

I have repeatedly watched the great depression at the rail joints from the passing of locomotives on good track and away from stations. In one instance, five heavy mountain engines coupled together passed me between stations on a road accounted one of the best. The rails not only bent deeply at the joints, but the ties away from the joints seemed to move freely up and down in the ballast. The ballasting, though apparently of the best, was too coarse, so that it did not hug the ties, and a large proportion of the spikes did not bind the rails to the ties. Though the curves were short here, and the grades heavy, there was no lateral bracing of the rails to insure their standing up, and I was told that accidents on this part of the line were of frequent occurrence. And here was in use a heavy, wide, tie plate, which practically covered the full width of the ties, whereas the ordinary tie plate, as I have seen it, is so narrow as to afford but little more bearing than the rail itself. Section men say that the short life of the tie is owing not so much to decay as to the cutting occasioned by the pounding of the wheels. How necessary, then, to employ a tie plate with a wide bearing on the tie.

On at least one great transcontinental line, the tie plate, so essential in preventing lateral movement also, is conspicuous by its absence; and this line boasts some of the heaviest locomotives in use. I noted also along this line piles of ties just removed and awaiting the torch, which seemed to be but masses of splinters and decay, so long had they been kept in the ground.

On another line I saw one place where the shattered ties, four or five together, afforded but little support for six or eight feet of rail. And no doubt it is in such places as this that the rails spread, as certainly there is little to hinder. One fast train which I failed to catch, I was later interested in learning, was ditched while running at good speed on straight track, by spreading rails.

No doubt individual pieces of track show care, or the want of it, on the part of the section boss, but the lack of tie plates, and of lateral bracing on curves, indicate a defective system.

I saw two rails, opposites, in which only two spikes at each end of the rail were driven home, the section men evidently having been called off to other work. All the rest were started only, and stood from one to three or four inches above the rail base. This condition lasted for forty-eight hours on a main line where there was an average of a train an hour, many of them fast and heavy express trains. It was invitation to disaster, and yet had a derailment and wreck occurred, who even of the officials would have suspected the cause?

On one electric line I watched for many miles a new curve. The usual joint depression was marked, but in addition the rails were spread at the joints, where they were highly polished by the pounding of the wheels, while on the apex of the curve the wear showed only on the inner half of the rail face. While high speed was made on this road, its roughness appeared from the fact that it was difficult to keep one's seat without bracing the feet. The rails were comparatively light, and more readily responsive to the inequalities of the roadbed.

I think these observations go to show not only the remarkable endurance of the American rail, but the need of a better bed for it to lie on, not only for its own life, but for that of the traveler.

Chicago, Ill.

GEORGE S. PAINE.

THE LOCUST TREE: AN IMPORTANT FIELD FOR INVESTIGATION.

To the Editor of the SCIENTIFIC AMERICAN:

The locust is one of the most valuable trees growing in the United States. In common speech we have the black, yellow, and honey locust. The botanists recognize the false acacia, or *Robinia pseudacacia*, and the *R. hispida*. The wood has a strength as great as or greater than any of our native woods. Its only rival in common use is the hickory. The latter, however, is not nearly as strong. Hickory has the one advantage of being much more elastic. The locust resists crushing in experiment to the extent of 9,800 pounds, and its tensile strength is put at 18,000 pounds per square inch. The wood is almost insensible to decay, and lasts under water like white pine, which is in that position indestructible. Its great tensile strength and durability caused its universal use for treenails in wooden ships. No other wood ever took its place for this purpose.

The insensibility of the wood to decay appears to be due to some form of pitch or waterproof varnish within the wood. It seems to the casual observer that there was some chemical combination with the cellulose itself, which rendered it immune from the action of water. Even a locust post seems perfectly indifferent to decay at the surface of the ground.

Since the cellulose of the locust seems not to be different from that of other trees, the importance of a chemical investigation, which shall discover the secret of its remarkable and valuable characteristics, can at once be seen. The discovery of some means of converting ordinary cellulose into a compound having the same properties as that of the locust would be simply invaluable in the arts. If merely a method of imparting its waterproof qualities to the cellulose of the spruce, for example, could be discovered, it would result in the creation of a new and gigantic industry, perhaps several.

An investigation of this subject opens a wide field to the young man. Its importance and value can hardly be overestimated.

It will be interesting to note the fact that the finest, strongest, and most desirable locust timber in the United States is said to be found on Long Island. It is also said that the tree grows more rapidly there than anywhere in the country. From the so-called annual rings, it appears to be one of our most rapidly-growing trees. Owing to the extreme hardness of the timber, it does not promise to be a favorite with lumbermen. It is somewhat surprising that the locust is not more frequently recommended for railroad plantations.

B.

WHAT IS THE SELDEN PATENT?

BY CHARLES B. HAYWOOD.

Although manufacturers' organizations, formed as the result of differences of opinion concerning its validity, have done a great deal to spread knowledge concerning it and have greatly emphasized its importance, much confusion exists in the public mind as to just what the so-called Selden patent is. Exactly what its claims cover is something of which even the majority of well-informed motorists have but the haziest conception. Probably the one thing that is generally known regarding what bids fair to make for itself a niche in American patent history, as lasting as that of the Bell telephone, or McCormick reaper litigation, is that there are a certain number of manufacturers who acknowledge the validity of the Selden patent and pay royalties under license; likewise that there are others who refuse to part with even the small percentage of their profits now demanded as tribute. Originally the royalty paid by the licensees to the owners of the patent was 1.25 per cent. A reduction to 1 per cent was afterward made by the owners of the patent, voluntarily, as the volume of business increased. Subsequently, owing to the refusal of several of the licensees to pay the royalties at the old rate to the receivers of the Electrical Vehicle Company, the owners of the patent, a petition, filed by the licensees, was granted by the Federal Court for a reduction in the amount of royalty from 1 per cent to 0.8 of 1 per cent.

It is also generally known that the two trade organizations in question have been formed for the mutual protection of the interests of their members; one to uphold the Selden patent, hold automobile shows, and generally advance the welfare of its supporters by various means, such as the maintenance of a laboratory, an engineers' department holding monthly meetings, and the like; the other to fight the patent, its objects otherwise being the same as the first, though it has not developed them to the same extent as yet. These are respectively the Association of Licensed Automobile Manufacturers and the American Motor Car Manufacturers' Association, generally known as the Licensed Association and the Independents. Each holds an automobile show in New York annually. In Chicago, they sink their differences for the time and exhibit together simultaneously. This serves to sum up the extent of general knowledge on the subject. It may be added here that there are other manufacturers, of no small importance, who acknowledge the standing of neither association by holding aloof from both. Needless to add, they pay no royalties.

The Selden patent was granted to George B. Selden, of Rochester, N. Y., November 5th, 1895, and is known in the United States Patent Office files as No. 549,160. The application for patent rights was filed sixteen years earlier, or on May 8th, 1879. The subject of the patent is set forth by the applicant as an "Improved Road Engine," while its chief advantages are stated as "the elimination of the great weight of the boiler, engine, water, water tanks, the complicated apparatus necessary to adapt the machine to the roughness of the roads which it must traverse, the necessity of a skilled engineer to prevent accidents, and the unsightly appearance of locomotives built on this plan."

Parts of the specifications upon which the inventor and the Licensed Association found their appeals to the courts to sustain the basic nature of the Selden patent, are as follows: "I have succeeded in overcoming these difficulties by the construction of a road locomotive propelled by a liquid hydrocarbon engine of the compression type, of a design which permits it to be operated in connection with the running gear . . . very largely reducing the weight of the machine in proportion to the power produced, and which enable me, while employing a most condensed form of fuel, to produce a power road wagon, which differs but little in appearance from, and is not materially heavier than the carriages in common use, is capable of being managed by persons of ordinary skill at a minimum of trouble and expense, and which possesses sufficient power to overcome any ordinary inclination. Any form of liquid hydrocarbon engine of the compression type may be employed in my improved road locomotive. As the general mode of construction and operation of liquid hydrocarbon engines of this class are now well known, it is considered unnecessary to further describe them here.

"The traction wheels are attached to the axle by clutches, splined on the driving shaft and held in mesh by springs in order to permit of the wheels rotating independently of each other to facilitate progress over rough roads and the turning of corners. These clutches may also be used for the purpose of disconnecting the engines from the traction wheels. Friction or ball clutches may be used for this purpose. Provision is made for backing my improved road engine by reversing the motion of the driving wheels by a set of reversing gears . . . a clutch is interposed between the engine and the driving wheels so as to admit of running the engine while the carriage is stationary."

Selden accordingly made the following claim:

"The combination with a road locomotive, pro-

vided with suitable running gear, including a propelling wheel and steering mechanism, of a liquid hydrocarbon gas engine of the compression type, comprising one or more cylinders, a suitable liquid fuel receptacle, a power shaft connected with and arranged to run faster than the propelling wheel, an intermediate clutch or disconnecting device, and a suitable carriage body adapted to the conveyance of persons or goods, substantially as described."

It will be apparent from this that the patent granted to Selden accordingly covers every one of the fundamental essentials of the gasoline automobile of the present day—the internal-combustion motor working on a compression cycle, a clutch or means of disconnecting the road wheels from the engine, the latter being designed to run much faster than the road wheels, and a means of reversing by a gear train. The differential principle of driving the wheels was also involved, but this has no bearing on the patent. Evidently, if Selden's claims can be substantiated, they are basic, and enormous royalties may be collected. It all hinges upon whether or not Selden was anticipated by other investigators in the same field, or as the legal phraseology of the Patent Office has it, whether there is anything in the "prior art," which would render his claims to originality entirely unfounded.

Apparently, this is rather a simple question and it has been settled times without number, both *pro* and *con*, by automobile enthusiasts, who are willing to pass unequivocal judgment in accordance with their own views without the slightest hesitation. Thus far, however, it has consumed nine years of litigation, almost half a million dollars, and 60,000 folios of testimony to provide the courts with something upon which to base a decision, and this has yet to be rendered. The life of the Selden patent comes to an end, November 5th, 1912, and there is at least a doubt as to whether the question of its validity will be finally settled before it legally expires. It has been considered in automobile circles that this is somewhat of an exceptionally long-drawn-out instance of patent litigation, but the telephone, reaper and binder, and the sewing machine furnish parallel cases that greatly exceed it, these landmarks in our patent history having been in the courts throughout practically the entire terms of their legal existence of seventeen years.

As early as 1899, George Day, then president of the Electric Vehicle Company, became convinced of the value of the Selden claims, and his company accordingly acquired a controlling interest in the patent. The company in question, which is now operating in the hands of a receiver, was then making gasoline as well as electric vehicles, and in 1900 it undertook the task of enforcing its right by bringing an action against the Buffalo Gasoline Motor Company, and the Automobile Fore Carriage Company (it was always Selden's idea to drive the forward wheels) as infringers. Half a year later, another action was instituted against the Winton Motor Carriage Company, which was one of the first concerns in this country to market gasoline-driven vehicles on any scale. About two and a half years then passed without any developments of note, and then George Day, having resigned as an official of the Electric Vehicle Company, undertook the organization of the Association of Licensed Automobile Manufacturers. It was on March 10th, 1903, that the association came into existence with ten American manufacturers of automobiles as charter members. The litigation against the Buffalo and Winton concerns was then amicably terminated by the defendants agreeing to become members of the association and to pay royalties. A number of minor actions in the shape of petitions to the federal courts to enjoin the use of imported vehicles were brought against individuals and importing companies about the same time, with varying results. One or two were allowed to go by default through the defendant's failure to appear and contest the case, and injunctions obtained under such circumstances were exploited as evidence of the validity of the patent. Judge Hough of the United States Circuit Court for the Southern District of New York, denying an application to punish for contempt of court the violation of one of the injunctions obtained by default, stating emphatically that the patent could not be established by injunction. As a whole, the result of these actions was not any great gain or loss to either side.

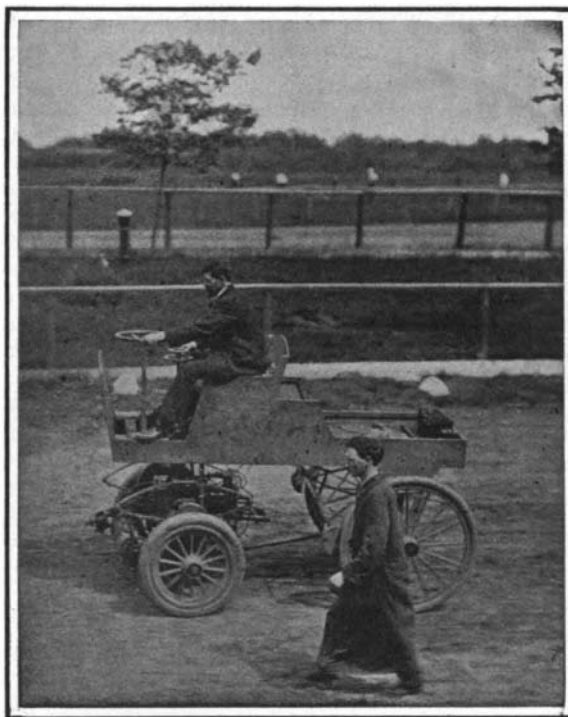
About six months after the actions against the first infringers to be proceeded against had been ended by their capitulation, the Ford Motor Company was organized in Detroit. One of the most important clauses in the articles of agreement of the Association of Licensed Automobile Manufacturers is to the effect that only firms which were actually engaged in the manufacture of automobiles on or before the date of its organization (it is not an incorporated body) were eligible to membership, and as the industry was hardly in its first swaddling clothes in the early part of 1903, it will be apparent that many important companies entering the field later were barred, willy-nilly. A notable instance of this was found in the organization of the Selden Motor Car Company in 1907, the inventor being com-

pelled to acquire an outstanding license under his own patent before he would be permitted to manufacture automobiles. This was accomplished by the acquirement of the license of the Buffalo Gasoline Motor Company, which relinquished its membership and gave up the manufacture of automobile motors, devoting its efforts entirely to the building of marine motors. As the number of licenses in the market was governed entirely by the failure or retirement of existing concerns, it will be evident that there was no alternative to companies starting at a later date, than to cast their lot with the Independents, whether they actually joined that organization or not. The American Motor Car Manufacturers' Association did not come into existence for some time afterward (February, 1905), and, due to poor management, did not make its influence felt at first.

Whether it had been possible to obtain a license or not would not have influenced Henry Ford, as he was determined to fight the Selden claims and has done so steadily for the past six years. From the very first, the action of the Electric Vehicle Company vs. the Ford Motor Company developed into a test case. During that period no stone has been left unturned to procure evidence of inventions antedating Selden. It is said that the claim of the combination of a hydrocarbon motor with a running gear and a device for disconnecting the engine from the running wheels is not tenable as such, whether as a basic claim or otherwise, and the upholders of the patent have accordingly founded their appeals to validity upon limitations concerning the type of engine to be employed. To prove these contentions, expert witnesses have been brought from abroad, a notable instance being that of Dugald Clerk, the well-known English authority on the internal-combustion motor, who spent several months here giving testimony for the owners of the patent. Every possible record having the slightest bearing upon the matter during the past century has been investigated, and in this way a mass of testimony, the taking of which was only concluded a month or so ago, has been accumulated.

Considerable misconception exists as to the vehicles which have been built under the Selden patent, one of

the chief contentions of the defendants in the test case being that a vehicle built to conform to the patent specifications would be utterly impracticable. The car shown in the accompanying photograph and bearing the date 1877 will be seen to resemble the vehicle of



"Hartford" Selden car built in 1905.

Note the control wheel. The exhaust is ahead of the car.

the patent drawings, though, as a matter of fact, it did not come into existence until the latter part of 1905, or the early part of 1906, and it is claimed to differ materially from the original specifications in that electric ignition has been substituted for the original device described. What is known as the "Hartford" car, which was built a little earlier than the

"1877" model by the Electric Vehicle Company at Hartford, is also shown by the photographs. In this engine the nature of the cycle differs materially from that of the patent, the motor being of the constant-pressure type, and also having electric ignition. It was tried out at the old Guttenberg track a few years ago, but it did not make as good a showing as the other car has in its various trials upon the New York streets, some of these events being illustrated by the accompanying photographs.

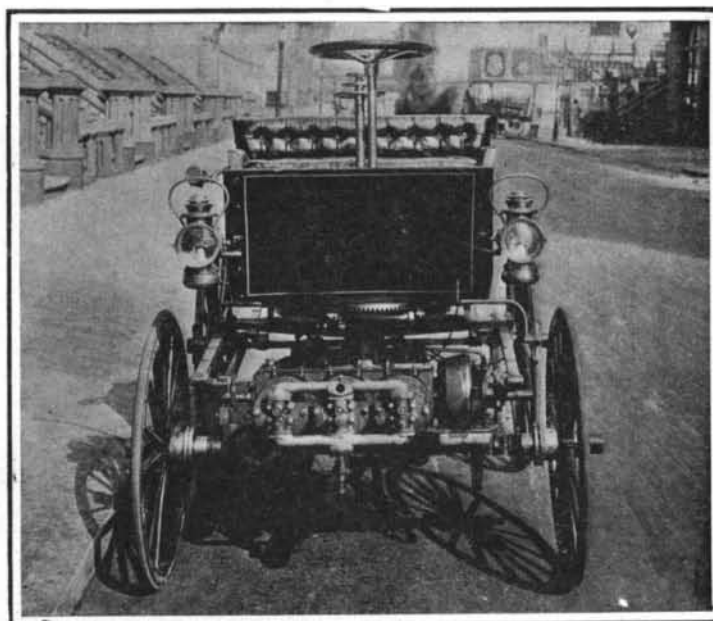
In the course of hunting up old records, an unusual number of instances that the respondents in the test case claim to antedate Selden have been found. Some of these go back as far as 1828, and it would require a volume of no mean dimensions simply to attempt to catalogue them all. The actual application of the automobile has really come about within a very few years, but it will be apparent from this that it is the development of a great many years of experimenting. Some of those cited as having antedated Selden in more ways than one, are Becquar, 1828; Lenoir, 1861; Carré, 1865; Menn, 1877, and a great number of others on the Continent. In this country, Brayton actually applied one of his constant-pressure type of gas engines to a street car in 1873, and to an omnibus five years later, though in neither case did these applications come into commercial use.

All this testimony is naturally merely supplementary to the contentions of the respondents that the machines built a few years ago by the upholders of the patent, in order to show that the latter was workable, are in reality not in conformity with the specifications of the patent, and that a machine built strictly in accordance with what it sets forth would be utterly impracticable. Both of the motors built to serve as exhibits in the case work on what is technically known as the two-part cycle, or more generally as the two-cycle, in that the cylinder fires a charge once in every revolution. The patent drawings show a type of engine having a differential piston, the small end acting as an air pump and maintaining pressure in a special air tank, while the liquid fuel is sprayed into the air rushing into the cylinder through the inlet valve, a small oil pump being employed for this purpose. One of the



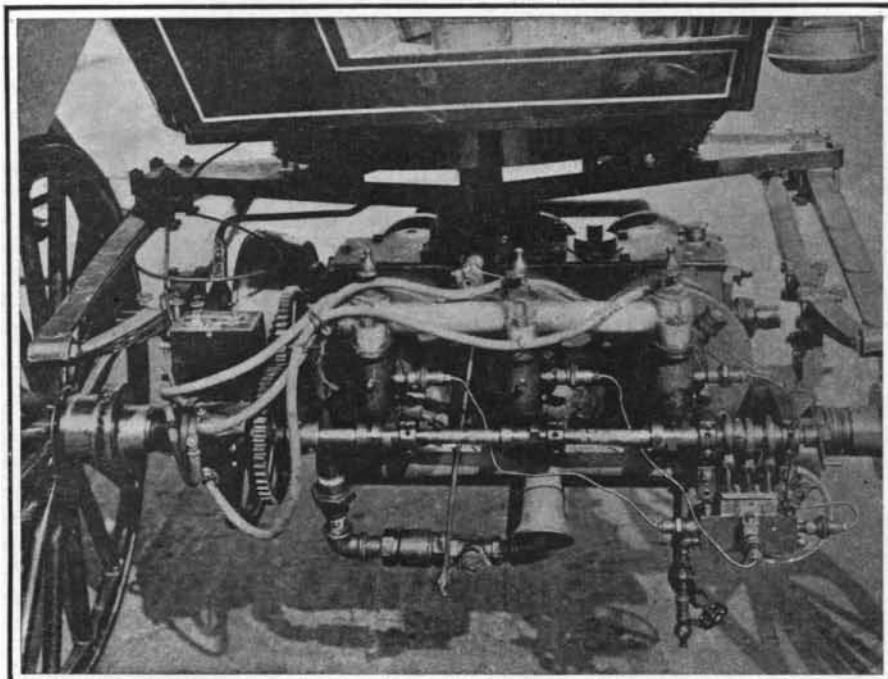
The "1877" Selden car built about 1905.

Standing at the curb is the car built by Henry Ford as an exhibit in the suit. It is equipped with a constant pressure engine and carburetor which was invented about 1865 and which is the large copper tank shown at the side.

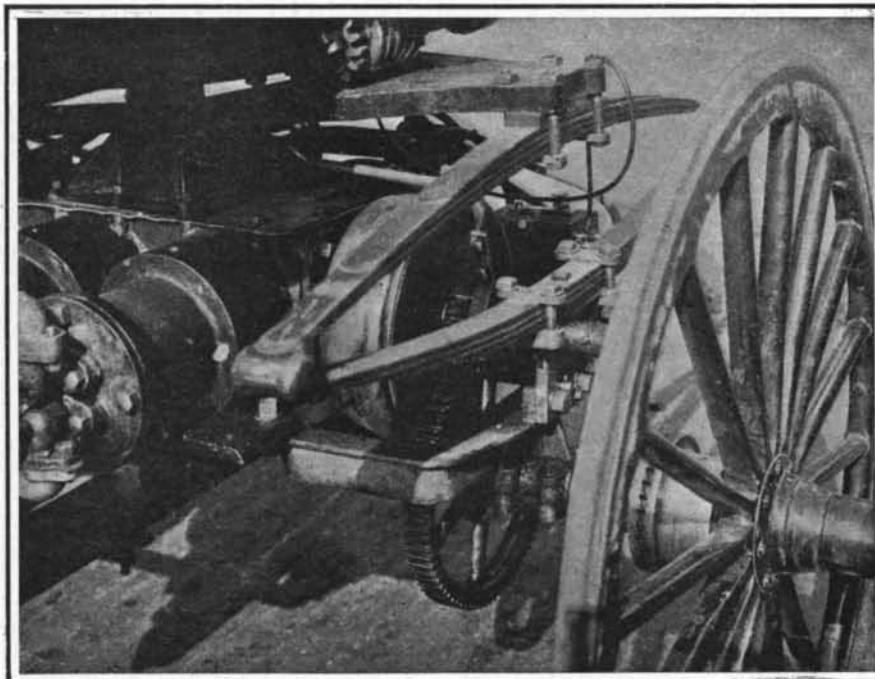


Front view of the "1877" Selden automobile.

The car has been built as nearly as possible to conform with the specifications of the Selden patent. The patent will expire in 1912.



Oil pump for fuel feed at right. The bell mouth extending downward is the exhaust.



Friction clutch, reducing gears, and hub clutch.

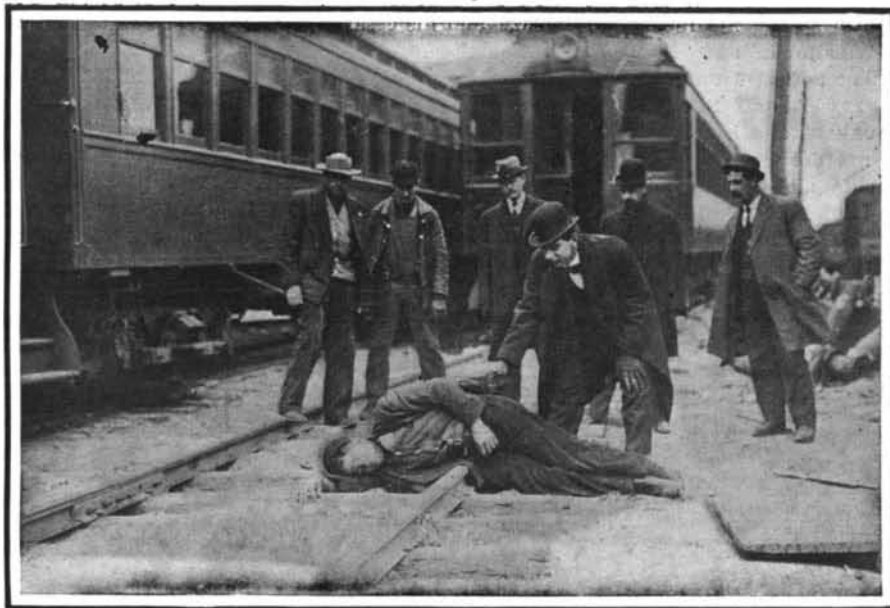
AUTOMOBILES CONSTRUCTED ACCORDING TO THE SELDEN PATENT.

contentions of those who are trying to have the patent declared invalid is that such an arrangement of feeding air and fuel could never be practical on a vehicle, regardless of the smoothness of the roads.

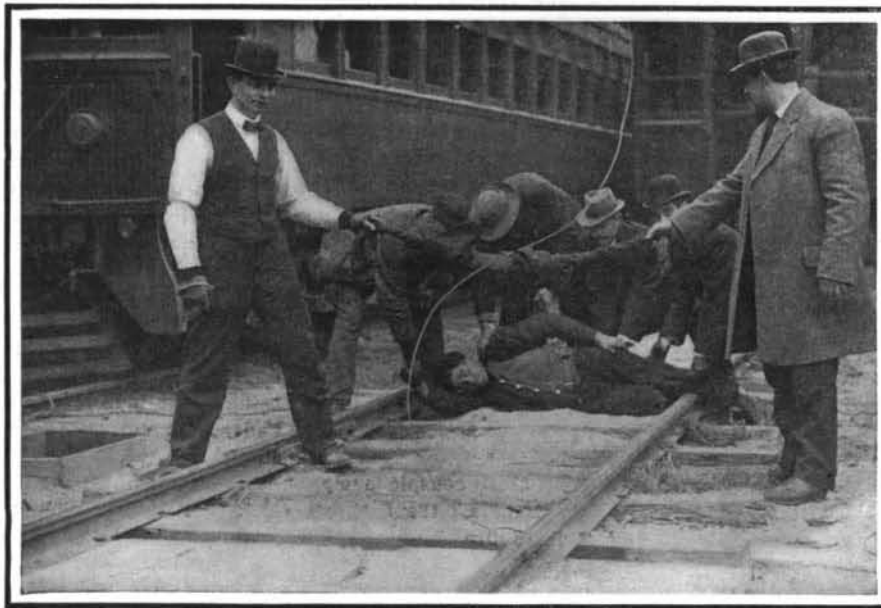
To sum up, the situation with regard to the Selden patent at the present moment is about as follows: All the testimony to be presented by both of the litigants has been heard, the last having been taken early in January of the present year. This huge mass of matter,

to attempt to move the wire away, or drag the victim out of contact with it, but by taking a coat by the sleeves and twisting it into a rope, as shown in one of the illustrations, two men on either side of the wire may lift it safely with the improvised rope. This experiment was tried even with a damp coat, and high-tension conductors were lifted without the operators' feeling the slightest shock. In case of a victim falling across a live rail, he may be removed either by

rent line. These experiments then show that a fireman need have little fear of injury to himself when operating in the vicinity of high-tension circuits. The experiment of using salt water in the hose line was not tried. No doubt, as salt water is a far better conductor than fresh water, the firemen might have found it quite hazardous to use the hose so close to the high-tension wires. Chemical extinguishers were found to be very dangerous. A voltmeter was connected be-



The safest way of dragging a man off a live rail.



Using a coat as a rope to lift a live wire.

comprising many thousand typewritten folio sheets, will be printed as the record of the case, and if the thirty-odd cases that are on the Circuit Court calendar in New York for its spring sessions can be disposed of in time, the Selden case will come up for trial in May next, this consisting principally of an oral argument of the merits, *pro* and *con*, by counsel for each side. Regardless of which party the court's decision favors, it is a foregone conclusion that there will be an appeal. That will mean the lapse of about another year, before the matter again comes before the court, this time the Circuit Court of Appeals. Then some time will elapse before a decision is rendered, so that it will probably be 1911 before there is anything definite to record. A few of the customary delays will easily bring this up to the date of expiration in 1912.

FIRST AID TO THOSE INJURED BY ELECTRICITY.

The increasing use of electricity on our large railroad systems, and the danger it offers to employees, have aroused officials to the importance of instructing their men how to act in case of accident. It frequently happens that a man who receives a shock is allowed to suffer from lack of proper immediate treatment, owing to the inherent dread of electricity among all those who are not familiar with the handling of electric circuits. Again, the victim may receive a severe shock and may appear to be dead when he is

seizing the twisted end of his coat and dragging him off, or by using a wooden pole; as dry wood is a very good non-conductor.

At the meeting in Altoona, a new type of pliers was tried out, and found to be just the thing for cutting live wires. The pliers were provided with wooden handles, so that the hand did not come in contact with any of the metal parts. The handles were boiled in paraffine, rendering them such good insulators that they withstood a pressure of 8,000 volts. With these pliers a line carrying 2,300 volts was repeatedly cut by a man standing on the ground, without his experiencing any unpleasant shock.

A very interesting series of experiments was undertaken, to determine what measure of danger there would be to a fireman who was obliged to direct a stream of water against a live wire. For this purpose several circuits were provided, one a 525-volt direct-current circuit. One side of this circuit was grounded, and a $\frac{5}{8}$ -inch stream of water was played against the other side. A voltmeter placed between the hose nozzle and the ground showed a potential of 20 volts when the nozzle was held at a distance of 7 feet 5 inches from the wire. At 3 feet $7\frac{1}{2}$ inches the potential was 60 volts, and at 2 feet 2 inches 70 volts, while at $7\frac{1}{2}$ inches it amounted to 210 volts. This showed that the firemen need not fear to operate the hose at a distance of 3 or 4 feet from the wire, and if stand-

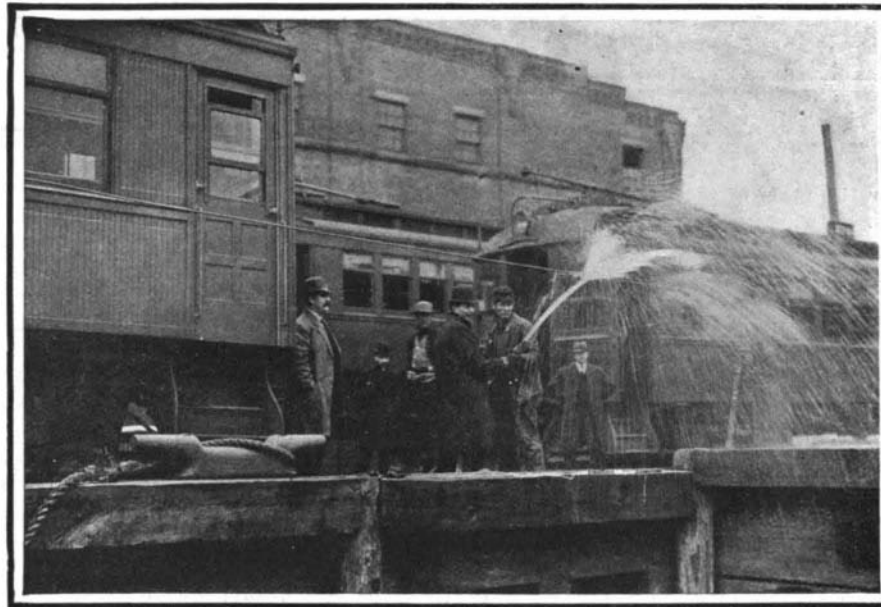
tween the ground and an extinguisher, and a stream from the latter played on a line carrying 2,500 volts. At a distance of 9 inches from the line, the voltmeter showed a reading of 1,500 volts. This is a very important matter to bring to the attention of the public, for the reason that passenger trains are usually equipped with chemical extinguishers, and in case of a wreck on an electrified line, serious consequences might result from the promiscuous use of these extinguishers.

Official Meteorological Summary, New York, N. Y., February, 1909.

Atmospheric pressure: Highest, 30.41; lowest, 29.24; mean, 29.95. Temperature: Highest, 58; date, 10th; lowest, 5; date, 1st; mean of warmest day, 47; date, 24th; coolest day, 12; date, 1st; mean of maximum for the month, 43.7; mean of minimum, 30.9; absolute mean, 37.3; normal, 30.7; excess compared with mean of 39 years, 6.6. Warmest mean temperature of February, 40, in 1890. Coldest mean, 23, in 1875 and 1885. Absolute maximum and minimum for this month for 39 years, 69 and -6. Average daily excess since January 1, 4.5. Precipitation: 4.31; greatest in 24 hours, 1.56; date, 23rd and 24th; average of this month for 39 years, 3.80. Excess, 0.51. Accumulated excess since January 1st, 0.08. Greatest February precipitation, 7.81, in 1893; least, 0.82, in 1895. Snowfall, 1.4. Wind:



Prying a victim off a live rail with a wooden pole.



Playing the hose on a high-tension conductor.

FIRST AID TO THOSE INJURED BY ELECTRICITY.

only stunned, and if properly worked over he may be resuscitated.

Not long ago the Pennsylvania Railroad assembled at Altoona, Pa., two hundred officials and employees from the various sections of its system, and gave them practical instructions in the various first-aid treatments which would be applicable to those injured by electricity. When a man is injured by coming in contact with a fallen live wire, it is a dangerous matter

ing on a ladder, they may hold the nozzle within a few inches of the wire. The same experiment tried with an alternating-current line of 2,050 volts produced no reading at all in the voltmeter when the nozzle was held within $3\frac{1}{2}$ and $6\frac{1}{2}$ feet of the line, and the only effect noticeable was a slight static discharge when the nozzle was touched with the hand. A similar result was observed when playing the hose at the same distances on a 4,100-volt alternating-cur-

Prevailing direction, west; total movement, 11,012 miles; average hourly velocity, 16.4 miles; maximum velocity, 73 miles per hour. Weather: Clear days, 3; partly cloudy, 11; cloudy, 14; on which 0.01 inch or more of precipitation occurred, 12. Sleet, 9th, 23rd. Fogs (dense), 15th, 16th, 24th. Mean temperature of the past winter, 35.23; normal, 31.80. Precipitation of the past winter, 10.85; normal, 10.94. Deficiency, 0.9. Snowfall of the past winter, 16.