issue so great a number of plates within the period required for permanent photographs." From a lithographic plate only about 500 good impressions can be taken, but here they can be made by thousands. It will also be of great advantage in copying plates from monographs, or valuable pictures of any kind which are out of print or otherwise inaccessible.

IMPROVEMENTS AT THE MOUTH OF THE MISSISSIPPI.

The long discussion relative to the most practicable method of improving the mouth of the Mississippi, so as to render the same passable to vessels of deep draft and thus to open the river ports to direct ocean traffic, was virtually terminated by the granting of an appropriation by the last Congress, for the construction of a system of jetties at one of the passes through which the stream enters the Gulf. The plans involving canals, which have been strenuously advocated by many eminent engineers, are therefore for the time at least set aside, and to Captain J. L. Eads, an engineer now widely celebrated for his successful construction of the St. Louis bridge, has been entrusted the task of causing the mighty current of the Father of Waters literally to undo its own work and to break down the barrier which itself has created.

The Delta of the Mississippi is formed of narrow strips of land, mostly low lying banks, through which the river winds until it makes its exit to the Gulf by a number of narrow passes. In some of these channels, previous attempts have been made to deepen them by dredging, with but partial success, however, as a single flood has been known to carry down sufficient sediment to fill them to their original depth; and the current besides, emptying into the open water at the mouths, speedily left at that point bars of blue clay, surmountable only by light draft ships. The gist of Captain Eads' plan will now be readily apprehended when it is regarded as shifting the point of deposit of these barriers from the shoal water at the entrance of one pass, out into the deep water where filling up by natural causes is impossible. By this means the river current is to be made to cut out and scour its own channel across the present bar. To do this, it is obvious that the banks of the pass must be extended, so as to lead the stream far enough out; another section of conduit, as it were must, be added, and this is now to be formed of the submarine dykes or jetties.

The materials of which these structures are to be composed are willow twigs bound in bundles, termed by engineers "fascines," eight or ten feet in length and about as many inches in diameter. A large number of fascines at a time will be lashed together to form rafts, the first of which will be from seventy-five to two thousand feet in width, the largest rafts being sunk in the deepest water. The rafts will next be towed to the proper point, there loaded with stones, and submerged, and thus the work will continue, one raft being sunk above another until the surface is reached. Each line of rafts will be narrower than the one below it until the upper course will not be more than ten feet wide. The two walls which will thus be constructed will be prolongations of the banks, and between them will form a channel with sloping sides. In the course of time, the interstices of twigs and stones will fill with sand and mud, so that eventually two solid submarine levees will be produced. Very little pile work, it is said, will be required except perhaps at the head of South Pass, which is the outlet at which the jetties are to be built, in order to provide for the proper regulation of the volume of water in the new channel at various stages of the river.

Captain Eads has already begun his surveys, in which work, together with the making of the necessary contracts for materials, labor, etc., the summer will be consumed. The first raft, it is expected, will be sunk by the beginning of October next.

MOTION ON A MOVING BODY.

For the last few months we have been receiving queries from all sections of the country, something like the following: "If a train is moving at the rate of sixty miles an hour, and a cannon on the train is fired, giving the shot a velocity of sixty miles an hour, will it leave the train, or just drop down at the mouth of the gun?" We have once or twice attempted to explain the matter in our correspondence columns, but our remarks seem either to have been overlooked or misunderstood, and we must try once more to stop this stream of inquiries by satisfying the inquirers. Our remarks may also be useful in giving some of our readers more correct ideas about rest and motion than they possess at present.

The dwellers on the surface of the earth are carried through space so smoothly that many of them doubtless forget that the earth is revolving on its axis with a velocity, at the surface, of more than 1,000 miles an hour, and moving in its orbit at the enormous speed of about 68,000 miles an hour. They know, however, that they can set up a target on the surface of the earth, and pierce it with a shot that has much less than the velocity of the earth, whether the shot be fired in the direction in which the earth is moving or the contrary. It is easy to see, then, that if a ship or train is put in uniform motion, and the same experiment is tried, it will give a similar result. The reason, too, must be obvious after a moment's reflection. Everything on the ship or train being carried along with it, an additional velocity will evidently move it away from the position that it formerly occupied, to some other position on the moving body.

This disposes of the first part of the question, and now we will consider what is necessary, in order to make a body leave the ship or train. Probably some of our readers have seen Mr. Hale's entertaining story of the "Brick Moon," which was projected into space with such velocity that it never returned to the earth. Many more of our readers, no doubt, have experienced some of the difficulties of leaving a moving body, as, for instance, a car: because, as we explained some time ago, the car had put them in motion, and so there was a liability of their being dashed back again violently if they attemped to jump directly from the rear of a train moving at high speed. Now of course the train is not going to be more considerate of the shot in a cannon than it is of a human passenger, so that, unless the powder drives it back faster than the train is moving forward, it will not leave the gun. It is scarcely necessary for us to say that the case supposed by our correspondents is a purely imaginary one, since a train or a ship does not move with perfectly uniform velocity, and neither does a shot from a cannon. Considered in this light, the subject is of no practical importance, and our only reason for referring to it in this prominent manner is to call attention to the principles involved, which are both interesting and useful. We do not propose to discuss this question of the cannon and the train any further, and beg that our readers will send us no more communications on the subject, as we have not room even for all the valuable and instructive letters that we are constantly receiving.

WHAT IS THE CAUSE OF TIDES?

There are occasional fallacies which, in some mysterious way, gain credence in the minds of men till they finally become accepted as unquestioned facts. Among these may be mentioned the oft-repeated proverb: "It is always darkest just before day," and the commonly accepted explanation of the rising of light bodies in a denser medium. It is not true that smoke, heated air, balloons, etc., rise because of their lightness, and then the air rushes in to take their place; but the air, being heavier, seeks by gravity the lowest place, and in so doing crowds up the lighter bodies. Water is said to contract down to a few degrees of the freezing point, and then to expand in changing to ice; but it is probable that the molecules are drawing closer to one another all the time, and that the apparent expansion is because the crystals of ice do not fit together exactly, and hence leave between them interstices filled with air, and thus occupy more space.

And it is quite possible, if not probable, that the common explanation of tides furnishes still another illustration. With sufficient credulity, the explained cause of the tide on the moon's side of the earth may be accepted as somewhat satisfactory: but there is room for reasonable doubt as regards that of the tide opposite the moon. This luminary is said, in the first case, to draw the water away from the earth, and in the second, to draw the earth away from the water. This is considered possible because the nearer object will be influenced more by the moon's attraction than the more distant object, and this difference of attractive force, as exerted on the stable earth and the unstable water, is said to produce the tides as we observe them. Attraction varies inversely as the square of the distance. If we represent the force with which the moon draws the earth by ten, the force with which it attracts the water on the opposite side of the earth will be about nine and two thirds. This latter force is not diminished by the intervening earth, and tends to draw the water toward the moon. The earth, by its attraction, holds the water to its surface, and its influence is not lessened when the moon acts upon it. As both these forces tend to draw the water opposite the moon toward that luminary, we would reasonably expect a low, rather than a high, tide at that point. It is said that the water remains behind by its inertia. But as the moon acts constantly upon the earth, and gradually upon anyone point of its surface, the inertia of the water would be overcome at least as soon as that of the solid earth, and probably sooner, as the water is more free to yield to the influence of attraction.

Again, the theory rests on the supposition that the attraction of the moon gives the earth a daily motion toward itself; but this cannot be strictly true, for, if so, the earth and moon would be continually approaching each other, and we would live in constant fear of a collision, whereas they maintain a uniform mean distance between them. In opposition to this, it is argued that the deviations from the tangential motion of the earth in its orbit are precisely those which the earth would move through if falling toward the attracting body unaffected by any other impulse. Whether this is satisfactory, each must decide for himself.

The sun also exerts upon the earth an influence tending to produce tides, which is about two fifths as great as that exerted by the moon. The sun's real attraction, of course, is much greater than the moon's, but, on account of its greater distance, the difference between its influence on the earth and on its aqueous envelope is less. From the sun's influence, we would expect a tide to follow the sun, as one is said to follow the moon, and differ from it only in being smaller; and when the sun and moon are in quadrature, we should expect, according to theory, that there would be four tides in a day: two caused by the moon and two by the sun, whose major axes would be at right angles to each other. When the sun and moon are in conjunction, we have the highest tides, because both act together and in the same direction. When they are in opposition, we should expect the lowest tides because they act in opposite directions and each tends to counteract the effect of the other. But in fact this combination also appears to produce spring tides.

If the tidal wave is caused by the moon, and follows her as she apparently makes a complete circuit of the earth in about 25 hours, it must travel at the rate of one thousand miles per hour, and this is hardly reconcilable with its mildness and harmlessness in dashing upon the shore, nor with Mr. Airy's law for the velocity of tidal waves, which makes it the "same as that which a free body would acquire by falling from rest, under the action of gravity, through a space equal to one half the depth of the water." The Pacific Ocean is estimated to average 440 fathoms in depth, and according to this rule the velocity would be less than 200 miles per hour; or, by a slight change in its application, the rule would make the average depth of water over the whole surface of the earth more than twelve miles. The tidal theory supposes the anomalous condition of an interrupted ocean enveloping the whole globe. Again, if the moon or sun causes the tide, we would expect an observable uniformity in the direction and velocity of the tidal wave from the eastern borders of the Atlantic and Pacific Oceans to their western borders; but on the contrary, it is acknowledged by orthodox believers in the lunar and solar cause of tides that we have little or no clue to the course or rate of travel of the ocean tide. Even for the North Atlantic, which is constantly alive with commerce, no connection has yet been discovered between tides of the opposite coasts.

The tide on either side of the earth does not rise on the vertical between the earth and the attracting body, but, under favorable circumstances, about three hours behind it; and when these are not favorable, the retardation may be almost indefinitely prolonged. The reason of this is said to be that the inertia and friction of the water, and other causes, prevent its rapid change of form; and although the elevating force is greatest under the vertical, it still continues to act in the same direction, and with but little diminution of force, for some hours after the passage of the moon. But, strange to say, when the influences of the sun and moon are combined to overcome this friction and inertia, the interval between the meridian passages of these luminaries and the spring tide is longest of all. The retardation so varies with the depth of the sea, form of the basin, interruption of the land, etc., that confessedly no regular progressive movement of the tide wave can take place except in the unfrequented Southern Ocean. This, together with the acknowledged want of observed connection between the tides on the opposite coasts of the North Atlantic—though here subject to constant inspection—leads to the conclusion that the belief, respecting the movement of the tidal wave around the earth from east to west, is based on conjecture rather than positive demonstration. On the other hand, there are some reasons for the supposition that this wave moves in the opposite direction Mr. John Wise, who suggests some of the objections mentioned above, claims that it moves from west to east, and is due to the action of the earth's centrifugal force, just as water is thrown forward on the surface of a rapidly revolving grindstone. In substantiation of this, he says: "The first authenticated records we have of this centrifugal wave rolling round the earth, from west to east, are given in the log of the clipper ship Sovereign of the Seas, in her remarkably short passage of eighty-three days from the Sandwich Islands to New York, in 1853, in accordance with Maury's chart furnished by our government. This ship made 16½ knots an hour in her easting for four consecutive days while riding this great centrifugal wave in her doubling of Cape Horn. And in the same year, by the same directions, the sailing ship Flying Scud made equally good castings, and made as much as 449 miles in one day, taking advantage of this fact of the great tidal wave." These statements would seem to necessitate the progressive movement of the water as well as the wave, for their explanation. But it is generally held that the water itself has little or no real forward motion.

Mr. Wise also claims that there are not two distinct daily tides in the Southern Ocean, nor at all intertropical points; and that where two appear, they are due to gurgitation and regurgitation of the water, occasioned by its forcible contact with the shores between which it oscillates, and may be influenced by the fact that the equator of the earth is an ellipse and not a perfect circle. He assigns, as the cause of their regularity, what Herbert Spencer calls the rhythm of motion, and says: "They have their elucidation in, and are manifestly referable to, that harmonious pulsation of Nature which exhibits itself in the throbbing of the heart, in the motion of the blood, the vibration of sound, the 'nodding' of the poles of the earth, in all mechanical movements, and in the measured cadence of the waterfall as it rises and falls in its musical rhythms."

That most of the objections cited herein have their stereotyped answers is not denied. But it will doubtless be conceded that there is some reasonable doubt as to their correctness, and that strict science, which rests on facts and not on theories, would not be injured by a careful revision of this whole question. With this end in view, we close our remarks as we began, with the honest query: What is the cause of tides?

Cambridge, Mass. S. H. TROWBRIDGE.

Coughing.

The best method of easing a cough is to resist it with all the force of will possible, until the accumulation of phlegm becomes greater; then there is something to cough against, and it comes up very much easier and with half the coughing. A great deal of hacking, and hemming, and coughing in invalids is purely nervous, or the result of mere habit, as is shown by the frequency with which it occurs while the patient is thinking about it, and its comparative rarity when he is so much engaged that there is no time to think, or when the attention is impelled in another direction.

A GELATINOUS substance frequently forms in sponges after prolonged use in water. A weak solution of permanganate of potassa will remove it. The brown stain caused by the chemical can be got rid of by soaking in very dilute muriatic acid.

The New York Tribune Building.

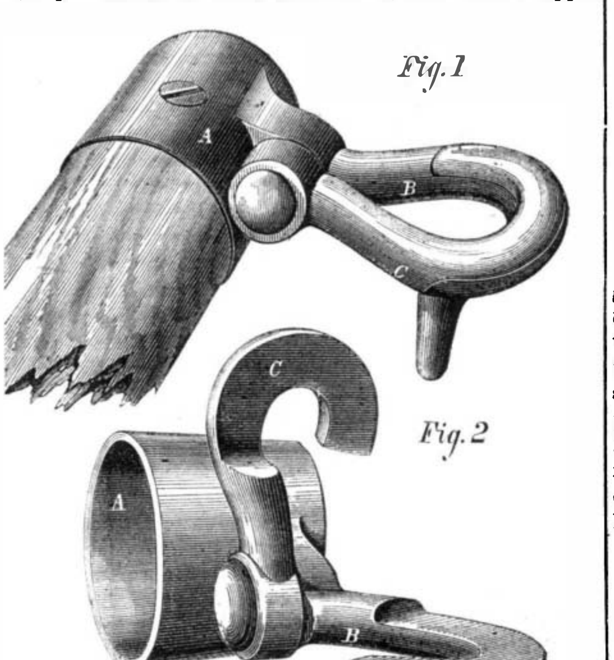
On April 10, the 34th anniversary of its commencement, the New York *Tribune* opened the doors of its new offices to the public. The structure is of great hight and immense solidity, and is built of brick laid in cement, with dressings of stone and granite. The finial on the clock tower is 260 feet above the sidewalk, surmounting a building containing sub-cellar, basement, nine stories, and attic. The walls of the lower portion, sustaining the great weight of the masonry, are 5 feet 2 inches to 6 feet thick. The building is claimed to be absolutely fireproof. No wood is used in its construction, except for floorings, doors, and window frames; and the wooden floors are mere plankings laid over solid cement. No iron pillars are used, masonry being employed on each floor to carry the superstructure. The floors are ingeniously constructed, being flat arches of hollow concrete blocks, resting at the ends on flanged iron beams; they are made of plaster of Paris, coke dust, and the hydraulic lime of Teil. When the whole building is complete, it will certainly be an exceedingly handsome and commodious structure.

A Hoe web press is already at work in the new press room, and has a capacity of 16.000 complete copies per hour. The composing room is fitted up for one hundred compositors, and the editorial and other offices are intended to be models of comfort and convenience. Speaking tubes are used for intercommunication, and pneumatic tubes convey papers and documents between the editors' room, the counting room, and the composing room; and the elevators and heating and ventilating apparatus are all of the most modern design. The pneumatic tubes are operated by a blower placed in the basement of the building, similarly to those in the Western Union offices, an illustration of which we recently published.

SMITH'S IMPROVED WHIFFLETREE HOOK.

This is a simple device for attaching the trace to the whiffletree, and consists of a pair of sister hooks, which are arranged to open to receive the trace, and which, when closed, prevent the trace from becoming accidentally detached under any circumstances.

Fig. 1, in the engraving, shows the hooks closed, and Fig. 2 the same open. A is the ferrule, which is secured to the whiffletree in the usual manner. The lower half, B, of the hook is in one piece with the ferrule, and has a downward projecting lug on the end, as shown. The upper half, C, is pivoted sidewise to the lower half, but is bent in opposite direction to the latter.



Both parts are recessed at their overlapping front portions, to form, when together, as in Fig. 1, an eye for the ring of the trace. In attaching the latter, the eye is first placed over the part, B, and carried back to the rear; the upper part is then brought down, and the trace pushed forward over both.

This device, the inventor informs us, has given general satisfaction wherever used. It offers no open hook in which the reins are apt to get caught, and yet allows of the attaching or detaching of the traces in the shortest possible time. It certainly is a very simple and ingenious appliance for the purpose intended.

Patented through the Scientific American Patent Agency, February 16, 1875. For further particulars relative to sale of entire right, or with regard to manufacturing on royalty, address the inventor, Mr. O. J. Smith, Wauwatosa, Milwaukee county, Wis.

Consumption of Wood in France.

The *Independence Belge* gives some curious statistics relative to the consumption of wood in France. A large quantity of soft wood is used for making toys, and to give an idea of the magnitude of this trade it will be sufficient to take one article alone, children's drums, of which in Paris alone 200,000 are sold every month. The total number made annually in France is estimated at 30,000,000, while a considerable quantity of woodmust be consumed to supply 60,000,000 drumsticks

A CURIOUS OCULAR ILLUSION.

It is generally believed that the minute striæ which appear upon diatoms, under the microscope, are in reality an assemblage of hexagons, as the striæ resolve themselves into an assemblage of such figures when subjected to higher magnifying powers. M. Nachet, the celebrated French microscopist, describes, in a recent number of *La Nature*, an odd optical illusion which, he states, accounts for the figures on the diatoms appearing as hexagons, when, in reality, they are spherical in shape.

The reader can see for himself, from the diagrams given herewith, that M. Nachet's conclusion is without doubt correct. The large circular dots in Fig. 1 are drawn as nearly as possible in positions similar to those of the supposed hexagons on a very beautiful diatom, called *pleurosigma angulata*. If the figure be looked at for a moment, especially through the eyelashes, that is, with the eyes nearly closed, the circles will instantly appear as hexagons. This effect is all the more striking in Fig. 2, which is the same reduced by photo-engraving. Fig. 3 is a negative reproduction of Fig. 2, by the same process. The curious effect of irradiation is noticeable by comparing the last two diagrams, the white circles, though of exactly the same size, appearing much the larger.

Fig. 1

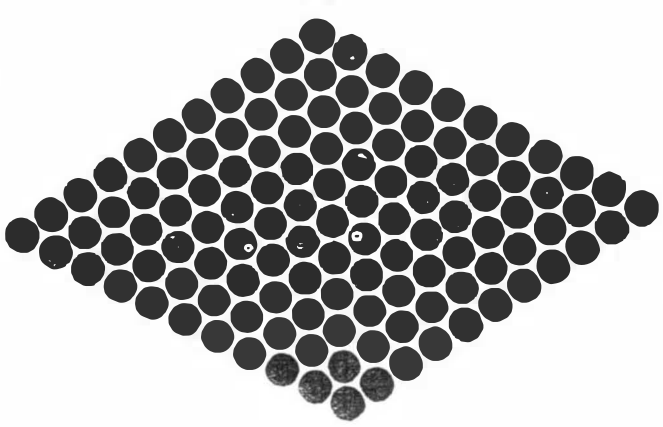


Fig. 2

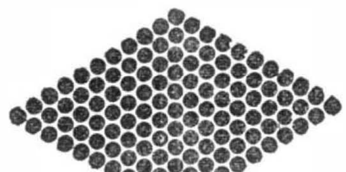
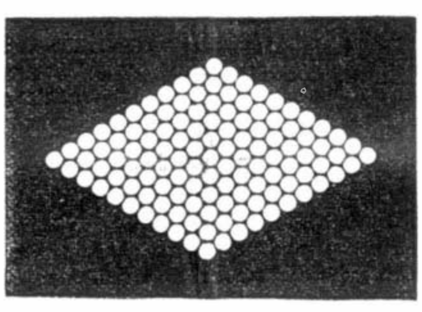


Fig. 3.



Pure Sulphate of Nickel.

The salts of nickel employed in the electro-deposition of that metal are prepared from commercial nickel, which is an alloy of nickel, copper, and iron, with traces of arsenic, containing from 40 to 90 per cent of actual nickel. The author's process consists of four operations: Solution of the crude metal in acids; precipitation of the copper by iron; peroxidation of the iron, and conversion of the metals into sulphates; precipitation of the iron by carbonate of baryta, and crystallization of the sulphate of nickel. The nickel is first dissolved in seven to eight times its weight of aqua regia; the solution is evaporated almost to dryness; the residue is re-dissolved in water, using about five times the weight of the nickel employed. A little arseniate of iron remains insoluble, and is removed by filtration. Metallic iron, preferably small nails, is introduced into the hot liquid, to about the weight of the nickel employed. It is stirred from time to time to detach the copper from the iron. As soon as a piece of bright iron, introduced into the liquid, is no longer coated with copper, this process is complete. The whole is thrown on a filter, and washed repeatedly. The copper is then collected by sifting it under water, in a sieve coarse enough to let pass the coppery metallic powder, but retain the iron. The copper is dried, and is then marketable. The filtrate now contains merely nickel and iron. The latter is peroxidized, either by a current of chlorine, or by treatment with nitric acid. Sulphuric acid at 66° Baumé is then added, in the proportion of 2 parts to 1 of nickel employed, and the whole is evaporated to dryness to expel nitric and hydrochloric acids. The dry residue is re-dissolved in water, a part sometimes remaining insoluble, consisting of sub-sulphate of iron. From the solution the iron is thrown down by means of carbonate of baryta (artificial precipitated). This carbonate separates the iron as sesquioxide, and forms at the same time insoluble sulphate of baryta, without acting upon the sulphate of nickel. The last traces of arsenic are thrown down along with the sesquioxide of iron The precipitation is effected by gradually adding a slight excess of carbonate of baryta to the liquid, slightly heated, but not so as to exceed 50° to 60° Fah. It is complete when a further addition of carbonate occasions no effervescence, and does not become covered with peroxide of iron. Pure sulphate of nickel then remains in solution. It is separated from the precipitate by filtration, and the filtrate is evaporated till a pellicle appears on the surface, when it is set aside to crystallize.—*M. A. Terreil.*

A Varnish from Vulcanized Rubber.

The following description of a method of making a varnish from vulcanized rubber is taken from the *Moniteur Industriel Belge*. In answering questions relating to the dissolution of vulcanized caoutchouc, we have repeatedly doubted the possibility of so doing. The present process, however, seemingly includes burning out the sulphur, etc., and then dissolving the residue. If any of our readers practically test the recipe, we should be glad to learn the result.

The fragments of vulcanized rubber are deposited in a deep earthenware pot, which is closed by a tightly fitting cover and deposited on burning coals for about five minutes. During this period care must be taken not to open the vessel, as the vapor is highly inflammable. On removal, the mass is examined by pushing a wire into it to see that it is uniformly melted; and if this be the case, it is at once poured out into a large, well greased, shallow tin pan, and left to cool. When hard, it is broken into small pieces, placed in a bottle with benzole or rectified essence of turpentine, and there thoroughly shaken and stirred.

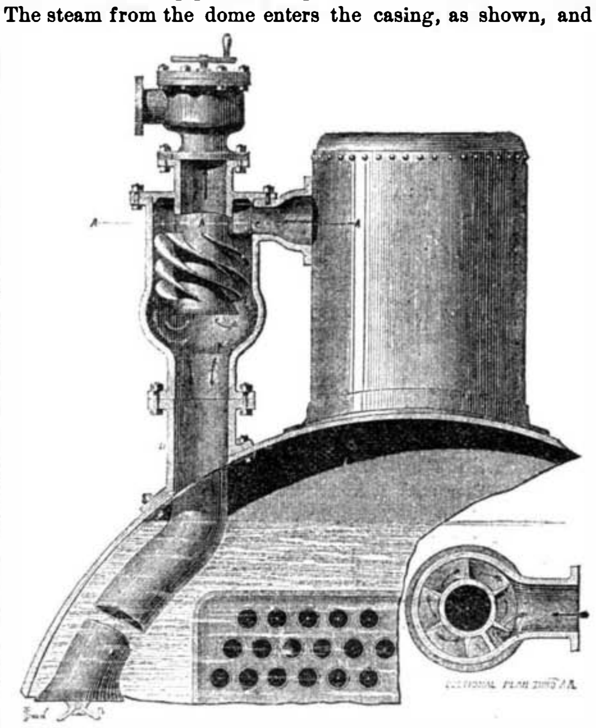
The dissolution then takes place, and after a brief rest the clear liquor which forms the varnish is decanted from the impurities which settle at the bottom.

STOCKLEY'S IMPROVED ANTI-PRIMER.

Hundreds of our readers have to complain of inefficient working done by steam engines, and of damage to cylinders (in the bore and to the heads) and pistons, all being caused by water working over into the engines in the steam. Dry steam is an absolute necessity to the engineer who desires to work economically, both in consumption of fuel and wear of his machinery.

Mr. J. Stockley, an engineer employed in the Wallsend coal district, England, has invented an appliance for securing dryness of steam, and it has, we are informed, been already applied to several marine engines with marked success

A fixed case or pipe, C D, is put on the boiler, as shown. The steam from the dome enters the casing, as shown, and



the theory is that the helix within C causes the steam to assume a whirling motion, by which the water is expelled by centrifugal force, and falls down D into the boiler, while the now dry steam, pursuing the course shown by the arrows, rises and escapes through the stop valve above. The action will, we think, be readily understood. Flap valves, to prevent the water rising, are inserted in the pipe, C D. This invention appears to have given excellent results in practice, and it is no doubt designed on sound principles.

An Excursion to the Mediterranean.

The memorable cruise of the Quaker City, so comically described in Mark Twain's "Innocents Abroad," is to be repeated; and those who have wished to "do" Europe, after the manner recounted by that genial humorist, will this summer be offered an excellent opportunity for so doing. Mr. George F. Duncan, himself one of the original Quaker City travelers, proposes to charter a steamer and secure about 100 passengers, whom he will conduct to nearly every point of interest in the Mediterranean. The ship will sail on about the 1st of June, and the cruise, which includes visits to the Holy Land, Egypt, etc., besides affording abundant time for rambles inland on the Continent, will terminate with the arrival of the travelers back in New York on about the 10th of November. The cost of the trip will be $1,500 currency for each passenger.

This is an excellent chance to see a large amount of the world for little money. The reader will find further particulars in the advertisement on another page