MARCONI'S PLANS.

MR. MARCONI was the guest of honor at the annual dinner of the American Institute of Electrical Engineers at the Waldorf-Astoria, New York, on January 13. Even the decorations were arranged in compliment to the inventor. At one end of the room the name of St. John's blazed in electric lights; at the opposite end the name Poldhu, and between these the electric current played like a lambent flame along cables, upon which at intervals were three dots, or more particularly, three very small incandescent lights in a group, the experimental letter "S" which Marconi flashed from Cornwall to Newfoundland.

Mr. Marconi, in a very interesting speech which held the closest attention of everyone in the room, not only described something of what he had done and what his aims were, but let it be known that according to his first intention these transatlantic experiments were to have been made between England and the United States, instead of England and Newfoundland.

Mr. Marconi, in his address, expressed his thanks and gratitude for the great reception and said that he was highly honored to be entertained by such an important body, as it was well known all over the world that America stands first in electrical engineering. He felt deeply the compliment of being honored by men whose names were household words all over the world.

Turning to what had been accomplished under his invention, he said that more than seventy ships now carry permanent installations for operating with wireless telegraphy. Of these thirty-seven are in the British navy, twelve in the Italian navy, and the others are on Atlantic liners. There are more than twenty stations, he said, in Great Britain and on the continent of Europe, with other stations here or soon to be here.

"I think I am right," he said, "in saying that there is a general belief that when a message is once intrusted to space by this system, any one with a receiver may pick it up. This objection to the earlier form of operations has recently been largely overcome. It has been found possible so to attune one transmitter to one receiver as to make it practically impossible for any one not acquainted with the qualities of those particular instruments to read the message."

"This is not the case with the installation on ships, because when a ship wishes to communicate with another in emergency she wants to be able to call up any other ship within range. For this reason, the installations on all ships are uniform, but on land or between lands we now use attuned installations. It was found possible by attuned instruments to cross 200 miles of land and that the power required for this was only such as is wanted to run a small incandescent lamp."

"It was then determined to erect two comparatively powerful installations, at Cornwall and at Cape Cod, for the conduct of experiments across the Atlantic. Unfortunately a hurricane partly destroyed the installation at Cape Cod and necessitated a postponement for some months. Rather than let the interval go by, it was thought well by a temporary installation at St. John's to try to cross 2,000 miles of ocean rather than 3,000 miles; so the attempt at Newfoundland was made with kites and balloons."

"Work with these meant a great deal of trouble, owing largely to tempestuous weather, but for a short time the kites were got into a correct position, and we got a succession of signals at the right time and at a prearranged speed. This was doing pretty well for an installation dependent on wind and weather."

"We should have done more there, except for finding out that the Anglo-American Cable Company had a monopoly of all forms of telegraphy there, and seemed to claim in a certain way a monopoly of the air and the sea. In England the British government has a monopoly of the telegraph, but I am glad to say that the government rather encouraged my work than attempted to interfere with it."

"The government did not seem to think of interfering with experiments made in the interest of science, but in Newfoundland the cable company did, although the manager of the company there told me that they got 50,000 words through in three days, owing to my presence."

"It was thought better not to put up a permanent installation in such a place, and so it was decided to cross to Nova Scotia, ninety miles away, and I think that a permanent station will be established there and that the one at Cape Cod will be repaired."

"I do not wish to be too confident, but I think that it will be possible in a short time to transmit a message, or perhaps several messages at the same time across the ocean in a commercially practicable manner. I think that it will be possible to bring about communication between people far apart at greatly reduced rates. Those at present are beyond the reach of people of ordinary means, but should my dream be realized, the cost of cables may be very substantially reduced, and another link will be forged in the ties that bind this country to Great Britain."

"I desire to say in this presence that I have built very greatly on the work of my predecessors, and I wish to mention Maxwell, Lord Kelvin, Prof. Henry, Prof. Hertz, Prof. A. G. Bell. Had it not been for the invention of the telephone I do not know whether at this date we should have received messages through the air across the Atlantic. They might have come later with greater power, but by the aid of the telephone they have come now."

For our engraving we are indebted to the Illustrazione Italiana.

CONTEMPORARY ELECTRICAL SCIENCE.*

MAGNETIZATION BY LIGHTNING.—Some further results of the exposure of basalt rods to induction by lightning are communicated by F. Pockels. The rods were mounted near the lightning conductor of the Monte Cimone Observatory. One rod was mounted in its

place in September, 1900, and could not be removed until June 3 of this year, owing to the configuration of the snow. The magnetization indicated a maximum current intensity of 5,600 amperes in the lightning flash. But as the date of the flash is unknown, and much of the magnetization may have been lost, this figure only represents a lower limit, two further rods, recently influenced by lightning discharges of known date, showing magnetizations indicating a current strength of 5,000 and 3,600 amperes respectively. Since they were attached to the two branches of the earthing conductor respectively, it may be assumed that the total current strength of the flash was 8,600 amperes, or a little more. Some other rods exposed to a flash on August 13 showed no trace of magnetization, and the author supposes that there are oscillatory lightning discharges, and that this was one of them. It would be well if personal observations of the flashes could be simultaneously recorded.—F. Pockels, *Physikal. Zeitschr.*, October 15, 1901.

IONIC VELOCITIES IN GASES.—The ratio of the velocities of negative and positive ions in point discharges through gases has been put at values ranging from 1.32 (Zeleny) to 1.58 (Townsend), the negative ions being invariably the more mobile ones. K. von Wesendonck inquires whether this peculiarity can be brought into harmony with the conductivities of the various gases for point discharges. It is well known that oxygen does not encourage negative discharges more than positive ones. Sieveking found, in fact, that a positively charged point discharges more easily in oxygen than a negatively charged point. In nitrogen, on the other hand, the negative current is several times, and according to Warburg, several hundred times stronger than the positive current. As the ionic velocity is always greater for negative than for positive ions, it follows that these velocities cannot be the determining element in facilitating the discharge. The author suggests other determining elements, such as dust, disintegration, occlusion, and chemical attack.—K. von Wesendonck, *Physikal. Zeitschr.*, November 1, 1901.

RECTIFIERS FOR X-RAY WORK.—The difficulties in the way of working X-ray tubes with alternate currents are serious, as the tubes flicker unless the current traverses the induction coil in only one direction. E. Knoblauch found that even Ruhmer's new interrupter could not be used with an alternate current of 50 periods and 110 volts, probably on account of the voltage being too low. But since it is specially desirable to be able to use low commercial voltages, he used the expedient of introducing an aluminium rectifier in the circuit, consisting of a lead and an aluminium electrode immersed in a 20 per cent Seignette solution. It is thus possible to use Wehnelt, Simon, and even mercury-jet interrupters. All of them worked faultlessly after introducing the rectifying cell, and the Roentgen tube showed a sharp division of the two halves, thus proving that only one phase of the alternate current is transmitted to the interrupter. The electrolytic interrupters all require somewhat strong currents, and thus lead to greater wear of the Roentgen tubes. Mercury-jet interrupters do not require great current strengths, and the use of the rectifying cell as described is, therefore, specially recommended in their case.—E. Knoblauch, *Physikal. Zeitschr.*, November 1, 1901.

THE "LATENT HEAT" FALLACY.

By R. H. THURSTON, Professor of Engineering, Cornell University.

THE accounts of the new ether vapor engine recently appearing in the Paris technical journals and one of which was reproduced in the *SCIENTIFIC AMERICAN*, January 4, 1902, revamp an old, and apparently still vigorous superstition among inventors. It is of such general acceptance and of such importance in its tendency to lead both inventors and investors astray and to waste time, talent and money, that it should be shown to be a fallacy so effectively that, among readers of the *SCIENTIFIC AMERICAN* at least, there can be no longer the slightest doubt.

In the article above referred to, it is said that the inventor of the new ether engine was induced to seek its perfection, being as stated, "struck by the theoretical advantages of ether over steam." The anticipated gain in the ether engine is assigned to the fact that whereas, in the case of the steam engine, in the exhaust "it has lost without utility the 971 British thermal units furnished to every pound of water in order to cause it to pass from a liquid to a vaporous state," this loss "may be notably diminished by using, instead of water, a volatile liquid that does not possess such great latent heat of vaporization."

So far from the truth are these statements that it would be more correct to reverse them. Rather than being a source of waste and loss of efficiency, so-called "latent" heat, and nothing but "latent" heat supplies the power of heat engines working in the most perfect cycle, attaining the highest possible efficiency and performing the largest possible quantity of work per unit of working fluid and of heat supplied from the fuel.

In the ideal gas engine of Carnot, the "perfect engine cycle" being employed, this transformation of energy affects the "latent heat expansion" of the gas and "latent" heat only; in the steam, ether, or other vapor engine, this heat, in the perfect engine cycle, with maximum possible efficiency, is the "latent heat of vaporization," and "latent" heat only. In neither case is sensible heat transformed at all; only "latent" heat is utilized.

In the gas engine of Carnot, every unit of heat entering the fluid in the progress of expansion is instantly converted into mechanical energy and work. The flow of heat into the charge occurs continuously at a constant temperature and the flow of energy out of the charge is just as continuous; and in the inflow of thermal energy and the outflow of its equivalent transformed mechanical energy, the one precisely balances the other, the air or gas neither gaining nor losing sensible heat in the process. The thermal line on the indicator diagram exhibiting this process is "isothermal." The Carnot cycle consists of a pair of isothermal lines, top and bottom, crossed by a pair of "adiabatics" along which no heat is either received from the

furnace nor given up to the refrigerator and along which the heat stored by conversion into work during expansion is restored during the later compression. All the heat received by the charge is received at the higher temperature and wholly converted into work, and all the heat rejected is rejected at the lower isothermal in the process of holding down the temperature of the working substance to a constant minimum.

The principle of Carnot is thus complied with and all heat passing from the source to the working fluid is received by the latter at the highest possible temperature, at a constant temperature, and all heat rejected into the refrigerator, condenser or other receptacle for that heat, is rejected at a constant and minimum temperature. This may be paraphrased and we may say that, in the heat engine of maximum possible efficiency, the range of temperature employed is made, and is retained, a maximum entirely across the cycle. The difference between heat received and heat rejected is necessarily a measure of the thermodynamic conversion of energies.

The steam or ether vapor engine, working in the most perfect cycle, also complies with the Carnot principle. Its indicator diagram consists of a pair of constant-temperature lines, "isothermals" (which, in the vapor engine cycle are also lines of constant pressure), crossed by a pair of "adiabatics." The maximum temperature is that of vaporization, and all heat entering the charge enters as "latent heat of vaporization." All heat leaving the working fluid leaves it at the temperature of condensation, at the lower limit of pressure, both of which remain constant during the process, and the line is both isothermal and of constant pressure. This rejected heat is that which, with reversal of this action, at that lower temperature and pressure level, would be the latent heat of vaporization at that lower limit. The pair of adiabatic expansion and compression lines do not either give the charge heat, from the source, or reject heat into the refrigerator or condenser; they temporarily transform heat into work in expansion, restoring it during compression, and all change of temperature in either direction is due to this action.

Thus all heat supplied for transformation into work is supplied as "latent" heat and the approximation of heat engines to perfection is the more complete as they evade the transformation of sensible heat and secure their mechanical energy by utilization of "latent" heat. The defect of the ordinary heat engine is evidently not that it employs a fluid having a large measure of so-called "latent heat," but rather that it does not employ "latent" heat and nothing but "latent" heat.

Carnot showed, as long ago as 1824, that, as he stated it, "the maximum of motive power resulting from the employment of steam is also the maximum of motive power realizable by any means whatever."

He further asserted, at that time: "The motive power of heat is independent of the agents employed to realize it; the quantity is fixed solely by the temperatures of the bodies between which is effected, finally, the transfer of the caloric."*

It has thus been perfectly well known for many years that the inventions by which it has been sought to evade the utilization of latent heat in the vapor engines, by substitution of other fluids, have been based upon a fallacy. In fact, the reasons given by these inventors for the use of other vapors logically compel the adoption of a gas for the heat engine, not ether, chloroform or ammonia, and the air engine should be substituted for all steam engines—if they are correct.

But while this is true and while, thermodynamically, there is no intrinsic advantage in the use of one fluid rather than another between two specified temperatures, and while the latent heat theory here criticized is a pure fallacy and quite the opposite of the truth, it does not at all follow that, practically, all substances are equally available for heat engines. There are other conditions and many controlling circumstances which determine choice. The subject has often been studied by engineers and men of science and, although it has commonly been concluded that, of all the available fluids, none is on the whole superior to water for this purpose, it does not necessarily follow that there may not be cases in which some other substance is more desirable or even that some other substance may not practically permit a larger transformation of heat into work. In the operation of heat engines, the temperature and pressure limits are always more or less fixed by external conditions and we cannot attain higher temperatures in the steam engines than those of steam of the highest safely controllable pressure, or higher pressures in the gas engine than those accompanying the highest safely controllable temperature; nor can we adopt a lower temperature for our minimum than that of the external world. That working substance which most perfectly adapts itself to these limits and, within them, provides the best adjustment of temperatures and pressures and highest net return of work for heat, it economically best—always provided its use is consistent with highest financial returns and contributes to the production of good dividends by affording a decided profit over all costs.

Thus the fallacy of the idea of the inventors of the ether vapor and similar engines becomes evident. So-called "latent" heat is the desirable form of energy in heat engines. In fact, probably, this confusion in the minds of the uninformed respecting "latent" heat arises from its unfortunate cognomen. "Latent" heat is, in fact, heat transformed into work and the work on the steam engine piston, for example, during the forward stroke of the piston up to the cut-off, is not performed by the steam in the engine, but by the steam at the instant forming in the steam boiler, which pushes out of its way the superincumbent steam and, through that displacement, pushes the piston, thus doing the work shown on the indicator diagram up to cut-off.

That this "latent" portion of the heat supplied is most efficiently utilized, rather than, as claimed, completely wasted, is easily seen by anyone who will take the trouble to compute—as did Mr. G. H. Babcock many years ago†—the weight of steam per horse power hour

* Carnot, Thurston's trans., pp. 55, 68; N. Y., J. Wiley & Sons.
† Manual of the Steam-Engine, Vol. I., Sec. 112.

* Compiled by E. E. Fournier d'Albe in The Electrician

required by even the ideal engine, under common conditions of temperature and pressure, assuming all "latent" heat wasted and only the sensible heat taken up by the feed-water being thermodynamically utilized. It will be found that, in the example taken, nearly 90 pounds would be demanded, where the "perfect-engine cycle" would do the work on less than 10 pounds. Again, a steam engine receiving 20 pounds of steam per hour would only thus receive about 200 B. T. U. per pound, 155,600 foot pounds of energy, or less than one-tenth horse power per pound, 2 horse power from 20 pounds, of which it might utilize one-eighth. In other words, "latent" heat performs the principal part of the work in the steam engine.

The volatile fluids, like ether, ammonia, chloroform, carbon disulphide, sulphur dioxide, etc., may prove to have their uses in heat engines, but for quite other reasons. They may permit the utilization of low-temperature heat in paying quantity. This, at the moment, is a question which is particularly interesting to the engineer in view of the claims based upon the Berlin experiments of Prof. Josse.

To utilize low-temperature heat, if we are to find that profitable at all, we must employ other fluids than steam, simply because, at those low temperatures at which we exhaust steam from the cylinder, ordinarily, the pressures are too low to drive our machinery and because the size of engine required to handle the steam for any stated power becomes enormously and impractically large. A working fluid giving the general action of steam, but with comparatively high pressures at and below the temperatures of exhaust of the steam engine, if unobjectionable on the score of cost, direct and incidental, or of danger or serious inconvenience, might add a large fraction to the power derivable from the use of heat or of fuel employed. This last is the line of improvement which has been sought so often during the past two generations by inventors of the "binary-vapor engine." It is here, if anywhere, that the volatile liquids may find their place in the heat engines.

This field of invention is open to all. The idea is very old and such patents as are fundamental have probably all long ago expired, leaving the would-be inventor entirely free to seek a way of utilizing low-temperature heat in volatile fluids and high-temperature heat equally far removed, apparently, from the range of the ordinary steam engine by the employment of other fluids appropriate to that higher portion of the scale of temperature.

THE NEW UNITED STATES WARSHIPS.*

No warships, perhaps, have had so many vicissitudes as the United States battleships of the "New Jersey" class. Once again they have been definitely decided on, permanently, perhaps, now; but it need not be forgotten that earlier designs have been "final" also. There is no getting away, however, from the fact that each new finality has been better than preceding designs. As with each the displacement has gone up this is not to be wondered at; but the great and essential point is this increase of displacement. In the past American ideals have tended to "whip creation" with the minimum of displacement; now obviously nautical influences can be seen at work, with the result that we observe an honest striving after a real best in place of what—rightly or wrongly—has hitherto been under suspicion of being rather a paper best. In fine, America is now definitely settling to building American warships to American needs.

The new battleships are to be of 17,604 tons normal displacement, 450 feet long by 76¾ feet beam by 26¾ feet maximum normal draught—the relatively small draught being necessitated by the depth of water about the American coast. Our 16,500-ton "King Edward" class will be, therefore, small ships beside them. The main belt, 9¼ feet deep, will be 11 inches thick on the water-line amidships, this thickness soon fading to 9 inches, and diminishing to 4 inches at the extremities. Here, then, we have the maximum of moderation in the disposal of the 4000 to 4500 tons odd of armor. No weights have yet been published, but, very approximately, this belt can be put at about 1500 to 2000 tons odd. A 7-inch belt protects the lower deck above—roughly, another thousand tons nearly. This, of course, includes bulkheads. The balance of the armor goes to barbettes, turrets, and battery. The armament will be four 12-inch guns in the usual turrets, eight 8-inch at the angles of the superstructure—the somewhat amateurish superposed turret idea being discarded; and ten or twelve 7-inch guns in the battery, protected by 7-inch armor. This 7-inch gun is a piece yet to be built. It is to be adopted because it "will pierce 7 inches of armor at 3000 yards." At sea, in battle, it is not likely to do anything of the sort, and the carrying of armor-piercing projectiles for the purpose must lessen the supply of the more useful common and high-explosive shell. However, no constructors have yet grasped the idea that secondary guns are shell guns, and that with high explosives to burst outside near a gun muzzle is likely to be more destructive than to make a hole in the place where the gun is. The great thing is to disable the gun. The burst of a 7-inch shell will be far superior to that of a 6-inch, but the latter is, with high-explosives, powerful enough for anything against so ideal a target as a ship. The Americans would, we think, have been wiser to have had the same weight in 6-inch pieces, unless—as is possible—space for them and their ammunition arrangements constitute the objection.

A remarkable feature of the new ships is the absence of all torpedo armament. This, too, we consider a mistake. After all, the weight of submerged tubes is a bagatelle in 17,604 tons; nor, in so large a ship can the saving of space matter very much. Useless the torpedo may be for long-range actions, but it has had much to do with the new leaning to long range work. After many guns are disabled, after speed is reduced,

ships are likely to get within torpedo range, while the absence of tubes is a draw to the enemy to do so. To be sure, by then all directors may be smashed; but of this there is no certainty, while the same objection might be extended to sighting hoods for guns and many other things.

We have drawn attention to these defects, not in a carping spirit, but because in spite of them we still hold these 17,604-ton ships, so far as the meager details available allow, superior to any other battleship designs, not merely as ships, but per ton of displacement. Political events, too, add an interest to American sea power. We are small believers in the Utopian dreams of a great Anglo-Saxon world-empire; but there are many indications that, whether the idea be pleasant to Americans or not, the great war of the future will find their ships fighting side by side with ours.

The new cruisers are, as yet, so shadowy that it is impossible to criticize them to any extent. But nothing could be sounder than the principle laid down by the Board, that while a battleship may have 22 to 28 per cent of armor, cruisers must be content with from 7 to 20 per cent—the balance being expended in speed. It is a palpable truth enough; but a review of existing types would hardly go to prove it conclusively. The nations are realizing it slowly.

The armament spoken of for these vessels is four 10-inch and sixteen 6-inch—no great change over existing models, save in the adoption of 10-inch in the place of 8-inch for the turret guns. The horse-power is 25,000, with 22 knots. For the battleships, speed has been written down as a minor desideratum, and they will be 18 knots only, with 16,500 horse power.

A very important feature in both types is the abolition of triple screws, after which the engineer-in-chief is supposed to hanker. Executive officers seem to have formed the opposition, and they have carried the day on the grounds that however advantageous the triple system may be in coal economy, it lacks the tactical advantage of the twin-screw system. Purely engineering disadvantages might also be alleged, but the primary question is one of fighting capacity. With two screws there is over 8000 indicated horse power available for assistance in a sudden turn; with triple screws considerably less power is available. This is the gist of the argument that has carried the day again with the United States Construction Board, and it argues a sound appreciation of a warship as a fighting machine before all else. This is the dominant note all through the report, from the specific reasons against wood sheathing—of which we shall have more to say on another occasion—the situation of magazines and facility of ammunition supply. Never before do we remember to have seen American designs thought out with so single an eye to the practical in all things. One may well contrast these new battleships with the "Iowa," of 6000 tons less displacement. The "Iowa" has almost as much weight of armor, while in armament the chief difference is ten 7-inch instead of six 4-inch—a small matter of weight in 6000 tons. The new type ship will carry 2000 tons of coal normally, an increase of 1375 tons over the "Iowa," and her horse power, and consequently the weight of machinery, is increased. Still the 6000 tons is not to be made up with these things also, and there is indubitably a heavy balance expended in strength, in solid necessities, that do not show on paper.—The Engineer.

THE CULTIVATION OF TOBACCO IN CONNECTICUT.

By CARLOS DE ZAFRA.

TOBACCO in Connecticut is raised principally in the Connecticut and Housatonic valleys, although it is also raised in various parts of the State. In view of the fact that in the sections where it is raised it is the sole product upon which the farmers depend for their support throughout the year, we believe that a description of the methods there employed in its cultivation would be of interest.

In the early spring, as soon as the frost is out of the ground, the seed, which is extremely small and black, is sown in nicely mellowed beds of rich ground, located on the south side of a fence or hill, or in some place not exposed to the cold winds. The seed is sprouted in rotten wood or between sods indoors until the cleft just begins to show, when it is mixed with wheat or rye bran and sown sparingly over the prepared beds. It has been found advisable to keep the beds covered with glass or cloth until the plants appear and while they are small, although they may be left to the open air during the middle of the warmer days. Ammonia in varnish water, if used sparingly, is found to expedite their growth. The beds are kept as clear of weeds as possible. If the seed is sown about April 1, the plants will be found sufficiently large to transplant about June 1.

In order to raise a fine quality of tobacco the ground should be of the light loamy character, well fertilized with specially prepared tobacco fertilizer, or part barnyard manure. The ground should be twice plowed and thoroughly harrowed that the earth and the fertilizer may be thoroughly mixed, thereby insuring a quick and even start for the plants as soon as transplanted in the field.

When the ground has been thoroughly prepared it is marked out into rows three feet apart, and by means of a pointed stick holes a foot and a half apart are made the full length of the rows. These are the distances generally observed by the growers in the Housatonic Valley. By means of a watering can each hole is filled with water before the plant is inserted. Only one plant is placed in each hole and the ground then pressed around the roots.

To insure a good crop tobacco should be cultivated as many as three times, in order to keep the ground mellow and free from weeds. When the plant has grown sufficiently to possess 16 to 18 leaves, everything above that should be destroyed by breaking off, which process is called "topping," and has to be done two or three times during the growth of the plant. The stalk should also be kept clear of branches or "suckers," the object being to confine all the nourishment obtained from the ground to the leaves. Great care has to be exercised to keep worms and insects from eating the leaf; for the more perfect the leaf

the more valuable the crop. After topping has commenced not more than four or five weeks should elapse before cutting. The proper degree of ripeness can be told by the thickness and brittle condition of the leaf.

The cutting, handling and hanging of the tobacco require great care in order that the leaf shall not be torn or broken. The plant, which has a woody stalk about an inch or so in diameter, is cut close to the ground by means of a hatchet or saw, and is laid carefully upon the ground to wilt, which it does rapidly, hence care must again be exercised that it does not remain on the ground too long lest it should be burned by the sun. After it has wilted sufficiently it is strung on lath, five or six plants to each lath. This is accomplished by the employment of a hollow steel needle which can be adjusted to the end of the lath, and is passed through the center of the stalk near the base. In order to cart the tobacco from the field to the barn, a high rigging is built and placed upon the framework of the farm wagon.

In the barn there are a series of poles placed horizontally, from which the tobacco is hung. In a well-built barn these poles are placed four feet apart, from center to center, and five feet vertical distance from one tier to the other. The ends of the lath containing the tobacco rest upon these poles and are placed nine inches apart in order to insure uniform ventilation and curing. Tobacco sheds are so constructed that they may be easily opened for ventilation.

After hanging, about nine weeks elapse before the plants are sufficiently cured and ready for "stripping," which consists of separating the leaves from the stalk. Owing to the exceedingly brittle character of the leaf this can be done only on the warmer damp days, which have the effect of softening the leaf, making it silky and pliable. Boxes 8 x 16 inches and 3 feet in length, and lined with hardware paper, are used for this purpose. Into the boxes the leaves are placed, the bases toward the end of the box, so that the tips will overlap in the center. When removed from the box they are removed with the paper and tied into bundles. Tobacco which has been stripped at the proper degree of dampness and properly packed will remain in the same condition for several months. In this manner it is taken by the farmer to the warehouse, where it is sorted leaf by leaf, according to its shade and quality.

The average price for tobacco in the Housatonic Valley for the past four years has been from 15 to 16 cents per pound. In the Connecticut Valley somewhat better prices have been realized. It is the best cash-producing crop that can be raised by the farmers in Connecticut, as it will bring from \$250 to \$400 per acre. The most valuable part of the crop is in the light-colored wrappers and binders for good seed and imported Havana filled cigars, and the packers generally find an open market for it.

In the cultivation of the weed one great risk is always taken, however, and that is the possibility of an entire crop being totally destroyed by hailstorms, which occasionally sweep over the tobacco sections. The hail tears the leaf to pieces, rendering it either entirely useless or reducing its value from a possible 16 cents to 3 or 4 cents a pound. In fact, during the past summer, in a few instances, the crops were so completely destroyed that what remained was plowed under. This, however, was an exceptional case, but it serves to illustrate the risk which prevails.

METAL WORKERS' SCHOOL IN SAXONY.

An exhibition of the work done by pupils of the Metal Workers' School at Rosswein has recently been held at Freiburg, which showed the thoroughness of the instruction given. The school has an average of sixty to seventy students, and the pupils are chiefly from Prussia and Saxony, but all sections of Germany are represented, and even Austria and Sweden. One of the conditions of admission is that the pupil shall have had three years' practical experience. Many of the States of Germany are liberally aiding the school, and granting free scholarships to deserving young men. The school is provided with a technical library, reading and reference room, and has a large supply of scientific apparatus, electro-motors, batteries, etc., and many practical models of buildings, machines, etc. Excursions are frequently made by the pupils to the large factories and mines of importance in the neighborhood. The course at the school lasts from eighteen months to two years, and embraces four departments—building, fine arts, machines and electro-technics. A great deal of attention is given to drawing. The student is taught to create, and in order to stimulate the inventive faculties the German Patent Office supplies the institution free of charge with copies of patents pertaining to mechanical, metal and electrical apparatus. In addition to the special branches in metal work, etc., attention is also given to physics, chemistry, algebra, geometry, bookkeeping and German language lessons. The tuition fee for the half year is 100 marks (£5) for citizens of the German Empire, and 200 marks (£10) for foreigners, and an additional fee of 25 marks (£1 5s.) for German, and 50 marks (£2 10s.) for foreigners for the use of apparatus, machines and material. The city of Rosswein has about 8,000 inhabitants, and is situated on the main railway line between Leipzig and Dresden.

Means of Distinguishing Egg Albumen from Blood Albumen.—According to Guerin, blood albumen upon addition of formal in the proportion of 15 to 20 per cent does not give any precipitate, but loses its precipitability after some time through heat as well as through nitric acid.

Egg albumen solution remains clear with formaldehyde and is no longer thrown down by heat, but always retains the property of being separated by nitric acid in the cold; hence, formal must have a different action upon the two kinds of albumen.

Serum albumens are rendered perfectly insoluble by formal. Strong solutions yield a gelatinous coagulum, while dilute solutions give a flocculent or pulverulent deposit.—Chemiker Zeitung.

*The warships herewith referred to by our contemporary are not the "New Jersey" class, but their successors, whose designs have recently been decided upon by the Board on Construction. There will be two of these ships and their names have not yet been decided upon. The displacement given, 17,604 tons, is too large. On a mean draft of 24 feet 6 inches they will displace 15,560 tons, and on a maximum draft 16,900 tons.