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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 434,

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SEPARATION OF OIL FROM IRON CHIPS.

After good lubricating oil has once been used, coming in contact with the metals and the oxygen of the atmosphere, it has changed its character so much that it is not proper for use as a lubricant, except in the "running through" for lathe and similar work, in cutting screw threads and lubricating for lathe tools. It cannot be returned to the shafts or to the permanent lubricating cups, and do good service. But this once used oil has its second and third use when separated from its surroundings. Oily chips from the lathe, the milling machine, the screw cutting machine, can be cleaned of their load of oil and the oil be returned for use, unchanged except for its semi-oxidation; the contact of iron or of brass will not, of itself, affect the oil. The exposure in driblets and drops encourages the oxygen of the atmosphere to combine with the carbon of the oil and so change its quality as to prevent its economic use as a lubricant for permanent employment, while it does not impair its value for temporary purposes. For these purposes it does not matter that the oil has partially returned to its base as an acid; its use in running through a screw machine or a lathe is so short that no injury can result. But if once used and exposed oil is fed to shafts and to engine cylinders, the acid from the oxygenized oil will surely make trouble. The proper method of feeding lubricating oil is that of an atmospherically closed reservoir, types of which are largely in use.

But to save oil waste the centrifugal machine is largely in use, and its adaptations are being extended to comprehend the oily debris of many various manufactures. A recent examination of this contrivance, at an establishment that works steel, iron, and brass with oil in streams, shows that the centrifugal machine saves the oil so completely that the resultant turning and drilling chips may be handled without serious soiling of the hands, and the filtered oil appears to be almost as limpid as before using. This appearance is, however, deceptive, for the oil contains chemically, if not suspended mechanically, a large amount of the oxides of iron, steel, brass, and bronze, with which it had been intimately associated, rendering it unfit for purely lubricating purposes. But the method of the centrifugal machine is a reasonable and useful one.

PROGRESS IN IRON FOUNDING.

The art of producing iron from its ores, and of remelting the iron to forms, has always been of an experimental character, owing to the lack of certainty as to its component parts and their proportions. Irons themselves differ in composition so greatly that it is one of the most exactive of arts to produce an unvarying grade for certain and demanded purposes; and the ores vary so much in the same mines that those coming under the same generic, and even specific, terms are not always analogous. As an instance, the Black Band ore mined at Mineral Ridge, Trumbull County, Ohio, is of one character when found under the sixth coal level, and of an entirely different character when appearing as an outcrop near the surface, where it is scarcely better than "kidney" ore or the ordinary "shell" ore, both of them too much oxidized to be of much value in the mechanic arts, except as makeweights. In fine castings, especially those of light weight, there is wasted usually about 700 pounds out of a ton of castings in "sprews," "gutes," and "cullings." This "back stock," or scrap, must be carried over from the first to possibly the fourth day, and be worked in only when the nature of the floor or bench permits it. And even under the circumstances most favorable, these leavings accumulate, to the annoyance of the foundryman and the injury of his customers. It is evident that the intelligent selection of irons and fuels, and especially the determination of the character of ores by analysis or experiment, ought to reduce the present uncertainty of product and insure a result in accordance with the foundryman's design.

This has been the endeavor of a competent mechanic, Mr. J. B. Renshaw, of Hartford, Conn., who has made a study of ores, their fluxes, the resultant iron, and the after-castings his business for several years. At length he has succeeded in putting the work of the foundry on a basis that removes it altogether from the line of speculation and experiment, and relegates it to one of the exact arts. His results from his studies are accepted in practice by a large number of manufacturers who make their own castings, and also by the managers of a number of blast furnaces, who reduce iron ores for castings and for the puddling furnace. One of these latter says that he is producing the best iron in the world from formulæ laid down by this investigator, and that he can sell all he makes, at the works, at satisfactory prices far beyond those of ordinary pig. He says his iron is readily taken, delivered in New England, at $30 per ton, to be used for light castings in combination with cheaper irons, and carrying a large amount of back stock. In this instance, the iron, which is of a very freely flowing nature, and is especially adapted to fine castings, as "bench hardware" and "builders' hardware," is made from 66$\frac{2}{3}$ per cent of Black Band ore and 33$\frac{1}{3}$ per cent of the Arnold ore from the Adirondacks, on the western shore of Lake Champlain. This mixture makes, also, iron for the puddler equal to the ores that produce the famous Lowmoor.

Further experiments and analyses have proved that the Black Band (two-thirds) and the Lake Superior hematite (one-third) make a superior neutral iron, possessing great strength with remarkable softness and fluidity. A neutral iron thus produced will reproduce in the castings the very qualities desired. In some respects the Black Band ore is remarkable. It is found in layered masses, as though deposited by water, the layers of iron being sandwiched by alternate layers of coal, so that the ore, when heated, is self-coking. In some instances these alternate layers are so thin that they measure only one-eighth of an inch each in thickness. Where they are thicker, the coal or slaty lignite appears to break into the mass. When melted alone this ore gives a tough result, almost like puddlers' screenings.

These results are only a portion of the outcome of several years of experiments and investigations; the most important parts are those which determine for the practical foundryman the sorts of iron he should use to produce his desired result, and the proportion of the different irons. These data have been determined by trials and experiments in the laboratory, the blast furnace, and the cupola, by chemical analyses, and by microscopic examinations; and that it is possible to determine, before a melting is made, just what iron shall be used, and the quality of the coke for melting, has been rendered certain.

Two other aids complete the means for insuring a certain result that shall be unvarying. One is the use of a centrifugal gate to be used in pouring, by which all the scum and lighter portions of the fluid iron are removed in the act of pouring. The other is the use of test bars—thin castings in the form of the blade of a draughtsman's square—a piece two inches broad, one-eighth of an inch thick, and two feet long, with a hole of from three-quarters of an inch to one inch diameter at one end. Each of these bars is poured from every melting, and it bears on it the date of the pouring. Thus the fluidity of the iron is proved, if it passes from a gate at one end and passes completely around the holes. Bits may be broken off for file tests and other experiments, while the preserved slips are proofs of the quality of the castings for that day, thus being evidence in case of dispute or doubt, and a guiding reference for the future.

What will Burst a Gun?

Perhaps the illustrations given as answers to this question in the SCIENTIFIC AMERICAN of March 22, 1884, are not comprehensive enough. For the safety of amateur sportsmen other instances of gun barrel bursting should be cited.

In bravado a young man placed the muzzle of his fowling piece under the water, and fired the charge. The result was the bursting of the barrel near the breech and the mutilation of his hand. Another placed and held the muzzle of his piece square against a piece of plate window glass, and fired the charge—powder and a bullet. The glass was shattered, so was the gun barrel. Another instance was that of an experimenter who had heard that a candle could be fired from the barrel of a gun through an inch board. He drove a candle into the muzzle of the gun, fired, and the explosion split the barrel almost its entire length, and did not even drive the candle from the muzzle. Still another burst of a gun barrel was caused by the use of wet grass for a wad, well rammed down over a charge of shot. But perhaps one of the most singular exhibitions in this line was a Colt's navy revolver, which some years ago was sent to the factory in Hartford, Conn. This was before the adaptation of these pistols to the metallic cartridges, and it is probable that in loading with open powder and ball only a small amount of powder got into the chamber, and the bullet was not propelled with sufficient force to drive it from the muzzle; at least the bullet did not go out, but lodged. As the shooter did not know whether the bullet escaped or not, he kept on firing until the barrel burst or bulged, and when it was sawed in two longitudinally there were found fourteen bullets wedged one into the other, and so much "upset" by the hammering of the successive explosions of the powder charges that some of them were not less than one inch diameter, being flattened disks instead of conical bullets.

Compressibility of Liquids.

From a paper recently presented to the Academy of Sciences of Berlin, by Mr. Quincke, it appears that the compressibility of liquids, which is generally considered to be practically *nil*, may be shown under pressures of even less than one additional atmosphere. Mr. Quincke experimented with liquids contained in glass bulbs, with a capillary tube attached to them vertically; the bulbs were placed in the chamber of an air pump, and the decrease of volume resulting from increased pressure was observed, which method promised more exact indications than the opposite one of watching the expansion under diminished pressure. Water carefully freed from air by continuous boiling was compressed by 49 millionths of its original volume under a total pressure of two atmospheres. The following figures express the compressions of some liquids resulting from one millimeter additional pressure, also in millionths of the respective volumes: Glycerine, 0·03; olive oil, 0·07; alcohol, 0·12. The observations, which extended over a large number of liquids, agreed well with one another of former, but not such extensive, researches by M. Grassi. Within the limits of pressure of one additional atmosphere, the compression remains proportional to the pressure. The experiments further confirm the theory that a certain relation exists between compression and the coefficient of refraction, but as yet they are not decisive enough, whether one or the other of the various ratios, which have been based upon theoretical calculations, is correct.