

thin jet that does not become darker than a light gray. One requirement is that the boiler capacity shall be ample. It is from having to crowd the boilers quite as much as anything else that so much coal is thrown out of the tops of chimneys unburned. The above results cannot be obtained if the steam-generating apparatus is scant.

A further result is the small cost of repairs, which is due both to the style of fuel and the generous boiler capacity. Last year, with insufficient boiler capacity, the repairs to the boilers cost over \$2,200. So far this year, with sufficient capacity, the repairs have cost next to nothing.

With the fuel in the above proportion it is found that the expenditure of 2.6 pounds of coal an hour is, under the most favorable conditions, sufficient for developing one horse power at the Urban mill.

It is believed that the advantages in cost of money and labor and in the ridding of manufacturing centers of smoke and carbon deposits independent of smoke, which are shown by this experiment, ought to lead to the development of a new system of firing steam boilers. With such a system in general use coal now considered practically worthless could be made of prime value and a nuisance would be abated.

JOHN CHAMBERLIN.

90 Johnson Park, Buffalo, August 17.

Gold in Photography.

It is not our purpose to write a treatise on bimetallism, though the erratic changes in the price of silver of late years have added to the difficulties of the plate maker; gold being the standard metal in this country, the pound's worth of gold which a sovereign originally contained is still the measure of its value. It is the physical qualities of gold and its salts that we now discuss. It is not a little remarkable that in the present day we never hear of this metal as a light-sensitive agent. Yet, in the early days of the science, there was considerable promise in the experiments made in this direction. So long ago as 1840, Sir John Herschel investigated its properties at length, and these were still further examined by Hunt. Washing the surface of paper lightly with chloride of barium followed by a wash of chloride of gold, then exposing a few minutes to the sun's rays the portions of the paper acted on by light—first whitened by the light—became a full purple brown when held in the vapor of boiling water or even dipped in cold water. If for the barium salt oxalate of ammonia be substituted, the paper passes rapidly to violet purple; but as the same effect is produced, though more slowly, in the dark, it would be difficult to utilize this property. Again, using acetate of lead instead of barium, we get a paper sensitive to light, the faint image so produced being capable of "development" by steam or cold water. Bichromate of potassium and gold chloride solution give a light-sensitive paper. When the print is placed in cold water, the yellow tint disappears entirely in the whites, while the image, which has passed in printing through deep brown to bluish black, becomes, according to the extent of the solar action, crimson, blue, brown, or deep black. It is evident that here we have a fertile mine of experiment if any one care to work it; but, in modern photography, the chief interest of gold lies in the toning powers of its salts—mainly its chlorides.

It might be thought that little remained to be said upon this well-thrashed-out subject; but so far is this from being the case, that we may draw attention to two very interesting papers on the qualities of this salt which have recently been read before the Chemical Society, a brief reference to one of them having already been given. When treating of "chloride of gold," most writers have in view the acid chloride. Very few people have ever seen the pure gold trichloride, free from acid. Indeed, Watts says, "the only method of procuring auric chloride perfectly free from acid salt is to decompose aurous chloride with water." This aurous salt is made by evaporating a solution of the acid chloride to dryness, heating the residue to about the melting point of tin, and constantly stirring it as long as chlorine is evolved. An almost neutral solution of chloride of gold is obtained by evaporating a solution of the acid chloride till the liquid is dark ruby in color and begins to emit chlorine. When cool, the result is a dark red crystalline mass, very different from the usual yellow crystals. We may say that we have often pointed out, in instructions upon making toning baths, this fact. Ordinary solution of commercial crystals of gold chloride, or the double salt, is a pale yellow color, but the neutral salt solution is entirely different, it is a rich brown. If a useful toning solution, uniform in character, is to be made, it is this brown, not the yellow, solution that should be employed.

The question of the volatility of gold chloride or chlorine has often been before chemists, and most varied have been the opinions they have given. While one says it is entirely unvolatilizable, another says it

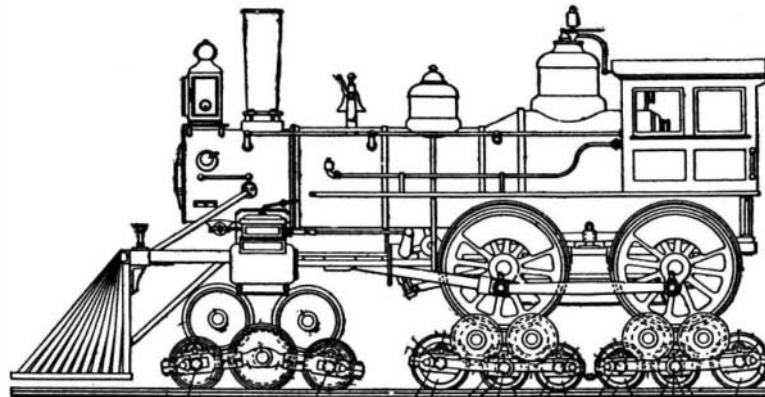
can be driven off by heat at comparatively low temperature. A word of explanation of a table recently quoted by us may be given: The volatility referred to an atmosphere of chlorine, the words of Mr. T. K. Rose, whose paper was quoted from, being "it is certain that, when gold is heated in chlorine at atmospheric pressure, trichloride of gold is formed and volatilized at all temperatures above 180° C., up to and probably far beyond 1,100°."

Lest some of our readers who manufacture, and wisely, their own chloride of gold may be under the impression that, during the heating of the capsule in which it is prepared, some of the gold may be lost by volatilization, we will again quote from Mr. Rose: "It may be added that, when gold is heated in atmospheric air or coal gas, no gold is volatilized below 1,050°, and only about two per cent in thirty minutes at 1,100°. There need, therefore, be no trouble anticipated in heating the gold chloride to expel free acid in the usual manner."

Similarly free from danger of decomposition will the heating, if moderate, prove to be, for, again quoting Mr. Rose, we have: "The decomposition of gold trichloride in air might be expected to become perceptible at 70°, requiring, however, about twenty-five years for its complete conversion into monochloride, AuCl, at this temperature. The observed rate of decomposition at 100° shows that a similar change would require about 1,000 days at this temperature, while it results from calculation . . . that at 200°, thirty-six hours, and at the melting point, viz., 288°, less than one minute suffices for the complete decomposition of AuCl₃ in air." These interesting investigations, which have a practical value of their own, besides leading up to other practical aspects of our subject, do not leave us enough space to continue our survey at the present time, and we will therefore resume it at an early date. —Br. Jour.

SPEEDING TRUCK FOR LOCOMOTIVES.

Our engraving shows a device by William J. Holman, of Minneapolis, termed a speeding truck, which



A LOCOMOTIVE SPEEDING TRUCK.

consists of reversely flanged wheels having inwardly extended hubs running in contact with the treads of the locomotive drivers, and flanged traction wheels having outwardly extended hubs supporting the treads of said reversely flanged wheels, and with the axles of said traction wheels coupled by independent side rods adapted to oscillate about the central axles, whereby the speed of the locomotive may be increased without altering its running gear or increasing the speed of the moving parts and the requisite flexibility secured.

This machine might almost be termed the locomotive cycle. It appears to be intended to do for a locomotive what the bicycle does for a man—increase the velocity of travel over the surface of the ground without augmentation of exertion. By means of the bicycle a man can travel a given distance far more rapidly and with less expenditure of power than if he were to walk. It remains to be seen whether mounting a locomotive as here proposed will accomplish any such improved result. We understand an experimental truck is now in process of construction. The result of the trial will be duly noted.

Wood Pulp Pinions.

The great development of electrical mechanism during the past few years has caused engineers and mechanics to give special attention to anything connected therewith. It has been found that an objection to nearly all electrical power apparatus is the extensive vibration of the gear wheels, which in almost every instance revolve at a higher rate of speed than in ordinary machinery. The effect of this vibration is detrimental in several ways. The jar tends to loosen bolts and nuts. Besides, the noise created is not pleasant. A number of methods for overcoming the trouble have been adopted, among which has been the use of gears constructed on the combination plan, the spokes and rims being iron and the cogs wood. But the temperature affects wood, causing it to contract and expand, resulting in needed repairs and alterations in order to keep the mechanism going.

Compressed rawhide pinions and cogs made from

same material have been adopted with some success. Even this material, however, has its drawbacks, all of which are claimed to be done away with by combining wood pulp with the same. Compressed rawhide and wood pulp form the foundation of the new pinions and adjustable cogs.

The Emancipation of Labor by Machinery.

One of the interesting proofs of the lightening of toil by the aid of machinery is found in the constantly enlarging sphere of labor being opened to self-supporting women, and the prediction is here made that within the next quarter of a century the ranks of the mechanic will be largely augmented by women.

Statistics show that the number of women to whom the sewing machine gives occupation to-day is vastly greater than the number who formerly gained a precarious livelihood with the needle, or who could obtain similar work under old conditions.

Contrast the "work-a-day" clothes and simply made "Sunday-go-to-meetin'" garments of the people of a century ago with the wonderful variety and complexity of finery comprising the holiday attire, and, indeed, the everyday wearing apparel, of those of a similar class to-day. If it is true, as stated, that one sewing machine operated by one woman will do the work of ten hand sewers, it is no less true that the modern woman possesses ten times as many garments as her sister of a former age, and each garment displays ten times as much machine-sewed work upon it.

But the sewing machine is a mere suggestion. The mind is fairly staggered in contemplation of the wealth of opportunity for wage earners that has been created by the steam engine—especially in the form of the steamship and locomotive, which have literally opened new worlds to the old world's poor. And what is true of the steam engine is true only in lesser degree of the telegraph, the telephone, the electric motor, the turbine and the whole range of modern agricultural machinery.

The modern bicycle—a theoretically perfect invention, and in some respects an almost perfect mechanism—has already produced beneficial effects upon the physical development of the wage-earning class sufficiently marked to attract general notice, and its future influence is incalculable. It is destined, in my judgment, to emancipate woman from many of the conventional shackles which have bound her for ages, and from some physical disabilities which have hitherto limited her sphere of occupation. This is only one of the many striking instances in which invention is helping to benefit the masses.

I am convinced that modern mechanical inventions have in all cases proved to be distinctively beneficial to the wage earner. He is through their aid better housed, better fed, better clothed, better educated, has more numerous and better amusements, and is thus approaching more nearly the condition of life of the employer; indeed, the wage earner to-day enjoys many advantages of civilization which were unknown to the employer of a generation gone by.

The majority of employers in this country are men who have risen from the ranks, and many of our most important inventions have been made by wage earners, who have the best opportunity, through experience in their daily work, to learn the necessities of the age.—A. E. Outerbridge, Jr., Engineering Magazine.

Queer Crankism of Electricity.

The Boston Journal of Commerce says that North Adams continues to be puzzled over a queer crankism of electricity in its vicinity. Although when the great 4½ mile Hoosac Tunnel was built no ores, magnetic or otherwise, were encountered, there was general expectation that rich ore pockets would be found; yet, for an unexplained reason, not an electrician has been discovered who can send a telegraphic message on a wire running from portal to portal of that tunnel, be such wire run inside of an ocean cable through the huge cavern or out of it. Therefore such messages have to be sent on wires strung on poles over the top of the mountain, fully nine miles, and that is the way in-going and out-going passenger and freight trains are heralded to the keepers of the two tunnel approaches.

Phosphorescence.

M. Raoul Pictet, the French chemist, who has long been experimenting with intense cold, finds that phosphorescence ceases at very low temperatures. Glass tubes filled with sulphides of calcium, strontium, and barium were exposed to the sun and then taken into a dark room where the intensity and duration of the phosphorescence was noted. After being again exposed to the sun the tubes were put into a mixture where by rapidly lowering the pressure their temperature was reduced to -140°; they then showed no sign of phosphorescence, but after a time the upper parts of the tubes which had been least cooled began to glow, and as the temperature rose the light extended, becoming at last as bright as in the first experiment.