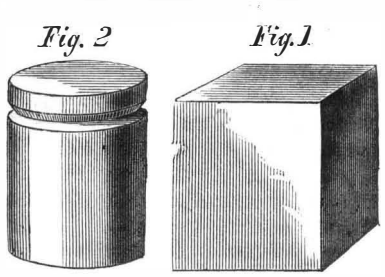
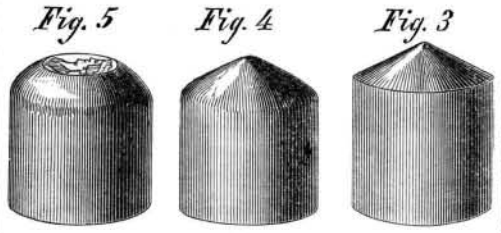
vertically through its center attached to the upper part of the screw, and above the press are two heavily weighted fly-arms which constantly tend to force down the screw. To the lower end of the screw, and with its face downwards, the matrix is firmly fixed by a workman, who stands in the recess sunk in the floor to the depth convenient for bringing his eyes and his hands to a level with the bed of the press. The puncheon block is deposited next it with its face turned upwards on the solid cast-iron bed of the press, and immediately and fairly below the matrix. All being ready, several strong-armed workmen seize the fly-arms and walking round with them raise the screw and matrix until the latter is several inches above the puncheon block. On a sudden they release their hold, and the weighted arms revolving with a speed and force which would be fatal to any person standing in their way, drive down the matrix until it impinges with a dull, heavy thud upon the puncheon block. Again the workmen stand to their fly-arms and raise the screw of the press. The effect of the blow is then seen in the depressed apex of the cone-topped die which received its impact, and in the transference to itself thereby of a partial copy in relief of the intaglio-engraved matrix. The compression of the particles of steel composing the puncheon by the stress of the blow, mechanically hardens the puncheon, and before its impression can be completed by a repetition of the act, it must be again annealed. This is effected in the same way as before, the puncheon is returned to the press, and the matrix, now detached from the screw, is placed loosely on the top of it, though, for an obvious reason, in such a way as that the engraving on the matrix and the partly finished impression on the puncheon shall exactly match or fit each other. A blank block of steel is then affixed firmly by aid of set screws to the place before tenanted by the matrix, and may be said to represent a hammer, for it will presently descend with great force upon the matrix. The fly-arms are turned backward by the workmen, the press screw is raised, the arms released, and, gathering momentum as they revolve, the hammer block is made to fall heavily on the matrix. The effect of the second blow will, perhaps, be to make the transfer of the engravings as complete on the puncheon as is that of a seal pressed by the hand upon molten sealing-wax, or it may be, if the steel is very obstinate, that another annealing and another blow may be required to effect that object eventually, at least the puncheon will be found upon examination to have imbibed an exact and faithful copy in relief of the engraver's work on the matrix to the finest line and most minute point of detail. The duty of this latter is now done, at all events for the present, and it is placed in the engraver's closet. Far otherwise is it with the puncheon, for its mission is about to commence. It is therefore hardened and tempered, polished it cannot be, on account of its raised surface, and then returned to the press. Such are the processes pursued in the making of matrices and puncheons in reference both to coining and medal-striking for obverse and reverse, although, from the bold impressions usual on medals, many more annealings and strikings of the puncheons are necessary than of those used for coin. Confining our attention for the sake of brevity to the florin, let it now be presumed that puncheons for its obverse and re-



verse have been successfully prepared, it remains to be shown how they are put into useful requisition, and how they are made the parents of rapidly-multiplying families of coining dies, Florin bars of cast-steel are about 10 feet long, $1\frac{3}{4}$ inches broad and $1\frac{1}{4}$ inches thick; upon these the mint blacksmith is the first operator. One at a time they are conveyed to the forge, and cut, while hot, into short pieces of $1\frac{3}{8}$ inches in length, and in this form, therefore, resemble Fig. 1. These square or rectangular blocks he next proceeds to hammer into a cylindrical form, as shown in Fig. 2. He then cuts off in a slanting direction one end of each of the die blocks, and shapes them, by way of preparation, for the lathe, and thus they take the appearance depicted in Fig. 3. Thus he



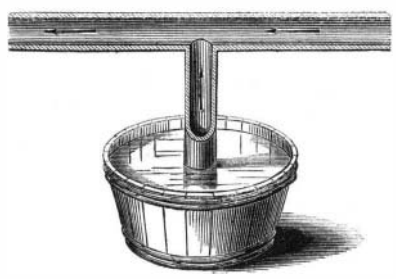
proceeds with die block after die block until he has accumulated a large quantity and diminished materially the length of the bar off which they have been cut. Owing to the severe hammering to which they have been subjected, they are at this stage very hard, and it becomes necessary to anneal them. This is effected by burying them in iron pots containing animal charcoal, and submitting the whole for many hours to the heat of coke furnaces. Subsequently, the blocks are allowed to cool gradually among the ashes and cinders of the furnaces, and are then ready for the turning-room and the lathe; here they are topped, as it is termed—that is to say the conical end of each is turned bright and prepared for its impression. After this operation they assume the appearance indicated by Fig. 4, and are removed to the die multiplying press, which is similar in form and arrangement to that already described.

[To be continued.]

OIL ENTERING A STEAM CYLINDER AGAINST PRESSURE.

In the Detroit Locomotive Works there was at one time a vertical high pressure steam engine (since altered to low pressure) which had an oil cup on the cylinder head. By opening this cup, during either the up stroke or down stroke of the piston, oil would flow in, although the steam gage indicated some 18 or 20 pounds pressure. This was somewhat remarkable. Oil would naturally flow in on the up stroke of the piston, because the exhaust would then be open, and the pressure less than that of the atmosphere; but how was it that steam did not blow out on the down stroke instead of the oil running into the cylinder?

By watching the operation closely we discovered



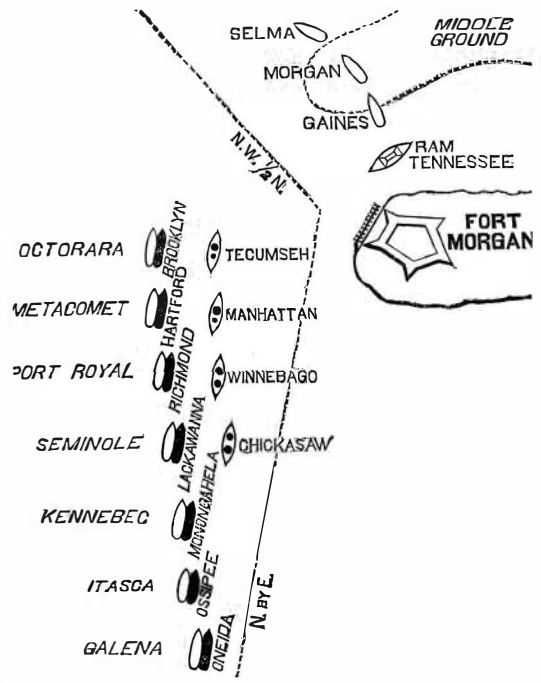
that the oil was drawn in during the first portion only of the stroke, that when the stroke was nearly completed the action was reversed and the oil was blown outward. Seeking for an explanation for this singular circumstance, we observed that the pipe from the oil cup entered the cylinder through the head, and directly over the steam port. We suppose that the oil was drawn in by the friction of the steam in its passage through the port.

A simple case of this kind of action is illustrated in the annexed cut. The two pipes communicate with each other, and the lower end of the vertical one is placed in a tub of water. Now, if a current of water, steam, or other fluid is forced rapidly through the horizontal pipe, it will carry along by friction the upper particles of any fluid filling the vertical pipe. The pressure of the air will force up other portions of the fluid in the vertical pipe to take the place of those removed, and these will in their turn be carried along. Thus an upward current will be created in the vertical tube. Steam pumps have been constructed on this principle. We suppose that this was the action in the case of the oil cup at Detroit.

An account of some experiments made in Newark by a practical engineer, were published in the *American Engineer*, a short-lived mechanical journal, printed in this city a few years ago. These experiments consisted in attaching a steam gage to the steam port, between the cylinder head and the slide valve. When the engine was at work taking steam the gage did not indicate any pressure, showing that the current passed by it entirely, the same as in the case of the oil cup. This case shows the importance of placing indicators in a position not to be influenced by the currents of steam, as they enter or leave the cylinder.

COMMODORE FARRAGUT'S REPORT OF THE ACTION IN MOBILE BAY.

From the report of the brave and skillful Commodore Farragut to the Secretary of the Navy (as published in the *Army and Navy Journal*), we extract a few paragraphs. We are also indebted to the same journal for the diagram which shows the second order of sailing of the fleet:—



"Having passed the forts and dispersed the enemy's gunboats, I had ordered most of the vessels to anchor, when I perceived the ram *Tennessee* standing up for this ship; this was at 45 minutes past 8. I was not long in comprehending his intentions to be the destruction of the flagship. The monitors and such of the wooden vessels as I thought best adapted for the purpose, were immediately ordered to attack the ram, not only with their guns but bows on at full speed. And then began one of the fiercest naval combats on record. The *Monongahela*, Commander Strong, was the first vessel that struck her, and in doing so carried away his own iron prow, together with the cut-water, without apparently doing his adversary much injury. The *Lackawanna*, Captain Marchand, was the next vessel to strike her, which she did at full speed, but though her stem was cut and crushed to the plank ends for the distance of three feet above the water's edge to five feet below, the only perceptible effect on the ram was to give her a heavy lift. The *Hartford* was the third vessel which struck her, but as the *Tennessee* quickly shifted her helm, the blow was a glancing one, and as she rasped along our side we poured our whole port broadside of 9-inch solid shot within ten feet of her casemate. The monitors worked slowly, but delivered their fire as opportunity offered. The *Chickasaw* succeeded in getting under her stern, and a 15-inch shot from the *Manhattan* broke through her iron plating and heavy wooden backing, though the missile itself did not enter the vessel.

"Immediately after the collision with the flagship, I directed Captain Drayton to bear down for the ram again. He was doing so at full speed when, unfortunately, the *Lackawanna* ran into the *Hartford* just forward of the mizzenmast, cutting her down to within two feet of the water's edge. We soon got clear again, however, and were fast approaching our adversary when she struck her colors and ran up the white flag. She was at this time sore beset: the *Chickasaw* was pounding away at her stern, the *Ossi-*

pee was approaching her at full speed, and the *Monongahela*, *Lackawanna*, and this ship were bearing down upon her, determined upon her destruction. Her smoke-stack had been shot away, her steering chains were gone, compelling a resort to her relieving tackles, and several of the port-shutters were jammed. Indeed, from the time the *Hartford* struck her until her surrender, she never fired a gun. As the *Ossipee*, Commander Le Roy, was about to strike her, she hoisted the white flag, and that vessel immediately stopped her engines, though not in time to avoid a glancing blow. During the contest with the rebel gunboats and the ram *Tennessee*, and which terminated by her surrender at ten o'clock, we lost many more men than from the fire of the batteries of Fort Morgan. Admiral Buchanan was wounded in the leg, two or three of his men were killed, and five or six wounded. Commander Johnston, formerly of the U. S. Navy, was in command of the *Tennessee*, and came on board the flagship to surrender his sword and that of Admiral Buchanan. The surgeon, Dr. Conrad, came with him, stated the condition of the Admiral, and wished to know what was to be done with him. Fleet-surgeon Palmer, who was on board the *Hartford* during the action, commiserating the sufferings of the wounded, suggested that those of both sides be sent to Pensacola, where they would be properly cared for. I therefore addressed a note to Brigadier General B. L. Page, commanding Fort Morgan, informing him that Admiral Buchanan and others of the *Tennessee* had been wounded, and desiring to know whether he would permit one of our vessels under a flag of truce to convey them with or without our wounded to Pensacola, on the understanding that the vessel should take out none but the wounded, and bring nothing back that she did not take out. This was acceded to by General Page, and the *Metacomet* proceeded on this mission of humanity.

"In this connection I must not omit to call the attention of the Department to the conduct of Acting Ensign Henry C. Nields, of the *Metacomet*, who had charge of the boat sent from that vessel when the *Tecumseh* sunk. He took her in under one of the most galling fires I ever saw, and succeeded in rescuing from death ten of her crew within 600 yards of the fort. I would respectfully recommend his advancement. The commanding officers of all the vessels who took part in the action, deserve my warmest commendations, not only for the untiring zeal with which they had prepared their ships for the contest, but for their skill and daring in carrying out my orders during the engagement. With the exception of the momentary arrest of the fleet when the *Hartford* passed ahead, and to which I have already adverted, the order of battle was preserved, and the ships followed each other in close order past the batteries of Fort Morgan, and in comparative safety, too, with the exception of the *Oneida*. Her boilers were penetrated by a shot from the fort which completely disabled her, but her consort, the *Galena*, firmly fastened to her side, brought her safely through, showing clearly the wisdom of the precaution of carrying the vessels in two abreast. Commander Mullany, who had solicited eagerly to take part in the action, was severely wounded, losing his left arm. In the encounter with the ram, the commanding officers obeyed with alacrity the order to run her down, and without hesitation exposed their ships to destruction to destroy the enemy. Our iron-clads. from their slow speed and bad steering, had some difficulty in getting into and maintaining their position in line as we passed the fort, and in the subsequent encounter with the *Tennessee*, from the same causes, were not effective as could have been desired; but I cannot give too much praise to Lieutenant Commander Perkins, who, though he had orders from the Department to return North, volunteered to take command of the *Chickasaw*, and did his duty nobly.

"The *Winnebago* was commanded by Commander T. H. Stevens, who volunteered for that position. His vessel steers very badly, and neither of his turrets will work, which compelled him to turn his vessel every time to get a shot, so that he could not fire very often, but he did the best under the circumstances.

"The *Manhattan* appeared to work well, though she moved slowly. Commander Nicholson delivered his fire deliberately, and, as before stated, with one of his 15-inch shot broke through the armor of the *Tennessee*, with its wooden backing, though the shot itself did not enter the vessel. No other shot broke through her armor, though many of her plates were started, and several of her port-shutters jammed by the fire from the different ships."

POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

The Association held its regular weekly meeting at its room at the Cooper Institute, on Thursday evening, Sept. 15th. From the proceedings we select a few items:—

NOVEL APPARATUS FOR RAISING PETROLEUM.

Dr. Rowell exhibited a glass model designed to illustrate the action of an apparatus previously mentioned by Mr. Overton as having been recently introduced in the oil region for raising petroleum. By the present mode, after a hole some four or five inches in diameter is bored through the earth down to the oil, a pipe is introduced with a pump near the bottom, and the oil is thus pumped out. In some cases the pressure of gas upon the surface of the liquid forces the oil nearly up to the surface, and it is in these cases that the new apparatus is employed. A second pipe is introduced into the hole with its lower end bent upward so as to enter tho lower end of the first pipe. Air is then forced by an air pump down through the second pipe into the lower end of the first pipe, and as the bubbles rise along this pipe they so reduce the weight of the liquid column that the pressure of the gas raises it to the surface, and thus a constant flow is secured. Dr. Rowell's apparatus consisted of two glass tubes immersed part of their length in water, with the lower end of one tube bent up and entering the lower end of the other. On blowing into the bent tube, the weight of the aqueous column in the other tube was so reduced by the bubbles of air that the pressure of the water outside of the tube forced the water within the tube to the top, and it overflowed.

The President remarked that this plan would require a larger expenditure of power than the pump, as the friction of an air pump is very great.

Dr. Rowell suggested as a counterbalancing consideration, that with the pump, motion must be imparted at every stroke, not only to the long line of pump-rods, but also to the whole liquid column, while with this air pump arrangement the flow of oil would be constant. There would, therefore, be less expenditure of power in overcoming inertia.

PETROLEUM FOR CURRYING LEATHER.

Mr. Page stated that the leather of which his boots were made was curried with petroleum in place of the fish-oil usually employed, and that, though a year old, it had shown no signs of cracking. He observed that many leather dealers thought petroleum made the leather tougher than fish-oil.

COST OF REFINING PETROLEUM.

Mr. Page, in reply to a question, said that the average cost of refining petroleum is about five cents per gallon, besides the loss or shrinkage, and that this ranges from 10 to 40 per cent.

PETROLEUM CANDLES.

Mr. Page remarked that he had compared the candles made of Marietta parafine with the best sperm candles, and their superiority was very marked. They are just about as hard as lead, and remain perfectly solid and dry in the hottest climates.

The Preservation of Fruit was selected as the subject for the next evening.

THE ONE THOUSAND-POUNDER CANNON.

On page 282, Vol VI. (new series) of the SCIENTIFIC AMERICAN, was published the following report made to the War Department by Capt. Rodman, on the 17th of April, 1861:—

"The entire success which has attended the manufacture and trial of the 15-inch gun, leaves no doubt of our ability to make reliable guns of even greater diameter of bore than 20 inches, and to maneuver and load with facility, and without the use of machinery, guns of that caliber. A 20-inch gun, one caliber thick, 210-inch length of bore, and 20 feet total length, would weigh about 100,000 lbs. A solid sphere of iron, 20 inches diameter, would weigh about 1,000 lbs. A shell, 20 inches exterior diameter, 6-66 inches thick, would weigh about 985 lbs. The ordinary service shell need not be over 3.5 inches thick; would weigh about 725 lbs., and contain about 38 lbs. of powder, making the total weight of the loaded shell about 763 lbs. Shells only 3 inches thick may be fired without danger of breaking in the gun; they would weigh about 657 lbs. each, and contain about 48 lbs. of powder, giving the weight of the loaded shell about 705 lbs. Adopting the same method of loading as for the 15-inch gun, nine men, four at each end of the handspike, would load this gun with nearly the same facility that five did the 15-inch gun; and seven men could load it. The charge of powder to impart the ordinary velocity to one of these shells, would be about 100 lbs. The living force of the service shell would equal that of six 10 inch solid shot, and that of the battering shell would considerably exceed that of seven 10-inch solid shot; and the destructive effect of such shells, compared with 10-inch shot, upon iron-clad ships and floating batteries, would be in a much higher ratio; their whole crushing force being brought to bear upon a single point at the same time, while that of the smaller shot would be unavoidably dispersed, as regards both time and point of impact, While, therefore, fully recognizing the principle that the destructive effects of projectiles upon a strongly resisting object, increases in a higher ratio than as their calibers, and having no doubt that reliable guns of larger caliber may be readily made, yet, from the fact that 20 inches is about the largest caliber that can be readily loaded and maneuvered, without resort to machinery, and because it is not deemed probable that any naval structure, proof against that caliber, will soon if ever be built, I propose 20 inches as the caliber next to be tested."

This idea, so clearly formed in all its details in the mind of the ordnance officer three years ago, is now embodied in solid metal. The first 20-inch gun, the largest piece of practical artillery ever constructed, is lying on the wharf at Fort Hamilton, eight miles below this city. The muzzle is marked "20-inch No. 1, Fort Pitt, 1864, 116,497 pounds." The gun was cast at the Fort Pitt Foundry, Pittsburgh, Pa., on the 11th of February, 1864, under the superintendence of R. Aulick, U.S.N., and his official report of the operation was published. with an illustration of one of the furnaces, on page 182, Vol. X., SCIENTIFIC AMERICAN. The dimensions of this monster cannon are, total length, 20 feet 3⅓ inches; length of bore, 17 feet 6 inches, greatest diameter, 5 feet 4 inches; least diameter, 2 feet 10 inches. The chamber is simply a hemispherical finish of the bottom of the bore, as we ascertained by going inside and examining it.

NEW BOOKS AND PUBLICATIONS.

THE MARINE STEAM ENGINE. Main and Brown. H. C. Baird, 406 Walnut street, Philadelphia, Publisher.

Very many persons write to us weekly asking information on the subject of the Marine Steam Engine, and where they can find a work treating upon it in detail. To such persons we recommend this work, for it contains accurate descriptions of the marine engine in its various forms; both vertical, horizontal, and inclined. The subject of valve gearing and valves, especially the English D-valve, long and short, is treated of in a lucid and interesting style. In addition to the illustrations, there is a large amount of technical matter referring to the management of engines, when disabled or under peculiar circumstances, as for instance, "how to ascertain if the piston be tight," "danger from impure air in boilers," "to get a cylinder cover into its place," "piston loose on the rod," "on stopping cracks in boilers," and other subjects of a similar character. From this the engineer or student will see that the work is a valuable one, and any one at all connected with or interested in the steam engine should possess a copy.

WEBSTER'S UNABRIDGED.—Messrs. G. & C. Merriam, Publishers of Webster's Dictionary, have recently issued a new edition of the Unabridged, which renders the Lexicon more valuable than ever. The enterprising Publishers seem determined that no work shall excel theirs, and thus by additions constantly being made in their new editions they keep Webster the acknowledged standard.