chloride of methylene or ether. In the narcotized condition, the vessels do not contract, but under the influence of ether, in the later stages, before death occurs, dilation and regurgitation are observed. The latter is noticed also when chloride of methylene is used. With both reagents breathing and vessel circulation ceasebefore the heart's action. The lecturer concluded that anæsthetic vapors act directly upon nerve matter either by preventing the developement of force or by stopping conduction. The latter hypothesis is supported by the fact, proved by experiment, that these vapors obstruct the conduction of heat and electricity.—*Med. Times and Gaz.*

ALLOYS--REVIEW OF A LECTURE BY DR. A. MATTHIESEN, F. R. S.

Up to a very recent period the knowledge of alloys was confined to the physical characters of a very few of the possible combinations of different metals, and the chief contributions to the general stock of information in relation to the subject were the result of unsystematic and desultory experiment. Nothing like generalization was reached, and it was impossible, from the knowledge of the properties of an alloy containing definite proportions of two or more elements, to predict, even approximately, the properties of a combination of the same elements in varied proportions. The great importance of the subject, has, however, stimulated investigation, until at last something definite has been reached; and although as yet the smallest possible portion of the field has been worked over, an approach has been made to the proper method of working, and as a consequence we shall no doubt witness results equal in importance to other modern chemical discoveries which have created new branches of art and manufacture and revolutionized many of the old.

The researches of Dr. Matthiesen, the results of which he submitted to the Royal Society, in a lecture delivered at the Royal Institution, on the evening of March 20, are of great interest. The lecture was illustrated by many beautiful and ingenious experiments, and undoubtedly ranks among the most valuable recent contributions to science.

Dr. Matthiesen's definition of the term alloy is, *a solidified solution of one metal in another*. By solidified solution is meant a solution of substances which have become solid, *e.g.*, glass obtained by fusing together different silicates, and allowing the homogeneous liquid to solidify. The most important characteristic of a solidified solution is its homogeneousness. The most powerful microscope should not reveal its components.

As an illustration of the difference between chemical combination and the solution of metal in metal, the lecturer plunged a rod of gold and another of copper into separate portions of molten tin. The gold dissolved rapidly in the tin, but the copper rod, though previously tinned to insure perfect contact between the two metals, remained undissolved. To properly appreciate this experiment it should be borne in mind that the fusing points of gold and copper are nearly the same (gold 2,016° F., copper 1,990° F.), and much higher than the fusing point of tin, which is 442° F.

This experiment was followed by others equally instructive and interesting, calculated to show the solvent power of fused substances.

Dr. Matthiesen proceeded to classify the phenomena attending the solution of metals in metals, as follows:

I. The solid metal dissolves quickly in the melted one with evolution of heat. Examples: gold in tin just melted; sodium in mercury.

II. The solid metal dissolves quickly without evolution of heat. Example: lead in tin just melted.

III. The solid metal dissolves slowly. Example: copper in tin just melted.

IV. Only a partial alloy is formed, or in other words, each metal dissolves to only a limited extent in the other. Examples: lead and zinc, lead dissolving only 1·6 per cent zinc, and zinc only 1·2 per cent lead; bismuth and zinc, bismuth dissolving only 8·14 per cent zinc, and zinc only 2·4 per cent bismuth.

He also divided metals considered as components of alloys into two classes:

Class A.—Those metals which impart to their alloys certain physical properties (such as conducting power for electricity) in the proportion in which they themselves exist in the alloys. The metals belonging to this class are lead, tin, zinc, and cadmium.

Class B.—Those metals which do not impart to their alloys such physical properties in the proportion in which they themselves exist in the alloys. All the metals, except the four named as belonging to class A, probably come under this head.

He further separated alloys into three groups:

a. Those made of the metals belonging to class A with one another.

b. Those made of the metals belonging to class A with those of class B.

c. Those made of the metals belonging to class B with one another.

The Doctor showed by a series of conclusive and remarkably ingenious experiments that in alloys specific gravity, specific heat, and expansion due to heat, are in all cases approximately equivalent to those possessed by the component metals; and that fusibility and some other properties are never equivalent.

Another class of physical properties are those which in some cases are, and in others are not, imparted to alloys in the ratio in which they are possessed by the component metals. This class of properties includes conducting power for heat and electricity, sonorousness, elasticity, and tenacity. The separation of metals into two classes (A and B) is founded on a consideration of the latter class of properties.

Alloys made of the metals belonging to class A only (lead, tin, zinc, and cadmium) conduct electricity in the ratio of the relative volumes of the component metals. The conducting powers of a series of such alloys, say those of tin with zinc, may therefore be represented graphically by straight lines.

In alloys made of the metals belonging to class A with those of class B, the conducting power of the B metal undergoes a marked change, while that of the A metal remains unaltered. The conducting powers of a series of such alloys, say those of copper with tin, is represented graphically by a bent line approximating to the form of the letter L. There is a rapid decrement on the side beginning with the metal belonging to class B (copper in the case referred to) until a certain point is reached, when the line turns and goes straight to the metal belonging to class A (tin in the case cited).

In alloys made of the metals belonging to class B only, the conducting power of each component undergoes a marked change, hence such alloys do not conduct electricity or heat in the ratio of the relative volumes of their component metals. The curve which represents graphically the conducting powers of a series of such alloys, say those of silver with gold, has approximately the form of the letter U. There is a rapid decrement on each side of the curve, and the turning points are connected by a line nearly straight.

The turning points of the curves representing the conducting powers of series of alloys of the second and third groups, necessarily correspond to certain alloys in which the alteration of the physical properties of the components is most strikingly exemplified. It is a fact of no small importance, therefore, that these turning points represent approximately the composition of some of the most valuable alloys which are employed for technical purposes. Thus, gun metal, containing 10 per cent tin, is marked on the copper-tin curve, the turning point of which corresponds to 12·5 per cent tin. Brass, containing 28 per cent zinc, is marked on the copper-zinc curve, the turning point of which corresponds to 25 per cent zinc. Twenty-two carat gold, alloyed with silver, is marked on the silver-gold curve, close to one of its turning points, and the same alloyed with copper, on a corresponding portion of the copper-gold curve. Again, a silver-platinum alloy, containing 33 per cent of platinum, employed by the electrical standard committee for their unit-coil, and largely used by dentists for making springs for artificial teeth, is the alloy which forms the turning point of the silver-platinum curve.

Further experiments demonstrated the fact that alloys of class B with those of class A give a great increase of sonorousness.

The following experiments were made to test the tenacity of metals and alloys. with the annexed results. The tension was made by the use of a winch, and measured by a spring balance. The wires used were double, gage No. 23:

	Breaking strain for double wire.	
Tin	under	7 lbs.
Lead	"	7 lbs.
Gold	about	25 lbs.
Copper	"	30 lbs.
Silver	"	50 lbs.
Platinum	"	50 lbs.
Iron	"	90 lbs.
Tin-lead alloy	under	7 lbs.
Tin-copper alloy (12 per cent copper)	about	7 lbs.
Copper-tin alloy (12 per cent tin)	"	90 lbs.
Gold-copper alloy	"	75 lbs.
Silver-platinum alloy	"	80 lbs.
Steel	above	200 lbs.

These results show that the tenacity of metals belonging to class B is greatly increased by alloying them with metals of the same class. By experiments with spirals of hard drawn wire of the same gage it was shown that elasticity follows the same law as tenacity.

The practical conclusion drawn from the facts illustrated by these experiments was, that when a new alloy is desired which shall posses some special physical property, an examination should first be made of the alloy indicated by the turning point of the curve which represents the conducting power of the two metals.

We consider these conclusions to be of the greatest importance, and venture to predict that through their application during the next decade many valuable discoveries will be made, and a new impulse given to the art of metallurgy.

THE WATCH---ITS HISTORY AND MANUFACTURE.

BY H. F. PIAGET.

No. 3.

THE SELECTION OF WATCHES.

Were it possible to give rules for the selection of watches, society might be benefited, as the young man who has a bad watch is less likely to obtain habits of punctuality than he who has a good one. I once heard an anecdote of two young persons who were allowed to select watches for themselves. One chose a plain watch, from being told that its performance could be depended upon. The other, attracted by the elegance of the case, decided upon one of inferior construction. The possessor of the good watch became remarkable for punctuality, while the other, although always in a hurry, was never in time, and discovered, as a celebrated writer justly observes, "that next to being too late, there is nothing worse than being too early." Unfortunately, no efficient instruction can be given, as none but a workman possessing the highest knowledge of his art is capable of forming a correct opinion, and a watch must be bad indeed for an inexperienced eye to detect the defects, either in its principle or its construction. Even a trial of a year or two is no proof, for wear seldom takes place within that time; and while a good watch, if in order, can but go well, a bad one may by chance occasionally do so.

I have myself seen some of the old rack lever watches that were more than fifty years old, and worn constantly, nearly as good as new, by having been properly attended to, and in time. It is not sufficient that a watch be well constructed, and on good principles. The brass must be hard, and the steel properly tempered. The several parts must be in exact proportion, and well finished, so as to continue in motion, with the least possible friction. It must also be made so that when taken to pieces all its parts may be replaced as firmly as before.

A watch thus constructed and properly adjusted will continue its motion and correct performance for years without trouble, and with little expense, except occasionally cleaning. A bad watch is one to which no more attention has been paid to the proportions of the parts or durability of materials than was necessary to make it perform for a time. It is either the production of inefficient workmen, or of those who, being limited in price, are unable to give sufficient time to perfect their work. There is a great fault in many watches and movements, sent both from England and Switzerland—they are not properly examined, adjusted, and regulated, before exported.

Formerly, and it is still the case in many instances, the most eminent watchmakers were all practical workmen. At present, there are but few manufacturers who work themselves, and if they do, have not time to see to every watch sent away. Those who value the reputation of their watches have a practical workman, one who understands thoroughly every branch of the business, who is called the examiner, whose duty it is to take every part and see that it is properly made, adjusted, and put together on correct principles; for where a piece of mechanism like a watch is made in so many parts or pieces, it is next to impossible but some slight oversight or imperfection may occasionally occur. The examiner or manufacturer then regulates every watch or movement (if correct) before being sold.

But latterly, the competition for cheapness has been so great that in many cases the examiner is dispensed with, as good examiners are paid very high wages—it being necessary for him to have considerable skill and experience before being entrusted with such an important position. Also, many watch manufacturers have not the opportunity of examining every watch, in order to fulfill their orders in time at the busy season, and many watches, particularly cheap ones, are merely *going machines*, and not time-keepers.

Another fault with many watches sent from Europe to this country, is that the oil has not been changed; the oil mostly used in the manufactories will not do in this climate, and but few watches will perform correctly until the oil is changed. Still, another fault, and one which often brings discredit on a good maker, particularly in cheap work, is that when the watch or the movements are cased in this country, the movements go in the hands of workmen, who merely take them down for casing, or are paid so little for the work that they cannot properly examine them, and correct any oversight or imperfections in manufacturing, and frequently have to do the work in great haste; if the balances only vibrate with a good motion, it is all that is wanted of them. Bad watches in some instances, with strong springs, will go well for a time, but as they wear from friction, they require frequent repairs, which cannot effectually be done, for in correcting one defect in a badly constructed watch. you frequently find several others, which could not be discovered before.

The principal cause of imperfect watches is the universal desire of obtaining them for as little money as possible, and to reduce the work of watchmaking to the same value, is to compel good workmen to produce bad work.

When an art is difficult to learn, requiring much knowledge and study, with years of experience, the number of really good workmen will be few, and therefore employed by those who can offer the best remuneration. Few can judge of a machine, the accuracy of which depends upon the most minute correctness of principle and execution; it is not wonderful, therefore, that there are numbers of bad watches, since a portion of the public considering them as mere ornaments, or in many instances only bought to trade, and not for use as time keepers, procure them from dealers who, however just and honest they may be, can never possess that knowledge which is only acquired by long practice in that particular art, and may therefore be themselves deceived. Those, also, who in order to meet the general desire for cheapness sell at low prices, can only do so by producing inferior watches, for a greater division of labor, or use of machinery, can scarcely be brought into operation. The workmen are therefore compelled to do the greatest quantity of work in the least possible time, and good work in watches must not be slighted. It is often supposed that the principle on which a watch is constructed must determine its quality. This is far from being the case. A duplex watch may be very bad if not well made and the escapement in its true principle. A chronometer watch with the same fault is still worse, while a common vertical watch may be good if well made. I have seen good vertical watches which had been in constant use for upwards of fifty years, with new verges put in occasionally, and kept reglarly cleaned, which were still much better than many of the full jeweled levers made at the present time. To make one watch better than another, execution must be added to principle.

It may be here mentioned, that undue importance is frequently attached to watch jeweling; many low priced and bad watches have eight or ten holes jeweled, while many that are good have but four. To state the number of holes which ought to be jeweled, would require details ill suited to a work which is merely elementary. But when it is known that in common watches the holes can be jeweled in Europe at less than fifty cents each, it will be seen that the number of holes jeweled affords no criterion by which to estimate the value of a watch. But in fine watches, which are jeweled with rubies and are highly polished, the cost is four times more. Therefore the judgment of the seller may be fairly questioned, should he attach much importance to the number of holes jeweled. The high sounding description, the maker's name (unless it is genuine), the offered trial, the enticing cheapness, are often effective baits to the short-sighted.

It has already been shown that the principle of a watch is no proof of the excellence of its quality, the beauty of its case, etc., in no way effects its works, and even the offered trial is not a sufficient test. The purchase of a very cheap watch may teach the useful lesson, that low price is not exactly the word for cheapness. The size and form of a watch are determined by fashion or convenience, and although the appearance is of less consequence to a person buying one for his own use than the quality, yet no reason exists why a good watch should not be handsome, while many that are showy and handsome are good for nothing as time keepers, and are merely useful as articles of trade.

The individual who wishes to procure a good time-keeper should apply to a watchmaker or dealer of known honesty and ability in his art or business, and who therefore should be implicitly trusted. The various prices will point out the comparative qualities of the works, for the external ornament of a good watch form but a small portion of the expense. In regard to choosing either an English, an American or Swiss watch, circumstances must in many instances determine that. There are good makers in each country. If you have a preference for any particular maker, be sure to get one with the genuine name engraved on it. For a moderate thick watch, choose an English or American watch; for a thinner watch, or one of small size for a lady, take a Swiss one, as Swiss watches are to be preferred for small size, style, and lowness of price. With the exception of size, the appearance of a watch is totally independent of its quality as a machine—it may be handsome, yet bad. But a good watch is seldom unsightly, for the knowledge of form, indispensable to a good watchmaker, is doubtless the reason why watches made by good makers generally look well, although they have become antiquated. With regard to size, although there is no necessity for the large, thick watches worn some years ago, yet those very flat and small are deficient in the first principles required for correct performances and durability, and are more easily spoiled by unskillful workmen in repairing. Although all the parts may be in equally reduced proportion, the very particles of the metals, the more rapid decay of the small portion of oil which can be applied, and the limits to the visual power of man, must ever prevent a very small watch from being as serviceable as one of moderate size; that is, the smallest consistent with accuracy and durability. The large, thick, old style of watch is less absurd than some now made. Reason may justify the one, while fancy is the only apology for the other.

There are other circumstances which must also determine the choice. If the purchaser is going in parts of the country where he may not find skillful workmen in case of an accident or repairs, he should procure a watch constructed on a principle generally understood, and which can be easily arranged when out of order.

The preceding remarks are all that suggest themselves as useful to the inexperienced in selecting watches. More detailed instructions would explain the construction of the machine, and might be interesting to a few, in particular to watchmakers—there are works published for their use and instruction; but to be able to discover the quality or imperfections of a piece of mechanism so minute and complicated as a watch, requires knowledge and patience attainable only by a long experience. I will therefore explain the different kinds of watches made, and leave it to the purchaser to make his selection.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

Do We See the Sun so soon as it Rises?--Aberration of Light.

Messrs. Editors:—When there are books, as stated on page 277, in which it is laid down that "as it takes light eight minutes to come from the sun to the earth, we do not see the sun until eight minutes after it has risen," then such writers, in order to be consistent, must also state that as it takes light one second to reach us from the moon, we see her at the place she left only one second ago; and as it takes light three, ten, or a hundred years to come from different fixed stars to the earth, we now also see those different stars at the place they occupied three, ten, or one hundred years ago, which is perfectly absurd; this might perhaps be the case if the earth stood still and the stars revolved. As however the earth moves between the sun and fixed stars, which are comparatively at rest, leaving out refraction or other disturbing elements, we see the sun, not eight minutes after it has left the place where we see it, but we see the sun (not only at sunrise but always) twenty seconds of a degree in its apparent orbit ahead of the place it really occupies. This may appear paradoxical, but I will prove it to be the fact.

EFFECT OF ATMOSPHERIC REFRACTION.

It may be well to dispose here of refraction, notwithstanding it is left out of account, its knowledge is related to our subject. It amounts at sunrise and sunset to about half a degree, thus equal to the apparent diameters of our sun or moon. We see, therefore, those bodies when rising or setting so much higher than their true position, so that when they are exactly below our horizon, so that this is in line with their upper edge, we see them above our horizon, touching it with their lower edge, as the apparent motion of the sun amounts to 15° per hour, or 30′ in two minutes' time, its apparent place, when rising almost perpendicular, is, at sunrise, two minutes ahead, and at sunset as much behind his real position. In winter and at high latitudes where the sun rises and sets in an orbit not perpendicular but very oblique to the horizon, its displacement by refraction is not in its orbit, as it is always an apparent lifting up, vertical to the horizon.

DISCOVERY OF THE ABERRATION OF LIGHT.

The problem of the combined effects of the velocity of light and the earth's motion, has been solved by the astronomers of a former century, and is known as the theorem of the aberration of light. Its theoretical solution is in perfect accordance with the minutest practical observations, made with the most elaborate and largest astronomical instruments, which in some observatories of Europe have been constructed, chiefly for the special purpose of measuring the amount of this aberration. The history of this discovery, and of the gradual development of its theory is very interesting, but would occupy many pages of this paper and therefore must be passed by. I will only state that it means the apparent displacement of all heavenly bodies by the motion of the earth, that its amount is independent of their distances from us, that it is zero for those bodies, towards or from which the earth is moving in its yearly orbit, and at its maximum for those placed at right angles to the direction of this motion.

EXPLANATORY ILLUSTRATION OF ABERRATION.

To understand this combined effect of the earth's motion with the transmission of light, let us imagine rain-drops to fall down like they do in a perfect calm, perpendicular to the earth's surface. Let us now suppose we are standing on the platform car on a railroad track, and rapidly moving forward or backward; when moving forward the rain drops will strike the front part of the body, and will appear to arrive under an angle, deviating forward from the perpendicular and greater in proportion as the motion of the car becomes more rapid. When moving backward, the opposite will be the case, the rain-drops will strike from behind at an angle which also will deviate more from the perpendicular in proportion as we are moving faster. In both cases the rain will appear to us to arrive or come down from a direction inclined towards the side we are moving to, and not perpendicular as is really the case.

APPLICATION TO THE ABERRATION OF LIGHT.

Now this is exactly the case in regard to light coming from the heavenly bodies. When we compare the direction of the rain-drops with that of the light, and the motion of the earth in its yearly orbit with the moving railroad car; when the light comes to us at a right angle with the direction in which the earth is moving, it will cause an apparent change in the direction of the light, and consequently in the apparent place of the heavenly body the light is coming from. If the velocity of the earth's motion in its yearly orbit was much slower than it really is, so that it was to our instruments incomparable with the velocity of light, it would exert no influence on its apparent direction; but it happens to be so rapid that the relation is quite within the pale of actual measurement, as the following calculation will demonstrate.

SIMPLE CALCULATION OF THE AMOUNT OF ABERRATION OF LIGHT.

The earth moves in its yearly orbit with a velocity of nearly 70,000 miles an hour, the light is transmitted at the rate of 650 million miles an hour, which is 9300 times faster than the velocity of the earth. When now we take in consideration that an equal velocity of both would change the direction of the perpendicular or 90° into its half or 45°, we see that a velocity of only $\frac{1}{9300}$ will deviate the angle only to $\frac{1}{9300}$ of 45°, or 18 seconds; which, however, ought to be corrected trigonometrically, (for which we have here no space) to about 20 seconds. This now must be the maximum aberration produced by the yearly motion of the earth, on the position of all stars observed at right angles to the direction of that motion. They must all appear displaced to an amount of 20″ forward to the direction of the earth's motion, and this is the most easily observed in all those placed at about right angles to the ecliptic. As the earth moves in its yearly orbit around the sun in the opposite direction it did exactly six months before or after, the apparent displacement or aberration must for the same stars near the ecliptic pole be 20″ in one direction, and six months afterward 20″ to the opposite side of the heavens, making in all 40″ displacement in their positions; they therefore will yearly appear to move in small circles of $\frac{2}{3}$ of a minute in diameter.

ACCORDANCE OF THEORY WITH OBSERVATION.

This now is actually and exactly the case. It takes, of course, very perfect apparatus to observe seconds of degrees, but the more correct and minute the observations have been made, the more they correspond with this theory; for stars around the poles of the ecliptic it is proved fully 40″, for those toward the ecliptic less, and finally for those in the ecliptic, for the time that the earth is moving towards or from them, no aberration whatsoever can be observed.

INFLUENCE OF THE EARTH'S DAILY MOTION ON THE APPARENT PLACE OF THE SUN.

The velocity of the earth's equator by the daily rotary motion, is 1500 miles per hour (only that of a cannon ball), and being thus about fifty times smaller than that of the yearly velocity, would in the most favorable circumstances cause an aberration of less than half a second, which is almost imperceptible by the at present existing most correct instruments, therefore it may be left out of our calculations.

As the daily rotation of the earth cannot to any perceptible degree have any influence on the apparent position of the heavenly bodies, it can have no influence whatsoever on the apparent position of the sun, even at midday, and much less at sunrise or sunset, when this rotation turns us toward or from this luminary.

APPARENT DISPLACEMENT OF THE SUN BY ABERRATION PRODUCED BY THE EARTH'S YEARLY MOTION.

It is only the yearly motion of our earth then, always nearly at a right angle to the position of the sun, which displaces this body apparently, but always in the same direction, to the amount of about 20″, to that part of the heavens toward which the earth is moving at the time of the observation; and as this yearly motion is from east to west, like the apparent daily motion, it must cause an apparent displacement of the sun also towards the west, therefore ahead. The daily rotation is retrograding in regard to the yearly motion, for those parts of the earth's surface where it is midday, and accelerating where it is midnight; at the equator this would diminish the sun's aberration less than half a degree, and in higher latitudes even less, therefore the effects of the daily rotation may be neglected.

RECAPITULATION.

Displacement of the sun upward, observed when at the horizon, caused by atmospheric refraction, 30′ of a degree and 2″ in time. Displacement of sun, forward aberration caused by the earth's yearly revolution as any where observed, 20″ of a degree, $1\frac{1}{3}''$ in time. Displacement of sun, backward aberration by daily rotation observed at the equator at noon, $\frac{1}{2}''$ of a degree, $\frac{1}{30}''$ in time. Displacement of sun, aberration by daily rotation observed near the poles, 0.

New York City. P. H. Vander Weyde, M. D.

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Velocity vs. Power.--The Value of the Indicator.

Messrs. Editors:—I was much gratified with your article on "Shafting and Belts—Absorption and Transmission of Power," in No. 16, current volume. Permit me to make a few remarks on the same subject.

That the indicator does determine, in the only positive and correct degree, the power developed by the steam engine, has come to be an established and indisputable fact. It has necessitated the abandonment of many beautiful theories, both in regard to the length of belts and the velocity of shafting. Many suppose that an engine of say eighty horse power, should work up to its maximum under all circumstances, and yield that amount of useful power, whatever the length of the driving belt, the relative position of driver and driven, or the velocity of the shafting. The engine that drives its shafting at six hundred revolutions cannot be supposed to yield such an amount of power as one that jogs along at one hundred and eighty. Velocity is a great absorbent of power, and in the first case a very large percentage of the real power of the engine is taken up by the friction of the shafting.

An experiment was recently made to determine the relative amount of power required to drive ring spinning frames at differing velocities. The result was as follows: Thirty-six frames of one hundred and twenty-eight spindles each, one and a half inches ring, running at 6,400 revolutions absorbed, exclusively of necessary friction of shafting and engine, 59.36 indicated horse power; at 6,000 revolutions, 52.78; at 5,400 revolutions, 51.21, and at 4,800 revolutions, 47.38, the other conditions being the same in each case.

More care should be used in the proportions of engines, as well as in the arrangement and velocity of shafting. Some engines have their pipes, valves, and ports too small to ever allow an approximation to the boiler pressure. Some users of steam believe that if an engine has a cut-off it *must* work on the expansion of steam to perhaps double its intended capacity. If valves are properly set, and the ports are of sufficient area, we shall not find, so often as we do now, one end of the cylinder doing from sixty to eighty per cent of the work. It is a wonder that some engines run at all, and they would not in some cases perform a revolution but for the momentum of the fly wheel. The indicator is the instrument for ascertaining these difficulties, and the time will come when it will be held in the estimation it deserves. He who makes its manipulation his specialty, should also understand how to remedy the defects his instrument discovers. He should be able to adjust the parts of the engine, and also ascertain the points at which the power is absorbed by improperly placed shafting, belts, and pulleys. T. P., Jr.

Providence, R. I.

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Cutting Mirrors.

Messrs. Editors:—Your correspondent "A. M. S., of Mass.," in reference to cutting small mirrors from large ones, is evidently an unskilful operator in the use of the diamond. A pure, clean diamond cut will separate silvered plate just as cleanly as ordinary glass, and without in the least degree injuring the silver. Solutions or other preparations are rather injurious than otherwise, owing to the contraction in drying, tending to "drag" the amalgam.

The chief danger in cutting silvered glass, lies in the unguarded manner in which some undertake the work. Secure a steady, level table; spread evenly thereon a piece of cloth or flannel, free from lumps, chips, drops of hardened glue, etc., (so frequent in workshops); measure off the desired size, and with a skillful confidence put in the cut, taking care not to change the angle of the diamond as the hand is drawn toward the body; commence the breaks at the end where the diamond leaves the glass.

A word as to the cutting properties of the diamond might not be out of place in this connection. Not over one-half of those who use this tool do so intelligently. A true diamond cut in ordinary glass, is a beautiful, clear, hair-like line scarce observable, and noticed plainly in silvered glass only on account of reflection. The usual so called "*cut*" with many is a heavy white line, *something they can see*, or they are not