials accompanying an application for employment in the office of the *Electrical Review.*

A Stopper for Rats.

A correspondent says: Soak one or more newspapers, knead them into a pulp, dip the pulp into a suitable solution of oxalic acid. While wet, force the pulp into any crevice or hole made by mice or rats. Result—a disgusted retreat, with sore snouts and feet, on the part of the would-be intruders. *Probatum est.*