The Holly Gravity Return System.

In a steam engine plant, this system is designed to return the water of condensation and entrainment without employing a pump or trap, by means of a simple open circuit, returning the water from below the boiler as if the boiler was below the surface. A single system receives and delivers the condensation from all the separators, drips, cylinder jackets, etc., effecting a saving of coal by returning the water to the boiler at very nearly boiler temperature. The system does not involve any mechanical movement and requires no attention after it is once put in operation. It has been placed in some of the best equipped power stations in the country, and is now being put in at the power station of the Metropolitan Traction Company, of New York City.

AN ATTRACTIVE HOUSE.*

The very attractive house represented herewith in perspective is estimated to cost $5,500. The cost of building materials and labor varies of course in different localities, but this is the estimate stated in American Homes, published at Knoxville, Tenn., for that section of the country.

The first story is of brick and the second story of shingles. Gables timbered and plastered. The staircase in the front hall is so arranged as to make the hall a nice, comfortable sitting room. On the stair landing is a handsome art glass window, producing a beautiful effect, both from inside and outside. Four pairs of sliding doors throw all the main rooms and hall practically into one room. The second floor has four large chambers, but the number may be increased by reducing their size.

The interior is finished on first floor in hard woods for main rooms, and whitewood stained or painted for second floor. Cellar under entire house. Plumbing and water supply complete. Roof is shingled, but slate would be better at a slight additional cost.

Size, 48 by 67 over all, except steps. Height of first story, ten feet; second story, ten feet; cellar, seven feet.

* Engraving from American Homes, published at Knoxville, Tenn.

JEANTAUD'S ELECTRIC CARRIAGE.

In the interesting competition of automobile carriages organized in the month of July, 1894, by the Petit Journal, every one remarked with great surprise and much regret the absence of electric carriages. Only one was entered, and that was held in the custom house by various formalities. We have already described some models of such carriages devised by various amateurs, but we must recognize the fact that up to the present the electric carriage has left much to be desired in its operation and has not given very satisfactory results. Must we blame the source of electric energy and the complex transmissions from the motor to the wheels for this? The blame might be equally ascribed to all these parts.

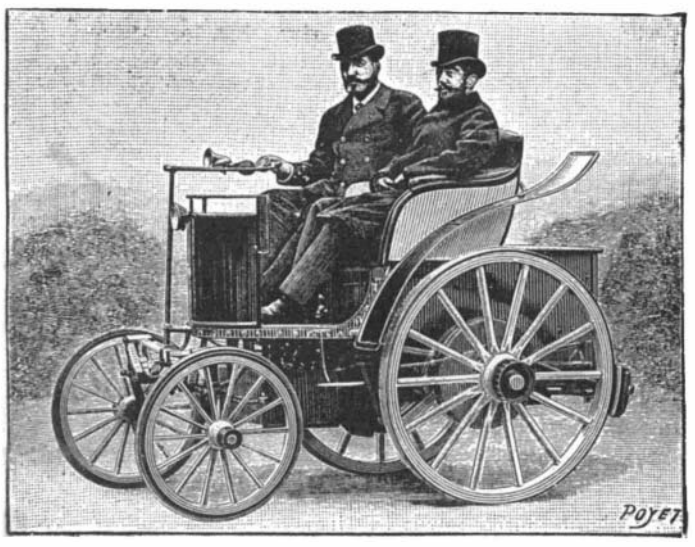


Fig. 1.—JEANTAUD'S ELECTRIC CARRIAGE.

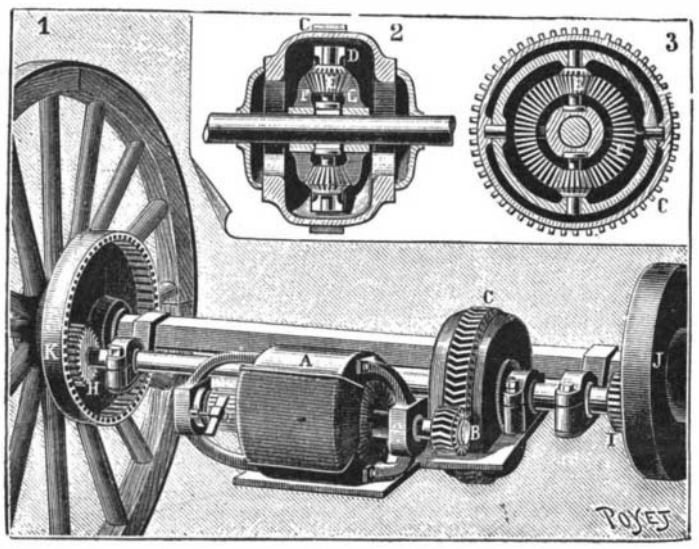
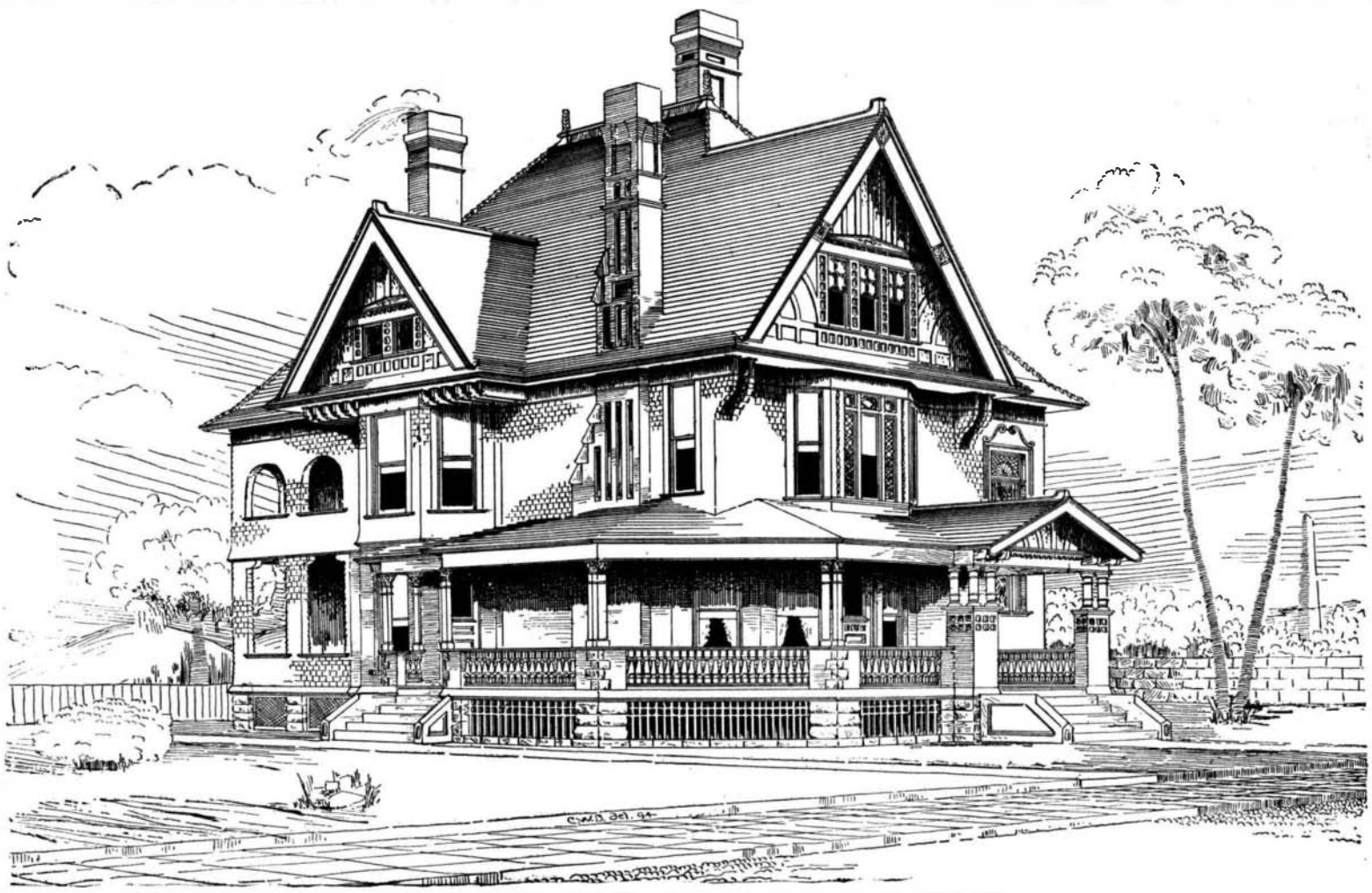


Fig. 2.—DETAILS OF THE MECHANISM.

Mr. Jeantaud, a carriage maker of Paris, has just made a long stride toward the electric carriage. He has been studying this question, he tells us, for about fifteen years. He has had the wisdom to mature it without stopping at the results of an incomplete invention, and to ever seek a really practical solution and one capable of industrial application. He has finally succeeded in constructing a carriage which, after a trial by Mr. Michel Levy, engineer of mines, has been authorized to run freely around Paris.

Fig. 1 gives a general view of the carriage, which is a four-wheeled phaeton with a seat for two and with accumulators. There is a box placed in the rear for the reception of the latter. In front is the steering axle, which is the same as the one now employed in all automobile carriages, which Mr. Jeantaud was the first to apply, and which is provided with a long rod within reach of the driver. Under the carriage there is suspended an electric motor that transmits motion to the hind wheels. A commutator is placed in front. Beneath the driver's foot there is a pedal that controls a circuit breaker and the brake. The weight of the vehicle and transmissions is 1,078 pounds, and that of the accumulators 925, inclusive of 615 for the plates and 310 for the liquid and the boxes. The motor weighs 240 pounds. Admitting an average weight of 330 pounds for two passengers, we reach a total weight of 2,573 pounds.

The source of electric energy consists of a battery of accumulators of the Fulmen type, of 21 elements distributed through 7 boxes of 3 elements each. Each of these accumulators contains 29 pounds of plates and is capable of furnishing, in normal operation, a capacity of 300 amperes-hour at a discharge of 30 amperes, of 240 amperes-hour at 40 amperes, and of 210 amperes-hour at 70 amperes. It will be remarked that it is a question here of discharges reaching as high as 3 amperes per pound of plates. In some particular cases, and certainly exaggerated ones, Mr. Jeantaud has been able to obtain discharges varying from 80 to 180 amperes, but for an hour and a half only. The capacity was 11 amperes-hour per pound of plate in the first case cited above and 7·5 in the last. The accumulators are mounted in tension, and keep this coupling constantly. From these figures, it may be remarked that the new accumulators are distinguished by a great capacity and by the high discharge that they are capable of furnishing, in resisting jarrings and shocks. These properties they owe to their very structure. The plates, which we have been able to examine at the works of the company, are formed of an internal mounting with honeycombings that are filled with active material, and the whole is inclosed between two celluloid plates containing apertures of small diameter. These celluloid coverings are in turn united and cemented at the top and bottom. A series of similar plates is grouped between them and mounted



PERSPECTIVE VIEW OF AN ATTRACTIVE HOUSE.

as in ordinary accumulators. These elements can thus be submitted to shock, jarring and variable discharges. The active material remains in the receptacles, and the accumulator undergoes no deterioration. These are observations that Mr. Jeantaud has been able to make with the accumulators that he has employed in his carriage and that he has very often submitted to difficult experiments.

The motor is a series one constructed by the Compagnie de Fives-Lille. It produces 2·6 horse power at an angular velocity of 1,200 revolutions per minute, and an industrial rendering of 74 per cent, with the bobbins of the inductors mounted in tension. Upon coupling these latter in quantity, the duty may reach 4·4 horse power at an angular velocity of 1,300 revolutions per minute. The industrial rendering is then 70 per cent. The motor is suspended from the carriage box by flat springs, which deaden the shocks at the moment of stoppages. As we shall see further along, arrangements have been made to allow the motor to follow the inflexions of the carriage box without the teeth of the transmission gearing ceasing to mesh normally.

Fig. 2 (No. 1) gives an internal view of the transmitting mechanism, and the figures in the upper right hand corner represent the arrangements adopted for the differential system. The transmission of the motor is realized without chains and pertains to the Gaillardet model. It is effected through the intermedium of a shaft revolving in two pillow blocks fixed to the axle and carrying at its two extremities two pinions with straight toothing, I and H, engaging with two drums, J and K, toothed internally. These two drums are fixed to the hubs of the wheels of the carriage. The shaft mentioned above carries a gearing, C, which is mounted upon a Cardan joint and is directly controlled by the pinion, B, of the motor, A. We cannot dwell too long upon these internal arrangements, but the details of the various pieces, C D, of the Cardan joint, and of the pieces, E, F and G, of the differential system may be seen in Fig. 2.

The maneuvering of the carriage is exceedingly simple. The starting offers no difficulty, and the stoppage can be effected almost instantaneously through a winding brake upon the hub of the wheels. This brake controls wooden blocks that bear against the tire of the hind wheels. The maneuvering of the brake is very easily done through a pressure upon a pedal. At the same instant a circuit cutter placed upon the latter interrupts all communication with the source of electric energy. The results obtained up to the present by Mr. Jeantaud are as follows: The carriage, of a total weight of 2,573 pounds, and with a complete charge of accumulators, is capable of making a trip of 18 miles at a maximum speed of 12 miles an hour upon a good level road. Such speed may be reduced at will. These results have been obtained in one hour and a half upon a dry macadamized road presenting gradients of 1·25 to 1·5 inch to the yard each for a length of 800 yards. Mr. Jeantaud is at present constructing another carriage capable of making a trip of 36 miles.

Upon the whole, the new electric carriage does not, as yet, permit of undertaking long trips, but it is distinguished by good construction, by great strength, and by very simple and really practical arrangements that permit of opposing it without fear to the petroleum carriages that have been so much talked about in recent times. We can, therefore, now assert that we are not far from finally knowing the electric coach that Mr. Hospitalier has so often called for so ardently. —La Nature.

Astigmatism—What it Is and What it Does.

Since by recent discoveries in the glassmaker's art, and in new properties in certain of his productions, the terms "astigmatism" and "astigmatic" or "non-astigmatic" are becoming more common than they were only a few years since, we find them occasionally glibly made use of by some who have no idea of what is meant by such terms. Questions are sometimes asked about astigmatism of about as intelligent a nature as was put by a purchaser of a lens who stipulated that the one to be supplied must have an optical center, and that, if this wore out by fair usage, another optical center must be refitted to it!

It is only since the advent of photography that astigmatism could possibly have applied to any optical instrument, for in no other than a photographic lens is there any recognition of the transmission of a ray obliquely through it, and obliquity of transmission is a condition inseparable from the production of astigmatism, or astigmation, as it formerly was, and still is occasionally, called. There is no astigmatism in a telescope object glass when employed as such, because the rays pass through it axially and not obliquely; but, if mounted as a photographic lens, it speedily shows that it, too, obeys the law which all achromatic lenses have hitherto recognized as regards astigmatism.

What, then, is the nature of astigmatism, and by what means is it to be discovered? Let us take any ordinary achromatic objective and subject it to critical examination by means of the ground glass focusing screen of the camera. The object to be focused may be a circular white object the size of a threepenny piece, or it may, perhaps with greater advantage, be a sharply cut white cross, or both, mounted upon a black ground for facilitation of clear observation, or a black cross drawn upon a white card, the limbs of the cross being placed vertically and horizontally. The lens in the camera should be used without a stop, for the larger the aperture, the more apparent will be the phenomenon. Let the camera be placed so that the image of the foregoing objects shall be sharply focused on the center of the ground glass screen, and it will be found that the circular one will be quite round and distinct, while both the vertical and horizontal limbs of the cross will be equally distinct, while, if the lens be racked in or out of focus, both will preserve their shapes, notwithstanding the indistinctness of outline necessarily caused by this treatment. The camera is next rotated until the objects are brought to the extreme side of the focusing screen, and the racking in and out proceeded with as before. Neither the disk nor the cross will be found to be sharp anywhere, but it will be noted that, at one position, the disk will be elongated vertically, being oval in shape, while, on racking the lens a little the other way, the elongation will now be horizontally, but the mean of the two distances will not show it to be of circular form. With the cross, at one distance the horizontal bar will disappear almost, if not altogether, leaving the vertical one only sharp and distinct, to disappear in its turn when, by an opposite turn of the rack, the horizontal one is brought into visibility. The distance through which the lens has to be moved to produce these phenomena shows the amount of astigmatism possessed by that individual lens at that degree of distance from the center of the ground glass, for at the center, as we have shown, sharpness and correctness of form prevail, the amount of astigmatism usually increasing as the center is departed from. We say usually, but this is not invariably the case, for in making charts of the amount of astigmatism given right across the whole field by lenses in our own possession, we find that over a considerable portion of the surface adjoining the center there is no appreciable astigmatism to be found until we approach much nearer to the margin. Noting that there are two foci to every point projected upon the focusing screen, and that one gives the image as a vertical line and the other as a horizontal line, it is a comparatively easy matter to construct a diagram or chart for every lens that passes through one's hands which will show not only its curvature of field, but the amount of astigmatism, from perfection or freedom from this evil at the center to the full development of the unwished-for propensity at the margin, represented by two lines running alongside each other, and usually drifting apart as they approach the sides of the plate.

It would occupy too much space to give in this article an account of the astigmatometer we devised and constructed for the purpose implied; suffice it to say in the meantime, and pending its publication on some future occasion, the whole capabilities, the failings and, in short, the character in this respect of a lens may be delineated with accuracy on a sheet of paper the dimensions of the ground glass, and this in about ten minutes after erecting the camera.

Having said so much about the nature of astigmatism, we shall dismiss its cause in a rather summary manner, contenting ourselves by a repetition of the explanation we once gave when bringing the subject before the now defunct Photographic Society of Scotland. Astigmatism, we said, arose from the obliquity of the cylindrical pencil of rays causing the aperture of the lens to cut it in an elliptical form. As the refractive power of the margin of the lens is equal all round, it follows that the refractions at the horizontal margins of this ellipse are as great as at the vertical margins; consequently the inclination of these rays toward one another is as great in one case as in the other; or, to put it another way, the angle at the focus, formed by the extreme rays of the pencil, is the same horizontally as perpendicularly; but, as the base line vertically is longer than the horizontal one, it follows that the focus of the vertical rays is further from the lens than the horizontal ones, so that for oblique rays there are two pseudo foci. Now, at the short focus, a point will be represented by a vertical line; at the long focus, by a horizontal line; and intermediately, by a combination of both. This accounts for the impossibility of getting anything sharp at the margins when some lenses are being employed. It is possible to arrange the curves of the lens so that even with full aperture there shall be what photographers term great "depth of focus," the meaning of which is, that no part will be in sharp exact focus, but that objects situated at varying planes shall be all pretty near it. A lens of this character is unsatisfactory, and is to be avoided.

A small aperture to a lens improves the marginal definition, the reason of this being that, as each point of the subject is represented by an irregular dot, the smaller the dots the less does their irregularity interfere with one another. The marginal smudginess which thus results from astigmatism is, as we have hinted, greatly minimized, and in some cases practically extinguished, by a small stop.

But lenses, formed of special glass, have of late been placed upon the market with a claim of their being free from astigmatism, even when used with a large aperture. This we rejoice at, not merely as an optical feat once thought impossible of accomplishment, but on account of the additional power thus placed in the hands of photographers, who like good definition all over the plate, but who may not desire it at the expense of having to secure it by the use of a small diaphragm. It is a pity that objectives of this nature, from the complexity of their construction—some having as many as eight individual lenses—and from patent restrictions, are not likely to be supplied at what have been designated "popular prices." The influence of time may, however, aid in the amelioration of this drawback.—British Journal of Photography.

Atmospheric Electricity.

Professor A. Schuster lectured recently at the Royal Institution of Great Britain upon "Atmospheric Electricity." When this science was but in its infancy, it was noticed how the spark of a battery resembled thunder and lightning, and the idea soon became generally, although somewhat vaguely, accepted that a flash of lightning was only a form of electrical spark, while it was left for Franklin, who had long suspected that a thunder cloud was charged with electricity, to establish by experiment a complete parallelism between lightning and electricity. This he successfully accomplished in the year 1752, and on his researches are based the complete understanding we now have as to the various phenomena of atmospheric electricity. After briefly alluding to Franklin's and Faraday's work in connection with the subject, the question of the origin of the "lines of force" was discussed, and Professor Schuster passed on to consider the various causes of de-electrification which are constantly going on. Important factors are fires; these discharge electricity constantly, and it was pointed out incidentally that factory chimneys themselves act as good conductors of electricity, better even than the lightning rod which is fixed to the summit. Having pointed out that the theory sometimes put forward as to the disappearance of the "lines of force" by passing away from the air into space was untenable, the professor showed that on rising in the air the "lines of force" at first increase, but at altitudes of 15,000 to 20,000 feet they end. Their disappearance, however, depends upon the condition of the atmosphere, as in very fine weather they end at 12,000 feet. The fact that electrical effect in the atmosphere is dependent upon the moisture present is well established, but some observers have had an idea that it is influenced by solar radiation instead, and an instance was cited which showed that electrical effect in Germany was directly connected with a dust storm which occurred in Alexandria, the electrification not being shown before the storm.

In discussing the effect of lightning upon trees, statistics showed that forty-eight oak trees are struck to one beech tree, the ratio being dependent upon the amount of oily matter contained. Some curious effects of lightning having been described, a series of photographs were shown illustrative of various types of flashes, and after briefly alluding to silent discharges, the professor described the phenomenon known as St. Elmo's fire. This name is derived from St. Erasmus, who was the patron saint of the Italian sailors. Its peculiarity is that it appears as either positive or negative, one condition being as probable as the other. The phenomenon is simply one of induction. The various hypotheses which have been advanced to account for atmospheric electricity were briefly noted. Their name seems to be legion, as they number since 1753 more than a score, while the year 1884 alone produced five new theories! Of this number the rotation of the earth, direct radiation, heat, and evaporation may be mentioned, and an instance was given where, from personal observation, electrical effect was shown to be due to the actual formation of cloud. Speaking of the aurora borealis, it was mentioned that it seems to be connected with cirrus clouds at low altitudes, and that the many spots in the sun have been sometimes attributed to the existence of many auroras. The lecture was profusely illustrated by experiments, all of which passed off without a hitch.

Exposition in Mexico.

A great International Exposition of Industries and Fine Arts, authorized by the Federal government of Mexico, by concession dated January 9, 1895, will be inaugurated in the city of Mexico on the 2d of April, 1896, and will remain open for a period of at least six months. This will be Mexico's first exposition.

It is to include all kinds of industrial, scientific, commercial, and artistic productions, and to embrace, in fact, the whole range of human activity.

The Exposition grounds are situated at the foot of the castle of Chepultepec, on the grand avenue De la Reforma, within ten minutes' ride from the center of the city of Mexico, and comprise an area of about 600 acres.