IRONCLAD VESSELS.

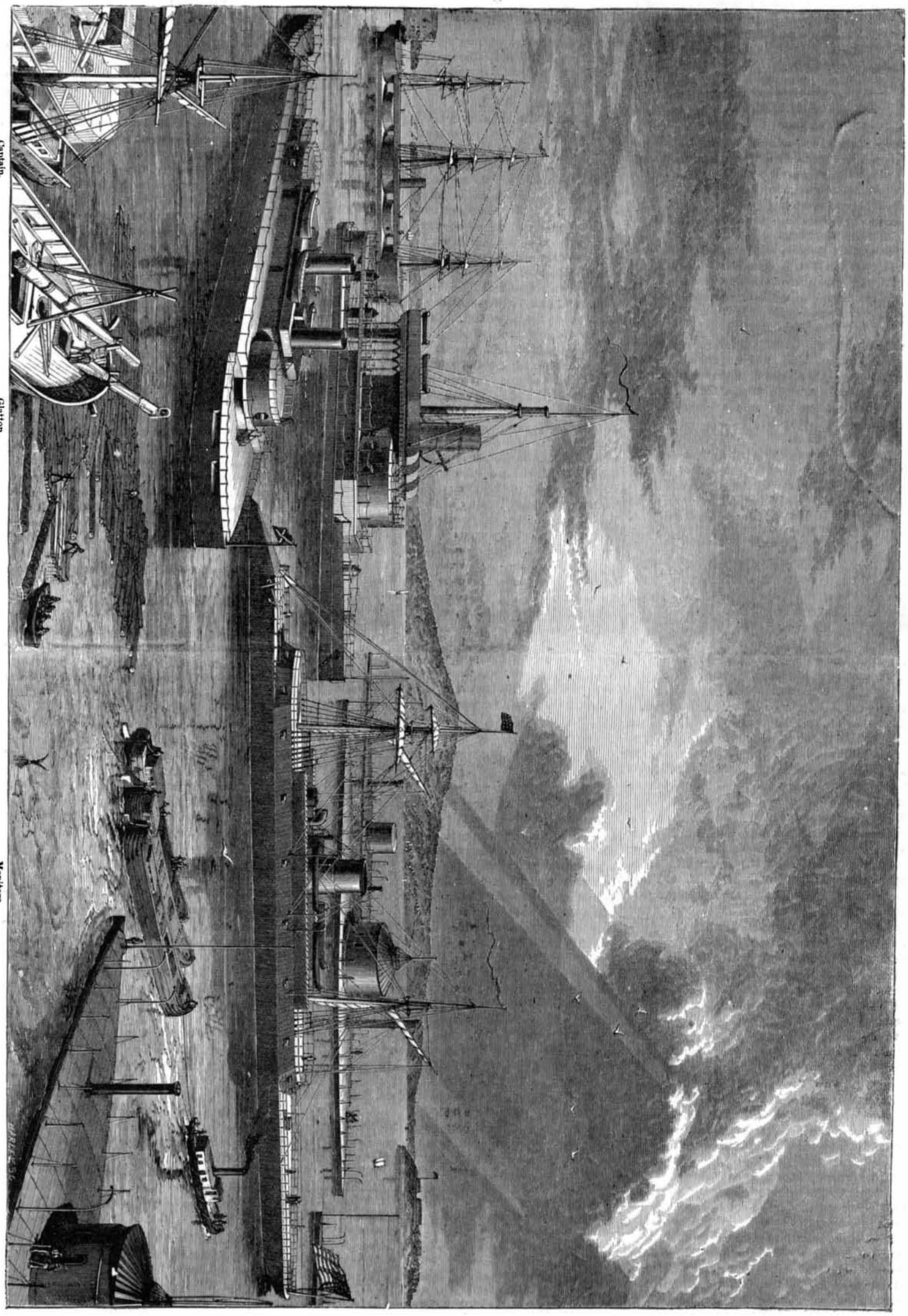
The contest between naval engineers and artillerists has been of long duration, and there seems to be no flagging in the zeal of either party. In the year 1860, France built the first ironclad, *La Gloire*, and her 4½ inch plates were at that time a marvel. Guns capable of piercing this armor at long range were, however, immediately constructed, and since then the rivalry has been unabated. Twenty-four inches thick of rolled iron of the finest quality is now used for protecting the turrets of the most recent naval monsters; and a gun of 81 tuns weight, capable of sending a shot weighing nearly three quarters of a tun through 24 inches of iron and several feet of timber backing, has been constructed as a specimen, and a gun of 120 tuns weight is already talked about. It would seem to be impossible to build a perfectly indestructible vessel; and so far as theory goes, the victory belongs to the artillerists. It must also be remembered that the heavier a ship's plating is, the more certain she is to be a total loss if she once springs a leak. And, on the other hand, the ships can always be armed with guns as powerful as any that can be brought to attack them: but their sea-going capabilities are reduced, and ironclads of the very heaviest armor and armament will probably be used only for coast and harbor defence. In conjunction with a well arranged system of torpedoes, a few turret ships carrying modern artillery could make the approach of an invading army by sea a risk that no enemy would care to encounter.

Our engraving represents three English and two American types of iron-plated vessels, each of which shows a different form of turret. The vessel in the distance on the left is the ill-fated Captain (English) which foundered off Cape Finisterre, France, in July, 1870. She had two large turrets placed amidships, in each of which were two 25-tun rifled guns, capable of throwing 600 lbs. elongated projectiles. In the forecastle and poop were guns of smaller caliber. She was full rigged, and had engines of extraordinary power, and two independent propellers. She carried a crew of 500 men.

The Thunderer is another British vessel, without rigging or masts, and may be better called an engine of war than a ship. Her offensive power is very great, consisting of 32 heavy guns and five of the largest pieces of artillery known at the date of her construction. The ship is handled entirely by steam, and her crew consists of engineers and fighting men. The Glatton is a very formidable vessel, carrying four of the largest guns, mounted in a revolving turret. She also depends on steam for her power of locomotion, and has engine room, magazine, and men's quarters below the water line.

The monitors of the United States Navy are familiar to most of our readers. Probably no ships could possibly be built that would offer less mark for an enemy's artillery, while they can carry guns of immense weight and destruc-

ENGLISH AND AMERICAN IRONCLADS.



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tive power. For river and harbor defence, they seem to be unsurpassable, combining great destructive force with a minimum of liability to danger.

The Dunderberg was a powerful vessel which was protected from the effects of shot by armor placed at an angle pointing seawards from the ship's sides. She was pierced for 20 guns, and mounted 16; and she had a submerged ram which, propelled by her large engines, would be found terribly destructive in action. This vessel occasioned some discussion among naval authorities at the time of her construction, full particulars of which were given in our volume XVII, pages 85 and 115. A description of her trial trip will be found on page 412 of volume XVI. She was designed and contracted for by Mr. W. H. Webb, and built by John Roach & Son; and she was subsequently sold by Mr. Webb to the French overnment.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The timesof risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for December, 1875.

Mercury.

On the 1st of December Mercury rises about 6 A. M., and sets before 4 P. M. On the 31st it rises before 8 A. M., and sets before 5 P. M. It is very small in apparent diameter, and is so nearly in range with the sun after the middle of the month that it cannot be seen.

Venus.

Venus is coming rapidly into better position for observers. On the 1st it rises at 8h. 39m. A. M., and sets about half past 5 P. M. in the southwest. On the 31st, Venus rises a little after 9 in the morning, and sets at 6h. 29m. P. M. It should be looked for as soon as sunset, keeping nearly the path of the sun. It will be small but bright.

Mars.

On the 1st of December, Mars will rise about noon and set at 10h. 27m. P. M. It will be seen on the east of Saturn, having, by its more rapid motion among the stars, passed Saturn, which seems scarcely to change its position from night to night. On the 31st of December, Mars rises about 11 A. M., and sets at 10h. 21m. P. M.

Jupiter.

Jupiter rises at 5h. 23m. A. M., and comes to the meridian at 10h. 20m. in the forenoon, on December 1st, setting at 8h. 22m. P. M. On the 31st, it is little better situated, as it rises at 3h. 55m. A. M., and sets at 1h. 42m. P. M.

Saturn.

Saturn is still easily seen in the early evening on the 1st of December, west of the red planet Mars. It sets on the 1st at 9h. 54m. P. M., and on the 31st at 8h. 9m. P. M.

Uranus.

Uranus is among the small stars of Leo. It rises before Regulus on December 1st at 9h. 50m. P. M., comes to the south at 4h. 47m. in the morning, and sets at 11h. 44m. A. M. It reaches an altitude of 63° 48′ in this latitude, and can be easily found with fixed instruments. On the 31st, it rises at 7h. 49m. P. M., comes to the south at 2h. 47m. in the morning, and sets before 10 A. M.

Neptune.

By an observer who has a meridian instrument, Neptune can be seen as a small star, when it passes the meridian, on the 1st of December at 9h. 15m. P. M., on the 31st at 7h. 15m. P. M. It is among the small stars of *Aries*, and may perhaps be recognized by its motion, although the change of place among the stars is very small,

Occultations.

On the 10th of December, the moon's path will lie among the small stars of the *Pleiades*, and it will pass over or occult some of them by coming between us and their light. As the moon will not be full, and the stars will disappear behind the dark limb of our satellite, the phenomenon is easily seen, can be watched with an opera glass, and affords to the young student an excellent opportunity for learning the moon's rate of motion in orbit. The first occultation occurs about midnight

Sun Spots.

The report is from October 21 to November 16 inclusive. On October 16 the two elongated spots, mentioned in the last report, appeared to have united, and before the next photograph, October 25, had passed off by the motion of the sun on its axis.

On October 25 two large spots, surrounded by penumbra and followed by faculæ, were seen coming on. No change was observed till October 28, when one of the spots seemed to have separated into two; but on October 31, seen through the telescope, these two appeared to have united again.

The photograph of November 3 showed that the two large spots, first observed on October 25, had changed into one huge one; and near the center of the disk, a small spot was seen, which had not been observed before. On November 4 the large spot was seen near the edge, and faculæ were again visible. As this spot probably passed out of sight on November 5, if it returns, it should reappear about November 18, and should be seen to traverse the disk. The small spot, near the center, had changed into two when seen on November 4, and after that date could not be found. From November 5 to November 16 no spots have been seen.

ON the last page of this paper will be found an advertisement of a new recipe book, just published, which will be found useful companion for reference by every one.

Testing the Fatty Oils.

The value of a fatty oil, especially olive oil, as a lubricant depends greatly on the amount of acid in it. The quantity of acid in the oil determines this value not merely on account of its destructive action on the journals and boxes, but because other qualities, such as fluidity, durability, purity in general, and lubricating power, vary with the degree of acidity. Burstyn, chemist in the naval arsenal at Pola, has published a method for determining acidity volumetrically, which has been proved by long experience to be trustworthy In judging of table oils, the process gives a numerical expression for the degree of rancidity, whereby the quality can be measured. The method is as follows: A tall cylindrical vessel, provided with a ground glass stopper and having two marks on it to indicate respectively 100 cubic centimeters (6·1 cubic inches) and 200 cubic centimeters, is filled to the first mark with the oil to be tested and to the second mark with 88 to 90 per cent alcohol. The cylinder is then closed and well shaken. Equal quantities, other than 100 cubic centimeters, can be employed without any other change in the process. After standing 2 or 3 hours, the oil settles, and the clear alcohol, which contains in solution the free acids and a little of the oil, rises to the top perfectly clear; 25 cubic centi meters of the clear alcohol is taken from the top by means of a pipette. A few drops of an alcoholic extract of turmeric is added, and the acid determined by means of a standard solution of potash, as in acetometry. The change from yellow to brownish red takes place with great sharpness when neutralization is reached. The number of cubic centimeters of potash employed multiplied by four gives the quantity of the normal solution requisite to neutralize the free acid in 100 cubic centimeters of oil. As it is not an individual acid but a variable mixture of acids, it is not possible to calculate the percentage of acid present. These numbers, however, may be taken as degrees of acidity. For instance, an oil of three degrees of acidity is one which contains enough free acid to neutralize 3 cubic centimeters of normal alkali.

If we assume that oleic acid predominates, which in most cases is the fact, one degree of acidity corresponds to 0 28 per cent by weight of oleic acid. The olive oil of commerce has an acidity ranging from 0·4° to 12°. The first passes as very fine, and is called free from acid or salad oil, while the latter is known by smell and taste as strongly rancid. Oil that has 4 to 6 degrees of acidity has been found by experiment to answer very well as a lubricator.

What relation there exists between the degree of acidity and an injurious effect upon metals is shown by the following experiments: Four shallow vessels of sheet brass, having a surface of 40 square centimeters (about 6 square inches) each at the bottom, were filled to the depth of 2 millimeters (0·78 inch) with oils of different acidity, and exposed to the air at the ordinary temperature. The vessels were soon more or less covered with green fatty salts, and the oil too acquired a green color. Oil and vessel No. 1 were the only ones in which no change could be perceived. At the end of twelve days, the vessels were cleaned with ether and weighed. The following table shows the amount of action:

Vessel No.	1,	filled with oil of	0·8	degrees,	lost	0·03	grain.
"	"	2	"	"	" 4·6	"	" 0 22 grain.
"	"	3	"	"	" 7·8	"	" 0·36 grain.
"	"	4	"	"	" 8·8	"	" 0·4 grain.

The quantity of metal destroyed in equal times and under equal conditions increases with the acidity of the oil.

This volumetric method of determining the amount of aci extracted from the oil is so simple that a person who is not chemist can with a little practice perform the operation if h can obtain from a chemist the normal potash solution. Ther is, however, a still more simple method, invented by the same person, which depends on the fact that the more acid has been taken up by the alcohol the heavier the latter becomes. It is only necessary to be provided with two cylinders, a sufficient quantity of alcohol, and a delicate hydrometer or alcoholometer. In one cylinder is placed the pure alcohol employed, and its specific gravity is taken; in the second cylinder the oil and alcohol are shaken up together, and when they have separated the hydrometer is transferred to the supernatant alcohol and its specific gravity taken. The greater the difference in the specific gravity found, the larger is the percentage of acid in the oil tested. There must, of course, be alcohol enough above the oil to float the hydrometer without its touching the oil. The hydrometer must be very delicate, so as to read to the fourth decimal place, and the scale need only extend from 0 825 to 0·850.

Burstyn is engaged in preparing a table to show the acidity corresponding to different readings of the hydrometer for alcohol of 88 to 90 per cent when the acidity ranges from 0·5° to 12°. The following table shows a few of his results:

Oil No.	Acidity volumetrically.	Specific gravity of wash alcohol	Specific gravity of clean alcohol employed.
I.	0·8	0.8324	0.8300
II.	2 2	0·8328	"
III.	2·8	0·8330	"
IV.	4·6	0·8336	"
V.	7·8	0·8345	"
VI.	8·8	0·8346	"

If some of our numerous and ingenious Yankee hydrometer makers will put a suitable instrument in the market, with large bulb and short scale, we may soon expect to see this quick and simple method of testing oils introduced into practice. It will not only prove very serviceable to the owner of machinery by easily and quickly informing him whether the oil in question can be used for lubricating, but it will also be useful to dealers and producers, because it enables them to judge, without special difficulty, of the value of their wares, and to know whether the process of refining has gone far enough.

It will scarcely be possible to mix adulterants with the oil so as to conceal the acid and render this test invalid, because the substance added for that purpose must be lighter than alcohol, must be soluble in alcohol as well as in oil, and free from odor, three difficult conditions to fulfil.

Irresolution.

An editorial under the above title, which appeared in a recent issue of the Philadelphia *Ledger*, has attracted our attention as possessing sound reasoning on a very common failing among business people. We make the following extracts:

"There are few conditions of mind more painful to endure, and more fatal to efficiency or success, than irresolution. Most of us can recal occasions when we have been thus afflicted, hesitating anxiously between two opposite courses, preferring first one and then the other, as their several advantages present themselves, becoming each moment more confused and uncertain, and, though vexed and ashamed of the delay, yet utterly unable to end it by a decision. We may be happy, if such a condition is rare and exceptional with us: if our usual habit is to think deliberately, decide resolutely, and act firmly.

"The irresolute man is continually wasting energy. The power that should be economized for action he consumes in anxious alternations of opinion. Does he propose a journey, a business enterprise, or some change in his mode of life, he is torn with conflicting thoughts as to its desirability. The inducements to carry it out appear in glowing colors, and he thinks his purpose is settled; then possibilities of failures and fears of disappointment bear on him so strongly that he almost renounces it. Again convictions of its benefit press with renewed force, and he oscillates most painfully between the two courses, not having sufficient firmness either to undertake or relinquish the enterprise. Meanwhile the delay itself frequently settles the matter: the time in which he might have chosen for himself passes away, and he is forced to accept what fate has left him without any reference to his judgment or preference. Directly the power of choice is removed, all the advantages of the opposite plan rush upon him with tenfold force; he is sure that that would have been his selection had the opportunity been prolonged; and consequently, acting upon compulsion, without heart or faith, and, indeed, against what he now thinks his better judgment, his failure and his discontent are both insured. In the smaller details of life, this irresolution, if less disastrous, is even more vexatious and annoying. To waver about trifles, to hesitate, and doubt, and balance probabilities upon every little matter that presents itself for immediate decision, is a lamentable waste of power, distressing to one's self, and irritating to every looker-on. It is better to make some mistakes, we should all declare, than to thus constantly lose time and force in debating the *pro* and *con* of each petty action.

"A habit of self dependence is one most important ingredient in a resolute character. He who, either from inclination or the force of circumstances, has always leaned upon others, can hardly be expected to show much energy in decisions, or much inflexibility of purpose. It is just here that freedom becomes so palpable a blessing, giving to every man and woman the opportunity for acquiring a self-reliance that nothing else can supply.

"It is perhaps hardly possible for one who has attained maturity with a vacillating, irresolute nature ever to become a decided and resolute character. Still there are various degrees of this valuable quality, and it is within the power of each individual so to discipline himself as to strengthen and increase it. A thoughtful survey of every important subject on which we are called to decide is necessary to this end. There is a time for deliberation as well as for action, and when the former is crowded into the latter a wise decision is impossible. All aids to this end should be warmly welcomed, not as props to support our weakness but as means to correct our judgment. The inflexibility that refuses to receive such aid and only seeks to enforce its own will is obstinacy, not decision. When, however, we have brought all foreign helps into connection with our own judgment, and have thus formed the best conclusion we can in the time allowed, we must, as far as possible, dismiss further consideration and proceed to immediate action. In the less important details of daily life, we shall not greatly err in forcing ourselves to an immediate choice, though we may still question its wisdom. This self-compulsion will be most salutary, especially if we cultivate the habit of revising our actions with a view to avoiding in the future the mistakes into which we may have fallen."

HERR KRUPP, the famous cannon founder of Germany, has just astonished the British Government by a positive refusal to sell one of his great guns to England, remarking that he was willing to contract for the arming of as many forts and ships as England wanted, but he must decline to part with specimens for experimental purposes. "Considering tha Herr Krupphas, in a great measure, learnt the art of big gun making from England," we do not see, says the *Ironmonger*, "why he should be so *krup* when asked, out of compliment, to send one of his big imitations to us."

FOR truing an ordinary oilstone for sharpening planes, take a sheet of glass paper No. 2, and place it on the bench. Rub the stone over it. In this way the stone can be trued in one quarter the time required by the ordinary process.

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