next heating. By mixing flour, yellow blood-lye salt, saltpeter, horn shavings, or ground hoofs, grease, and wax, a paste is formed which serves the same purpose. A choice may be made of any of the preparations sold as a "hardening paste"; they are all more or less of the same composition. We give one recipe: Melt 500 grains of wax, 500 grains tallow, 100 grains resin, add a mixture of leather-coal, horn shavings, and ground hoofs in equal parts till a paste is formed, then add 10 grains saltpeter and 50 to 100 grains powdered yellow blood-lye salt, and stir well. The tools are put into this paste while red hot, allowed to cool in it, then reheated and tempered.—Der Metallarbeiter.

BETHLEHEM STEEL COMPANY EXHIBIT IN THE MINES AND METALLURGY BUILDING.

By the St. Louis Correspondent of the SCIENTIFIC AMERICAN.

Too much cannot be said in praise of the very thorough manner in which several of the largest industrial concerns in the United States have exhibited the products and processes of their plants at the St. Louis Exposition. The Bethlehem Steel Company is a notable instance of this, and their remarkable collection of material in the Mines Building is one of the best

In view of the popular belief that the price paid for modern armor plate is such as to secure for the company unprecedented profits, there has been laid out on shelving that runs entirely around the depressed portion of this exhibit, a display of the materials that are necessary to produce an armor plate. First on this shelf is seen a small model of the big "Louisiana" armor plate shown at the left of the exhibit, the model being one-twenty-fifth the size of the actual plate. Then follow little (and not so very little) piles of ore, coal, and limestone, representing the actual amount necessary to produce the pig iron from which the plate is cast and forged. Then follow other piles of coal, representing the fuel used in the various heat treatments; piles of fuel representing consumption of power in the machine shops, one pile for each machining process through which the plate has to pass—the whole proving clearly that the mere bulk of the plate is no criterion whatever of the enormous cost in fuel and labor necessary to bring it to the proper condition for resisting modern projectiles. We venture to say that if any citizen will take the trouble to enter this exhibit, pass around this succession of coal piles, and learn from the engineer in charge just what each represents, he will come away with a new idea of the marvelous complexity and difficulty of armor-plate manufacture, and with a clear understanding of why

developed, he has come to the conclusion that the Norwegian fjords furnish no argument against his doctrine that there has been no recent upheaval of the land. He asserts that "we must interpret all the *seter* (rock-shelves) and the great majority of the terraces in the fjords of western Norway as proofs of the retreat of the ice that once covered so much of the peninsula, and not as proofs of any oscillations of the surface of the sea, still less of any movement of the solid land." It would widen the inquiry too much to enter upon an examination of the evidence as it is presented in Scandinavia. But the author of the address, having been all his life familiar with the strand-lines of this country, and having traced those of the Norwegian coast from Bergen to Hammerfest, directed attention to one or two of the insuperable difficulties with which Prof. Suess's theoretical explanation seemed to him to be beset. The great Austrian geologist appears to have unwittingly confounded two sets of beach-lines, which differ a good deal from each other in general character, and are entirely distinct in origin. Availing himself of the remarkably full and interesting researches of Scandinavian geologists regarding the glaciation of their country, he dwells upon the importance of the terraces left by the fresh-water lakes that were dammed back by the great ice-sheet as it retired. He believes that these phenomena extended even to the Nor-

EXHIBIT OF WAR MATERIAL IN THE MINES AND METALLURGY BUILDING.

exhibits in the whole exposition. It stands partly upon the level of the main floor and partly in a large depressed area. Upon the upper portion stands a full-sized model of a 12-inch gun turret, with the two 12-inch guns projecting far over the exhibits in the tower area. Flanking this gun on either side are several fine specimens of the smaller types of army and navy guns.

Below the 12-inch guns are several pieces of armor plate which have undergone test at the proving ground. To the left of the 12-inch gun turret, as viewed in the picture, is a section of the cast-iron lining for the tunnel beneath the Hudson River, one tube of which was recently completed, and has been fully described in this journal. In front of this section is a 4-inch 50-caliber rapid-fire gun on a pedestal mount, and, from left to right, are a limber for a 3-inch field gun, a three-pounder semi-automatic gun, a 3-inch long recoil horse artillery gun and carriage and a limber for the same, while in the right-hand corner at the foot of the stairway is a 5-inch 45-caliber gun on a pedestal mount. Returning to the left side of the picture we see a full-sized model of a side armor plate for the United States battleship "Louisiana," and back of it is a model of the big steel ingot from which this armor plate was forged. In the foreground to the right of the picture is a hollow forged-steel jacket for a 13-inch gun, ready machined for assembling; its weight is 43,000 pounds. The large piece shown adjoining this in the foreground is a cast-steel top-carriage for a 12-inch disappearing gun carriage, and to the left of that is half of a four-throw crank-shaft for a marine engine.

it is that the government pays from \$400 to \$500 for every ton of armor plate that it places upon its war-ships.

SIR ARCHIBALD GEIKIE ON EMERGENCE AND SUBMERGENCE OF LAND.

At the recent anniversary of the Geological Society, when the president was unable from illness to be present, his place was taken by Sir Archibald Geikie, who prepared an address for the occasion on the evidence supplied by the British Isles as to the problem of the causes of changes in the relative levels of sea and land. This address appears in full in the Quarterly Journal of the society, and we here reproduce it in abstract.

(i.) *Emergence.*—Geologists in the British Isles have long indulged the confident belief that raised beaches afford demonstrative proof of changes in the relative levels of sea and land. The abundant and striking examples of them around our coasts have been universally accepted among us as marking former sea-margins, whether the sea be supposed to have risen upon the land or the land to have been upheaved above the sea. The recurrence of precisely similar terraces along the western coast of Norway, but on a still more impressive scale, has been regarded as furnishing evidence of an extensive emergence of land, from the south of Britain to the northern end of the Scandinavian peninsula. Prof. Suess, however, seeks to show that, at least as regards the northwestern coast of Norway, these opinions are based upon a misreading of the evidence. After his visit to that region, and his study of the literature of the strand-lines, there so wonderfully

wegian coast, and that the strand-lines of the fjords, whether in the form of platforms eroded out of the solid rock (*seter*) or terraces of sediment, mark former levels of lakes that filled these valleys when their mouths were blocked up with the ice-sheet. As the lowest of these strand-lines includes sands and gravels crowded with marine shells, he is compelled to admit that it marks a former sea-beach. But he endeavors to discriminate between it and the other horizontal shelves, which follow it in parallel lines at higher levels. He affirms that the latter present a series of "characters absolutely irreconcilable with what we know of the action of the sea along a shore"—such as the series of fragmentary terraces found at increasing heights inland, their absence from the parts near the general coast-line, and the breadth of the *seter*. He passes lightly over the fact that some of these higher terraces have yielded marine organisms which are progressively of more Arctic character, according to their altitude, and according, consequently, to the antiquity of the sediments in which they lie.

Now, according to the experience of those northern geologists who have specially studied Scandinavian glaciation, the lakes that were formed by the ponding-back of the drainage against the flanks of the ice-sheet lie to the east of the watershed of the peninsula. These observers have ascertained that when the ice-sheet was waning, it retreated eastward from the backbone of the country and lay on the eastern or Swedish slope, leaving a gradually increasing breadth of ground clear of ice. The streams flowing eastward over this liberated area had their drainage arrested against the margin of the ice; and hence arose a vast series of