guns may now be dispensed with. A short, thick, hollow cylinder being cast, may be at once rolled out direct between rollers into a musket or rifle barrel of any desired form; and great guns may be cast hollow, and put under the operation of a tilt or steam hammer, if needed, to consolidate the metal. And these malleable iron guns can be procured at one-third the cost of the ordinary cast-iron guns; and what is very important, the malleable steel is even cheaper in cost than malleable iron. The class of guns described in the last number, to be borne on wheels without horses, might be produced with little labor and cost, ve y rapidly to any amount.

With regard to monster guns, they may be regarded as useful only for two purposes—to mount on forts for defense, and to place in vessels. They are not otherwise transportable weapons of offense. This question is yet in embryo; but if armored ships are to obtain, this question must obtain also. For shot that are to pierce armored vessels, it is quite clear that the Bessemer malleable steel will prove a most important material, as it can easily be tempered to any required hardness to act as a punch, and can be more easily manufactured than the wrought iron shot that have replaced fragile cast-iron.

Before constructing monster guns we have yet to settle the question of the form, proportion and weight of the shot we are to use for given distances with a given destructive power. This ascertained, there will be no difficulty in the construction of the gun itself. But it should be a gun so proportionably heavy as to be absolutely without recoil; so long as to expend expansively the minimum amount of powder required to obtain the longest possible range; so dense in the material as not to fracture; and so solid as not to spring and temporarily enlarge its diameter with the explosion. A maximum-sized gun of this kind would probably weigh 100 tuns, and if used for forts would require machinery to move it and aim it. If used on vessels it would be placed fore and aft with only a vertical movement, and the vessel itself would serve as a stock to it, lateral movement being given by the screw and rudder. Fitted to an armored vessel, with the bows thoroughly protected, such a gun would be able to batter down everything in the shape of a stone wall at such a distance as to render being hit from the fort almost an infinitesimal chance. It would be like shooting at the edge of the east wind.

Long-range rifles, it may be remembered, were more than a match for the fort-mounted artillery at Bomarsund and in the Crimea, killing off the artillerymen. This will become more and more the rule as guns are improved. Monster guns are not calculated to pick off skirmishers, and it therefore becomes needful to protect their gunners. With the large embrasures of the ordinary kind which would be required for monster guns, the risk to the gunners would be much increased. It therefore is well to inquire whether there is any reason why the gun should not be closely covered in. With the ordinary mode of mounting on trunnions this seems scarcely practicable. But it would be very practicable to mount the gun on a sphere or ball working in a socket and capable of radiating in any direction. If the radius of the gun were only required to be small, as in a moving vessel, the ball might be placed at the muzzle, and in such case little sound or vibration, and *no smoke whatever should come into the vessel*, and no damage could be done to the gun save by shot striking exactly in the muzzle. This is so perfectly practical an arrangement, that nothing but the fact of a ship's sides being too weak to sustain the recoil of guns so attached ought to keep it out of use. Our sailors are too precious a commodity to have them wasted in working muzzle-loading guns at open ports. The steam ram now constructing is perfectly adapted to this arrangment, and a properly-constructed gun should be free from recoil. Even in our present state of knowledge, muzzle-loading guns must be regarded as things of the past, matching with "Brown Bess," and other tower antiquities. Into the details of construction it is not desirable to enter; and although the improvements indicated give these advantages chiefly to nations with manufacturers widely spread and of a high order, still the State should ever have in reserve a stock of improvements to meet emergencies; not making them common till required by the presence of adverse circumstances. The State should "keep a hold of the actual, knit the new securely to it, and give to them both conjointly a fresh direction." The astonishment created by the results of the Armstrong gun is simply a proof how much the progressive actual is overlooked by the many, while the special individual by time and thought turns it to account; and then it is assumed we can go no further, not heeding the words of the philosopher poet—

Men my brothers! Men the workers! ever making something new;
That which they have done but earnest, of the things that they shall do."

W. B. ADAMS.

NEW YORK WATER.

A few years ago the water with which Boston is supplied became quite fœtid, acquired a fishy taste, and formed a subject for much anxiety to the people of that city. In the subsequent year, the water in the city of Albany, N. Y., was affected in a similar manner; and now the "Croton," of this city, seems to have caught the infection. It has not yet acquired the exact fishy taste of the Cochituate fountains; but as it has been growing gradually worse for the past two weeks, it may yet arrive at that stage of deterioration if something is not immediately done to discover and arrest the evil. The reports of the scientific committees which were appointed to investigate the water evils in Boston and Albany attributed them to minute animalculæ and the decay of vegetable matter, brought about by a deficient supply of water in dry seasons, whereby the ponds became, in a measure, stagnant by the very limited quantity that was permitted to flow into the distributing reservoirs. The impure water in New York this season cannot be ascribed to such causes, because there has been no drouth; the supply of water has been abundant, and the season has not been unfavorable. The taste of the water is similar to that retained in a "moss-covered bucket" for several days, and the odor is very like that of marsh gas, thus affording some evidence that there has been an overflow of marsh lands into Croton Lake.

It has been stated that Dr. Chilton and some others have analyzed the Croton, without finding anything of a deleterious character in it. This may be true. The waters of the Dismal Swamp, although of a berry-brown color, are stated to be very healthy and very pleasant. The first quality may belong to the Croton, but not the last. That's certain.

ON HARDENING STEEL.

There are few things of which it is more difficult to understand the *rationale* than hardening steel; or why the same operation of heating red-hot and plunging into a cold fluid, which hardens steel, should soften copper.

Some persons will explain everything whether they understand it or not, and for this also have they found, in their own imagination, perfectly satisfactory answer, and cut the difficulty by saying steel is condensed by the operation; but, unfortunately for their theory, the reverse is the fact, and instead of being condensed, it is expanded by hardening, as any one may soon satisfy himself by taking a piece of steel as it leaves the forge or anvil, and fitting it exactly into a gage, or between two fixed points, and then hardening it; it will then be found that the steel will not now go into the gage or between the fixed points. Or let him rivet together a piece of steel to a piece of iron, filing the ends of both even, so that they may be exactly the same length, then heat them to a proper heat to harden the steel, and plunge them into water; he will find the expansive force of the steel has nearly torn the rivets out, and that it extends beyond the iron at both ends, any article may be taken with steel on one surface and iron on the other—such as a joiner's plane iron in the forged state—flat on both surfaces, and hardened; and the expansion of the steel will cause that side to be convex, and the iron side concave; how this is to be got flat again will be explained afterwards.

All steel expands in hardening, but that expands most which is most highly converted, and in direct proportion to the amount of carbon it received in that process. No other general rule can be given for the treating of steel for hardening than this, and it should in all cases be heated as regularly as possible to the lowest temperature at which that particular kind of steel will harden, and as little as possible beyond it, remembering that the more highly converted the steel is, the lower the temperature at which it will harden; and that a small article, such as a penknife-blade, will harden at a lower temperature than a more bulky one made of the same steel, because the small article is more suddenly cooled. The hardening of the very bulky articles, such as the face of an anvil, cannot be affected in the same way as smaller articles, by plunging them into water; for the length of time required in cooling will be almost certain to leave the middle of the face soft, where it is of the most consequence that it should be hard. Where the anvil-forge is worked by water-power, they possess the best means in hardening them, which is this:—The anvil, properly heated, should be placed in a water-tank face upwards, under a chute connected with the mill-dam; the chute drawn, and a heavy and continuous stream of water let fall from a height of ten or twelve feet upon the anvil-face, which effectually hardens the surface.

A red-hot anvil plunged into water would for a time, be surrounded by an atmosphere of steam, which would prevent its direct contact with the cold water, whereby its cooling would be retarded too much to harden the face; and hence the advantage of a continuous stream of cold water. Hence, also, the necessity of moving about in the water even articles of a pound or two in weight, to remove them away from the stream as it is generated upon their surfaces and thus promote more rapid cooling.

It is a good plan to harden hammer-faces, where there is a tub and water tap conveniently near, by plunging the red-hot hammer, held with the face upwards, into the water, so that a stream from the tap may fall upon its face. The face of hammers and anvils is ground after being hardened, but should never be tempered.—*Orr's Industrial Arts.*

DURATION OF LIFE AMONG THE JEWS.

According to the observations of M. Gatters, the duration of life among the Jews is considerably longer than with Christians; even in infancy, the mortality of the former is relatively less than among the latter. From his calculations, it results that the average length of life is, for Israelites, 46·5 years; for Germans, 26·7; for the Croats, 20·2; for the Austrians, 27·5. Gatters attributes the superiority on the part of the Jews, in different climates, entirely to the influence of race, and suggests the advantage of paying attention to the ethnographic element in the etiology of diseases. It is very probable that the cause of the greater longevity of Jews over Christians does not depend wholly on race, as Gatters thinks, but especially, if not entirely, on the fact that the Jews are more wealthy than Christians, and that their hygiene is superior to that of the latter.

EXPERIMENTS ON THE OLD ATLANTIC CABLE.—The Buffalo *Republic* says three pieces of the Atlantic cable, which were purchased by Messrs. Tiffany & Co., of New York, have been laid across the Mississippi, at St. Louis, in order to put that office in connection with the eastern lines. The first cable worked very well for about three weeks, the second about thirteen hours, and the third, which was laid on Saturday evening, gave out on Sunday night. On Thursday the second cable was under-run by experienced electricians, but no flaw was discovered—nothing perceptible to account for the cessation of the working capacity of the cable. The last cable was put to a good test, having been entirely submerged for over two hours before being laid. The first cable was examined from St. Louis to near the Illinois shore, where the cable having been imbedded in the sand gave way. Up to the place of parting there was nothing perceptible that could lead to the discoverery of the existing trouble. The third cable also furnishes no evidence whereby the cause of the difficulty can be detected.

IRON RAILROAD CAR.—An iron car, built according to the patent of Dr. La Mothe, was exhibited for a few days last week at the New York and Erie Railroad station, Jersey City. It is one of the handsomest cars we have ever examined, and we have no doubt but the proprietors of the road for which it was built (Boston and Lowell) will feel highly pleased with its appearance. Its sides are of double plates, with a space between, and the seams are branded with narrow strips, riveted on in such a manner as to form panels. It is fire-proof, and lighter than a wooden car of the same size.

C. A. Schultz has a new and economical steam-engine on exhibition at the Neptune Iron-works, foot of Eighth-street, East river, in this city. The novelty of this engine is so great that we shall shortly give an illustration and description of it in the SCIENTIFIC AMERICAN

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