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THE IDEAL AUTOMOBILE.

The automobile has been sufficiently long in our midst to enable us to define the essential qualities which go to make up an ideal machine. Naming them in their order they are as follows: low cost, durability, endurance (large fuel supply), ability to climb hills, and speed.

Low cost is given the first place for the reason that the present price of the automobile places it altogether beyond the means of the average individual, and renders it a very decided luxury. It is certain that cheapening the cost will produce a proportionate increase in the demand, and the increased demand will lead in its turn to a reduction in the price. This was conclusively proved in the history of the bicycle, the cost of a first-class machine to-day being about one-quarter what it was a few years ago, when the number of riders was limited.

But while the ideal automobile must be cheap the reduction in price must not be gained at the expense of sound materials and good workmanship. However great may be the demand for a low-priced machine, our manufacturers must never attempt to meet it by making a short cut by the way of showy but inferior construction. The folly of such a method was demonstrated very conclusively when the bicycle was at the height of its popularity.

Next to its low cost and durability we place the endurance of the automobile; by which we mean its capacity to cover a large mileage without having to refill its fuel tanks. Liberal fuel capacity will be a very strong recommendation to the bicyclist, who has been accustomed to rove all day on long-distance excursion with the knowledge that he is not tied to particular stopping places, or liable to be hopelessly "stalled" by a collapse of his motive power in out-of-the-way or unexpected places.

In view of the fact that the steam-driven automobile has shown such superior hill-climbing powers, it is certain that the appetite of the public, being thus whetted, will demand that the ideal automobile shall be able to negotiate any hill that it may encounter in the course of an extended tour. It must be able to carry its occupant through, if need be, a mountainous country; for we have a precedent in the successful trip up Mount Washington recently accomplished by a builder in one of his own machines. The records for hill-climbing are at present held by steam-driven motors; and it will be a fortunate day for the automobilists when builders succeed in combining with the cheap cost of operation of the gas-propelled type, the hill-climbing powers of its strongest competitor.

In placing speed at the bottom of the list we may seem to be making too little of a feature of the automobile which many of the riding public believe should receive the first consideration; but as a matter of fact, every type of automobile that is now on the market is capable of running at a higher speed than the law allows. Although a rate of twenty miles an hour or more is no doubt frequently accomplished on the public roads, there is no question that the rapid increase in the number of riders in the future will lead to a restriction of speed to a maximum of twelve or fourteen miles an hour.

PROSPECTS OF THE PEARY RELIEF EXPEDITION.

The outlook for Peary's Polar expedition does not seem very bright, as great difficulty is experienced in finding a steamer and a crew suitable for a three years' sojourn in the Arctic regions. The "Windward" was a slow boat and was hardly adapted for the purpose. She was sent back last August to the Peary Arctic Club which has already spent $64,000 on the expedition, and it is evident that they will have to raise a large sum of money to enable the plans to be satisfactorily carried out. Either a Newfoundland sealing steamer will have to be purchased, or the "Windward" will have to be repaired. It is almost impossible to lease a steamer owing to the fact that they are all needed in seal fishery. It was hoped that a second-hand set of engines and boilers could be obtained for the "Windward," but up to the present time nothing of the kind seems available, and the engines will probably have to be patched up to answer. It is found very difficult to get twelve men to venture north this year with the prospect of not returning for three years. It is to be hoped that the explorer will not be balked in his plans, as his disappointment will be a bitter one.

ELECTRIC TRAIN LIGHTING.

BY ALTAN D. ADAMS.

The very general use and appreciation of the incandescent electric lamp for stationary lighting has suggested its adoption on railway trains. A number of more or less satisfactory attempts at electric train lighting have been made and cars are thus lighted on several regular trains in different parts of the country. The methods of electric train lighting thus far tried with success may be divided, as to their sources of power, into three classes. On one plan an engine, served with steam from the locomotive boiler, is used to drive a dynamo in the baggage car, and suitable conductors are supplied to connect the dynamo with electric lamps in all the cars of a train. As lamps can only be operated by dynamo current in the several cars, so long as they are coupled to the baggage car and locomotive, a storage battery on each car, or at least on the baggage car, is necessary to make the steam-driven engine and dynamo at all satisfactory. With a storage battery of suitable capacity on each car, enough energy from the dynamo may be stored during the times when the train is connected up to light the several cars when they are being switched or a change of engines is being made. If the battery is placed entirely in the baggage car, the change of engines may be made without putting out the lamps, but if the train is uncoupled, or the baggage car removed, darkness ensues.

One objection to the use of steam from the locomotive boiler for electric lighting, is that all the power possible is usually wanted for train propulsion. It is also objectionable to pipe steam from the locomotive to the baggage car, because of the tendency to condensation losses. Another source of power for electric lighting on trains is found at the car axle. In order to deliver energy at constant pressure, as is necessary for incandescent lighting, the ordinary dynamo must be driven at a uniform speed, but by special and somewhat complicated construction dynamos are made to produce a nearly constant electric pressure when driven at a variable speed by the car axle. The speed of the dynamo armature must not, however, vary outside of certain limits or the automatic regulation of pressure cannot be maintained. The dynamo to be driven from the car axle is usually placed in or under the baggage car, and the necessary mechanical connections made.

It is at once evident that when a dynamo is driven from the car axle, not only must the locomotive remain connected with the train, but it must also remain in motion so long as light is to be had, unless a storage battery is provided. As it would never do to have electric lamps go out every time the train stops, a storage battery is usually provided when the power for dynamo is taken from the car axle. The battery may be all together in the baggage car, but the ideal place for it is under each car, in sections. A third method of lighting railway cars is that entirely with storage batteries. The batteries are usually charged at terminal points for all-night runs and are carried in suitable compartments beneath each car. This last arrangement makes each car independent of the train or locomotive, as to light.

So far as the quality of service is concerned, train lighting with storage batteries is ideal, but the first cost of batteries is comparatively high, the shake and jar of travel hastens their deterioration, and their weight has to be considered. The total weight of battery necessary per car is, of course, much greater when they are used alone than when in conjunction with a dynamo on the train. When used with a dynamo on the train, the capacity of the battery need be only sufficient to operate the car lamps during times when the dynamo cannot be used, say for not more than one hour per night, or at any one charge. When, however, the battery is used alone, it must have capacity for an entire night, or say ten hours, and will, therefore, be much heavier, since weight increases directly with the capacity. The first cost and rapid depreciation of storage batteries, together with their expense of operation are such that their general and exclusive adoption in the lighting of railway trains seem very doubtful. If electric lights are to come into common use on cars drawn by the steam locomotive, they will probably be supplied from dynamos carried on the trains and supplemented by a small storage battery on each car.

In first-class train service the system of lighting by compressed gas is no doubt more generally used than any other at this time. The compressed gas is carried beneath each car in steel tanks, and flows to the burners under the tank pressure, which, of course, decreases as the gas is used. A supply of gas being thus carried with the train, it is pertinent to inquire whether means exist by which more light can be had per cubic foot of gas than is now obtained from the burners. Instead of consuming gas at the burners it may be used in a gas engine and the power thus developed, expended to drive a dynamo. A good coal-gas, of about 600 heat units per cubic foot, will yield one brake horse power hour for each twenty cubic feet of gas consumed in the cylinder of a modern gas engine. This brake horse power hour represents 746 watt hours applied to the armature shaft, and allowing the low average efficiencies of 85 per cent for the dynamo and 95 per cent for the line and connections, the lamps will receive $746 \times \cdot95 \times \cdot85 = 600$ watt hours for every cubic foot of gas consumed by the engine.

Incandescent lamps of nominal sixteen-candle power are now largely used, that require but fifty watts each, and twelve of these lamps may obviously be maintained per hour for each cubic foot of gas burned in the engine. Even if an incandescent lamp that requires sixty watts is used, ten may be operated per hour for each cubic foot of gas consumed. Incandescent lamps of other candle powers can be had at about the same efficiency as that just stated, the watts per candle increasing slightly in very small lamps and decreasing for very large ones. The candle power of gases vary somewhat, but four to five cubic feet of good coal gas, at the burner per hour, are commonly considered about the equal of one sixteen-candle incandescent lamp. On the basis of five cubic feet of gas per hour, twenty cubic feet supply but four burners, and with only four cubic feet the burners maintained per hour is only five. As ten to twelve sixteen-candle incandescent lamps are maintained per hour, per twenty cubic feet of gas expended at the engine, from two to three times the amount of illumination can be obtained when the gas is exploded in the engine cylinder that is given off by the same quantity when consumed at the burners. This difference in operative efficiency is more than enough to offset the higher first cost of the electric equipment. The best location for the gas engine and its driven dynamo is probably in the baggage car, and this would bring the gas reservoirs to the same point. Power for the electric light is then independent of both the motion of the train and the presence of the locomotive, but if storage batteries are not used on each car, light can only be had so long as the baggage car is connected with the train. The cost of sufficient batteries on each car to supplement the service from the dynamo, being charged by it and used only when the baggage car is disconnected, is not large, and their use makes the system ideal in service as in cost of operation.

AIR PIPES FOR MINES, MADE OF CLOTH.

A Dusseldorf firm is making cloth air pipes for mines. They are made of strong sail cloth impregnated with India rubber so that they are both air and water tight. They are much cheaper and lighter than those made of zinc and wood and they can be easily transported and secured. The galvanized iron rings are provided with the pipes. They are spaced at certain distances for suspension. Steel rings are also inserted at places and prevent the pipes from kinking. Several hundred feet can be put up in a few minutes and the transportation of the pipes around the mine is easy. One great advantage is, according to The Colliery Guardian, that when shots have to be fired the cloth pipes can be folded together and put out of the way, whereas zinc pipes are not easily removable and if they are left would be much damaged.

"HALL I' TH' WOOD," BOLTON.

Mr. W. H. Lever has presented "Hall i' th' Wood" to Bolton, England, together with the sum of $6,000 for its maintenance. It was the home during some years of Samuel Crompton whose father rented here two or three rooms of the house, and who devoted five years from 1774 to 1779 in secret to the invention of the spinning mule, a machine which was long known as the "Hall i' th' Wood wheels." This machine was sold to a body of eighty manufacturers for $300, about 1785. The woods around it have long since been cut down, says The Builder from which we obtain our information.

THE FATHER OF PHOTOGRAPHY.

February 11 was the one hundredth anniversary of the birth of Henry Fox Talbot, for whom is claimed by many the place which has long been held by Daguerre in the estimation of the world. Those in favor of the claim say that Fox Talbot deserves this position because by his public announcement of a successful photographic process he anticipated Daguerre by some months, and secondly, present day photography is a direct descendent and modification of the Fox Talbot method, and has no connection with that of Daguerre which process is now archaic. Daguerre has many public memorials both in France, England and America, but Fox Talbot, who died in 1877, has never been honored. A committee has been formed at his own home, Lacock Abbey, near Chippenham, England, to raise a memorial fund for the restoration of the chancel of Lacock Church. As he was lay rector of the church this seems to be a memorial which he would have desired most. A small edition of prints from three of Talbot's photogravings on copper have been made and published, the money received from purchasers of these will be handed over to the fund without any deduction of expenses.

TURPENTINE AND ROSIN.

BY C. K. HAWKINS.

The manufacture of spirits or oil of turpentine, and rosin has been for many years the principal industry of the entire part of the Southern States known as the long leaf pine belt, and the business of "yarding" and shipping of these and other naval stores has been and is now the basis of the prosperity of many of the cities on the South Atlantic and Gulf Coast.

Both spirits of turpentine and the solid product known as rosin are obtained from the exuded gum or resin of various members of the yellow pine family, but principally of the variety Pinus Palustris, or "long leaf" yellow pine.

The resin which is of a semisolid consistency and whitish in color, is insoluble in water, but readily soluble in ether or spirits of turpentine. It is obtained from the tree by boxing, or cutting a deep notch in the trunk, about a foot from the ground. These "boxes" hold about a quart, their number is limited by the diameter of the tree, the usual rule being to leave 12 inches of bark between each box, this giving two to four and sometimes six boxes to each tree, the box being 10 to 12 inches across the opening. Ten thousand boxes constitute one working unit or "crop," requiring from 100 to 200 acres in the new regions along the Gulf Coast, and from 500 to 1,600 in the "worked-out" districts of North Carolina.

The boxes are cut with an axe having a very long and narrow blade, and short and heavy handle. This is done during the winter months, when other work on the turpentine farm is at a standstill. Upon the opening of the warm weather, which causes a flow of sap into the boxes, the trees are "chipped" or scarified, by removing the bark and wood to a depth of about an inch just above the box. This operation is repeated every week during the season, each "chipping" exposing about an inch and a half further up the tree, but maintaining the same depth. The tool used is called a "hack."

The gum exudes from the scarified surface and flows down into the box, whence it is collected every four weeks by means of a "dipper" which is simply a flat pear-shaped blade, and sets into a handle. The average weight of a barrel of "crude" is 240 pounds, and a crop of first-year or "virgin" boxes should yield 35 to 50 barrels at each dipping, or 245 to 350 barrels during the season, decreasing to 12 or 16 barrels per dipping during the fourth year, at the end of which the farm is usually abandoned and turned over to the timbermen, although some of the smaller landowners in the older districts, especially in North and South Carolina, work their trees as long as they can get anything out of them.

The stills usually hold from 10 to 50 barrels of crude, and are made of copper. The kettle, which is in a brick setting with furnace underneath, has an opening near the bottom with a gate faucet, out of which to run the charge after distillation.

A little water is run in when the still is charged, and heat applied gently at first, being gradually increased until the whole mass reaches the boiling point, where it is maintained during the remainder of the process. The steam produced by the evaporation of the water passes over into the worm, bringing the turpentine in a vaporized form with it, and being condensed, runs off into a vessel placed to receive it, in which the water settles to the bottom, and the turpentine, being of a less specific gravity, collects on the surface and is dipped off into barrels. Water is constantly added to assist in the vaporization and to prevent burning of the charge. With a glass the distiller notes the proportion of spirits and water coming over, and when the spirits has decreased to about one-tenth of the whole the distillation is stopped and the remainder of the charge is run out into a wooden trough, passing first through a strainer of No. 6 mesh, next through one of about No. 40, and last through a No. 80 mesh. While still hot is is dipped up into barrels.

The number of charges per day which can be run in a still of ordinary capacity is from two to five, depending on the character of the crude and the time of distillation.

A charge of twelve barrels of crude gum should yield 120 to 130 gallons spirits and seven or eight barrels of rosin.

Spirits of turpentine fresh from the still is perfectly clear and transparent, with a faint, pleasant, aromatic odor, and is very different from the ill-smelling, yellowish liquid that we usually see in paint stores.

The spirit barrels are prepared by being coated on the inside with glue, which being insoluble in turpentine renders them impervious to the action of the liquid and prevents leakage.

There are fifteen recognized grades of rosin, those known as W. G. (window glass) and W. W. (water white) being the finest and most valuable. and from N, which is very clear, the grades run through M, L, K, J, H, etc., to A, which is almost black. Of these the W.W. and W. G. grades are produced from the "virgin dip," or first year's run, each subsequent year's run producing a poorer grade.

During the latter part of the season, as the weather becomes cooler and the flow of sap diminishes, the gum forms on the boxed face in a hard white mass, greatly resembling honeycomb. The scraping off and distilling of this is the last operation of the season. This scrape which amounts to from seventy barrels per crop the first year to 100 barrels in the fourth, produces rosin of an inferior grade and but little turpentine.

The next important step is the shipping of the finished product. The stills are usually situated at a considerable distance from transportation, and most of the larger operators either build tram-roads to reach the shipping point, or else make use of those built by the sawmill people. The rosin which is shipped in very rough barrels, made at the still, and holding 350 or 400 pounds is, upon its receipt by the factors at the seaport, first weighed, then graded, and after reheading, is stored in open yards, to be presently loaded upon vessels for export. The vessels usually employed in the foreign trade are Norwegian and Swedish barks, of a tonnage varying from 500 to 1,100 tons.

The spirits receive a rather different treatment, being run from the cars under open sheds, and the barrels emptied and reglued, if necessary. The spirits is then rebarreled, if destined for export, or run into tank cars, if for shipment to the interior.

A shipload of spirits when the price is ruling between 30 and 40 cents per gallon is rather more valuable than the average reader would at first suppose.

By far the largest amount of rosin produced is consumed in the manufacture of soaps and varnishes, of which it is an important constituent. A great deal of it is redistilled for rosin oil, which is used as a basis for various grades of machine oils, and in the manufacture of wagon grease, printing inks, and lacquers.

Spirits of turpentine is used in the manufacture of varnishes and paints, and to some extent in chemical operations and medicine.

OUR RAPIDLY GROWING IRRIGATION AREAS.

The United States Department of Agriculture has issued a bulletin regarding irrigation in the Rocky Mountain States, by J. C. Ulrich an irrigation engineer, of Denver, Colo., describing the agricultural conditions of the Rocky Mountain region, covering more particularly the States of Colorado, Idaho, Montana, Utah, and Wyoming. How ditches are built, rights to water established, and the water diverted into canals and ditches and applied to the land, as well as the climate, resources, and general character of the region, are well covered, the main purpose being to instruct those to whom the subject is new and enable them to avoid the costly mistakes which novices are liable to make. The difference between ditches belonging to individuals, corporations, or districts are outlined as well as the methods of operation. Of the latter Mr. Ulrich says:

"The owner of an individual ditch operates it as he pleases, subject only to the State laws governing the diversion and use of water. But when several persons are interested in the same ditch the necessity for some system of control arises. In the case of unincorporated community canals, this control is secured by the selection of a water-master, who is usually one of the owners, to have charge of the operation and maintenance of the system and the distribution of its water to those entitled to its use. It is on the large corporation canals, however, that the necessity for a careful system of operation and management is most apparent. Many of these canals are more than 50 miles long and number their water-users by hundreds. The Ridenbaugh Canal in the Boise Valley, Idaho, furnishes water to more than 500 farmers. The High Line Canal in Colorado has 433 consumers under it; the Loveland and Greeley has 257, and many other systems are as large or larger. . . . It can thus be readily seen that the proper operation of such canals involves a very thorough business organization and careful attention to many important details."

The flooding, furrow, and compartment systems of applying the water to the land are described, and their special conditions and applications are setforth. The value of reservoirs in equalizing the supply from streams and in enlarging the watered area is pointed out. Of this the author says:

"The quantity of water necessary or used for irrigation fluctuates during the irrigating season, but unfortunately the period of maximum use does not coincide with the period of maximum flow of the streams. . . . The time of greatest need for water varies somewhat in different localities, but generally there is very little water used in April, and the quantity used in May is relatively unimportant. June and July are the months of maximum use, and the use in August is usually considerably greater than that in May. . . . The August flow of streams is that which limits their irrigating capacity. Not more than about 20 per cent to the total annual discharge of streams can be made available for irrigation from their natural flow. . . . Where the topography of the country is favorable this loss of water may be prevented or greatly diminished through the construction of reservoirs for storing the surplus during the early part of the season for use in the later months. . . . With these benefits there are also complications. If a comprehensive system of storage is to be adopted it will doubtless increase the difficulty of dividing water among the different claimants to a common supply and make it necessary to have additional legislation to define the character of the rights to these stored waters."

In an appendix, Mr. Ulrich describes the methods by which the various States divide water among appropriators and gives the names of officials in charge. One gathers that there is now pressing need for National legislation to control the whole subject of water storage and supply, where more than one State is involved in the same system, as is not frequently the case. E. M. A.

NEW STEAMSHIPS BUILDING.

In many respects a new era of steamship building is in progress, both abroad and in this country, and the recent withdrawal from commerce of the large fleet of steamers to carry British soldiers to South Africa seems to demonstrate the inadequacy of the present vessels for the ocean-carrying trade in emergencies that may at any time arrive. Not only was our Pacific Coast trade hampered by the withdrawal of steamers for duty in the Philippines, but the passenger service to the Paris Exposition next summer will be more or less seriously affected by the lack of ships. There will be few if any steamers that can be chartered for carrying the extra crowds, and some of the regular liners will probably be out of commission. Six of the Cunard line's steamers are employed by the British government, including some of the most commodious vessels engaged in transatlantic service, and three of the White Star steamers, including the big "Majestic." These vessels will hardly be returned to the companies in time to participate in the active ocean traffic for the Paris Exposition.

There will be several new ocean liners finished by spring which will partly compensate for the loss of these big steamers of the English companies. The Holland-American line expects to have ready for the spring rush to Europe the new "Potsdam," a liner of large dimensions and superb accommodations. The French line will launch three new steamers equal in capacity and service to any engaged by that company in transatlantic service. These vessels, "La Savoie," "La Lorraine" and "l'Aquitaine," will form quite a formidable little fleet by themselves, and they will add greatly to the carrying capacity of the French line.

There is building in this country quite a formidable fleet of steamers which will be completed at different times within the next year or two. The Pacific Coast will monopolize many of these new American coasters, and they are being built for trade on that side of the world. The Pacific Mail Steamship Company will soon launch two fine steamers for Oriental commerce to ply between San Francisco and China and the Philippines. The Oceanic Steamship Company has three steamers under way, and the International Steamship Company is having two commodious vessels constructed. There are four new steamers being built for the Hawaiian trade with a gross tonnage of 26,590. The New York and Cuba Mail Steamship Company have three more vessels partly finished.

The majority of the new steamers are being built on the Pacific Coast, and indicate the prosperity that will follow our new policy in the Far East. President Hill, of the Great Northern Railroad, promises that within five years there will be twenty-five new steamships in the Oriental trade, plying between the Pacific Coast and China, Japan, and the Philippines. These, he predicts, will be of the largest size, with enormous carrying capacity, and slow of speed. Speed is not considered so much an object as to be able to lay the goods down on the other side of the Pacific so that they can compete with the native product.

The shipbuilding yards of both coasts are reported to be full of orders, and even those on the Great Lakes have all they can reasonably construct in the next year. According to the Commissioner of Navigation there are 50 war vessels, with a total displacement of 140,813 tons, under construction or contract in this country, and 45 coasting vessels besides the large ones mentioned above with a total gross tonnage of 76,007. The construction of these vessels assist in promoting the new era of prosperity in American shipbuilding. The world's carrying trade has in recent years increased faster than the number of steamers built to transport it, and the peculiar conditions brought about by war have merely tended to emphasize this fact and bring the matter to an acute crisis. In the new shipbuilding era we shall no longer stand by and permit other nations to do most of the building; for the signs are unmistakable that the long-looked for and urgently-needed revival of American shipbuilding is at hand.