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Julien Street Car Motor.

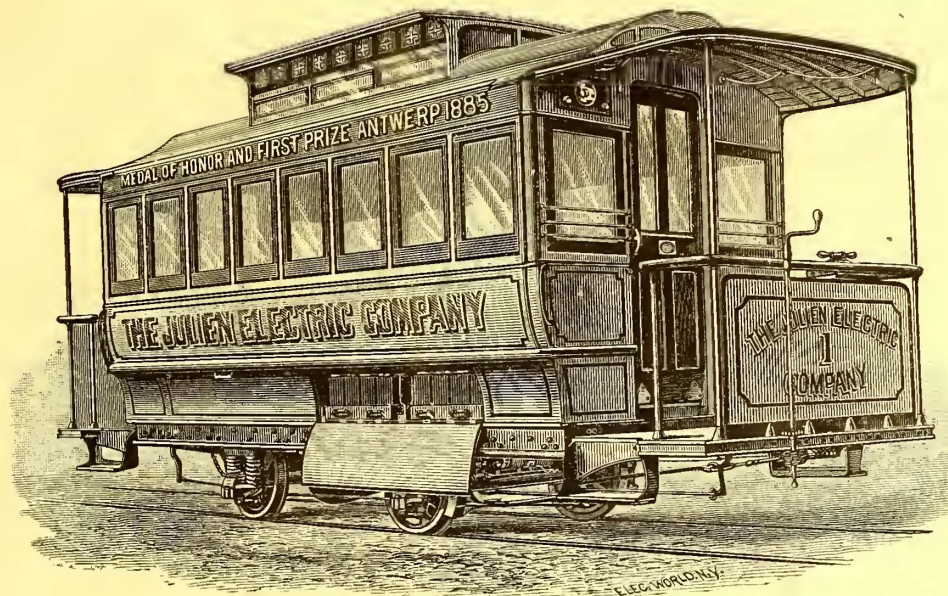
For several years considerable attention has been attracted by those who have been engaged in the construction of storage batteries for street railway purposes, as well as for those systems which are designed upon the principle of using a direct conductor. The first attempts at the application of the accumulator for electric traction were in 1882, and were made upon the Boulevard Voltaire at Paris. The result of this experiment showed that the problem involved the construction of a machine which should be perfect in all its parts, and especially

prises, first, a source of electricity; the accumulators, and an electric motor which is adapted to the car; means of transmission from the accumulator to the motor, and a suitable apparatus for controlling the motion. The source of electricity is a dynamo-electric machine which is usually driven by a steam engine, and these appliances are proportioned to the amount of electric energy which is to be produced. The accumulators are arranged under the seats of the car and contribute by their weight to increase the adherence necessary for overcoming grades. In order to facilitate its movements the elements are grouped in

the sills. The motor can be placed at one end of the car or between the axles. The transmission is made by belts to an intermediate arbor and thence by an endless chain to the axle of the car.

The regulating apparatus constitutes, with the accumulator, one of the most important parts of the whole. It is necessary, in fact, that the electric motor should be easily driven in either direction, and it is indispensable that the driver should be able to regulate the speed of the car at will, by furnishing a current to the motor in proportion to the resistance to be overcome.

Change in direction is obtained by



THE JULIEN ELECTRIC STREET CAR MOTOR.

that the accumulator should be so designed that its length of life should be considerably lengthened over what had been previously obtained. It is claimed by the promoters of the Julien system that this has been done in the case of their device by the use of a non-oxidizing grid which forms the basis of their plate, and then by filling them with red and white oxide of lead they claim that they have practically an indestructible plate and one which will last indefinitely. In other words, they have discovered a means of preservation of the electrodes from the oxidizing action of the electric current.

An installation for electric traction com-

series in low troughs, which are furnished with handles and by means of which the batteries may easily be placed underneath the seats from the outside, as shown in our engraving Fig 1. The elements of the same series have their electrodes in metallic connection. The extreme electrodes are brought in contact outside of the trough in such a way that, when the batteries are put under the seat, the contact is automatically made by springs which establish the electric communication between the different parts of the system. Fig. 2 shows the arrangement of a battery with the method of making the contact. The motor is put under the floor of the car and is fastened to

changing the position of the points in contact upon the brushes of the commutator, or rather in certain special machines by changing the direction of the current in the induced bobbin. Both arrangements have been used. The strength of the current furnished to the motor is regulated by a coupling up of the elements in such a way as to modify the electric motive force of the battery. In order to obtain this the accumulators are grouped in a series, ordinarily to the number of four. Each of the troughs, of which we have spoken, form a series, and by means of a special commutator these four series can be grouped, one in derivative action, two in

tension, leaving two groups united in derivative action, and the third with the four series in tension. They have also intercalated a fourth group in which the third series are arranged in tension and the fourth in derivative action upon one of the three others. The plates of the commutator are in electric communication with the extremities of the series and with the electric motor. The controlling lever is placed convenient to the driver; an indicator running over a dial indicates the grouping corresponding to the position given to the lever. Each notch corresponds to one of these groups; the first notch is employed for starting; the fourth notch, that is to say, the fourth series in tension, is used for developing great power upon grades and curves of a short radius. The car which has been placed upon the Eighth avenue line in New York is the last of a number which have been located at different cities, the others being in Europe. This car is larger than those of the others and is put

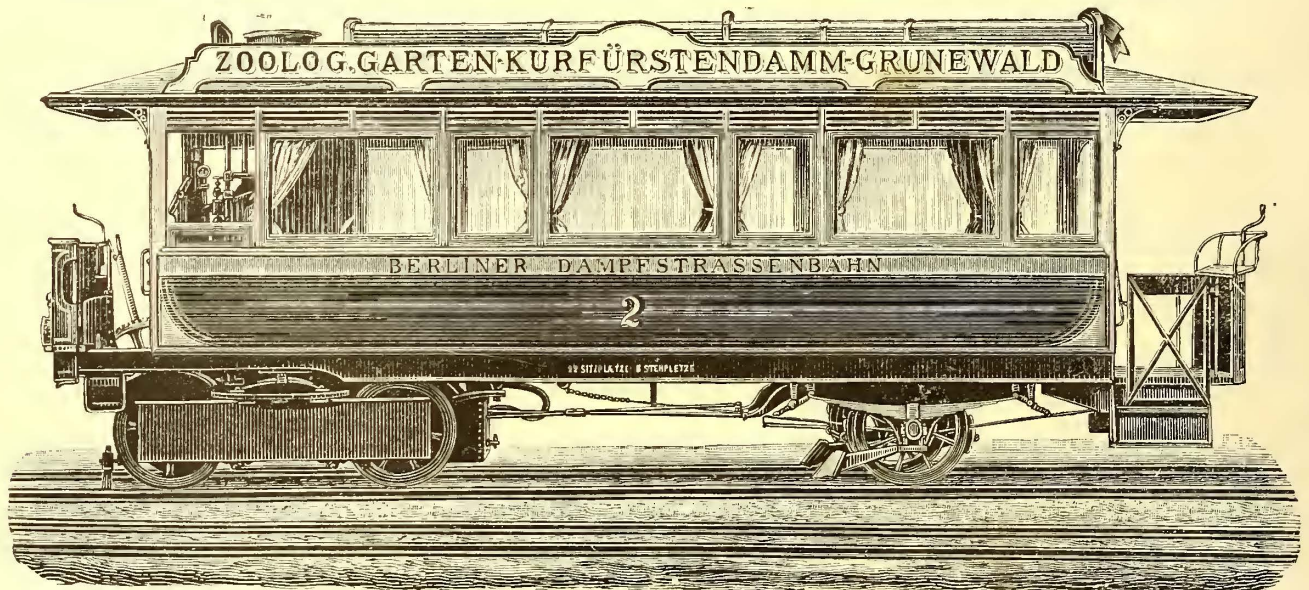
Rowan's Tram Cars.

The steam cars known as Rowan's steam cars, though employed for several years on a number of the Continental railways, are, in their present form, with noiseless engines and steam and smoke consuming apparatus, a new invention, and have been put into regular service on the new Kurfurstendamm Tramway at Berlin. It was one of the steam cars built in this line that took part in the International Exhibition at Antwerp, and was there awarded the gold medal. It was the open summer car for 60 passengers, illustrated in our Fig. 1.

It had then to compete with the best forms of electric and other motors, as well as several types of tramway locomotive. The Antwerp exhibition lasted four months, during which time all competitors were in regular service, conveying the public through the streets of the town from the railway station to the exhibition. The jury consisted of eight engineers of various

Before describing the car in detail, it should be noticed that it has not been designed with the idea of enabling tramway companies to run regular trains in the streets, but in order to supersede two horses in town traffic, as the true principle has always been that of small and frequent trains. They are, however, powerful enough to draw a second car after them, when desired, and as the cost of working one of the steam cars carrying fifty passengers does not exceed the cost of working one horse car, the advantages to be obtained by their adoption are desirable. It may, at least, appear improbable that the cost of working a steam car carrying fifty passengers should not exceed the working cost of a one horse car, yet such is the case, if the cost of renewal of horses, which is heavy, is also taken into consideration.

The car, as it is represented in our illustrations, consists of a body resting on two bogie trucks, a four wheel truck at the



ROWAN'S STEAM TRAM C-R, IN USE ON THE KURFÜRSTENDAMM TRAMWAY IN BERLIN. FIG. 1.

upon a line where the traffic is very much heavier than on any of the others. It was built at Brussels, and great care has been taken that all parts should be most carefully designed with the latest improvements, and also that the electric energy should be reduced to the lowest point. The accumulators which are put in this car have 20 plates each and weigh about 30 lbs. They are divided into eight series, each comprising 12 elements, and the weight of the whole battery is about 3,300 lbs. The experiment as tested in New York is an exceedingly interesting one and it is being watched by those who have the development of electricity in mind with a great deal of care, as well as by electricians who look upon it as a matter of purely scientific interest.

EMPLOYED AS A MODEL by every country in which street railroads are operated, the modern American horse car is recognized as alike perfect as a comfortable conveyance and as economical, durable in use and capable of adaptation for all climates and conditions.

nationalities, and the trials were carried out under strict control, as regards consumption of fuel, reports, etc. A resume of the report of Capt. Galton on these tests has been published in our columns, so that it is merely sufficient to note here that the Rowan steam car proved itself able to leave the yard in the morning and to do the whole daily service of fourteen hours without a fresh supply of either water or fuel. In this car, however, the water tank was exposed to the air, so that the feed water only kept its temperature on warm days, and as this defect can be easily remedied, the inventor claims that his car can obtain every day the same results as regards the consumption of fuel, as when obtained at Antwerp on warm days when feed water had proper temperature. It has been shown from the memorandum of the jury that the car has done fourteen hours service, running fifty miles, with the consumption of 220 lbs. of coke and 20 gallons of water. These results seem to be almost unprecedented, and further data on the subject will be exceedingly interesting.

front and a two wheel at the back. The motor is a steam engine of light and simple form, evenly balanced and completely protected from the mud, although open and accessible to the driver in all its parts. It is supplied with steam from a water tube boiler, with very perfect combustion, so that all smoke is consumed. The boiler is so constructed that it can easily be opened, and every part of the interior examined and cleaned.

The exhaust steam is passed into a copper surface condenser of peculiar design, with about 1,000 square feet of surface, carried on the top of the car and from which hot and perfectly pure water is supplied to the boiler. The steam is entirely condensed, none escaping into the air.

The cars are nice looking and handy, can run on any kind of rail and on almost any grade of curve; they are not wider than ordinary street tram cars, and take less room in the street than a tram car and two horses.

The brakes, acting on all six wheels, are worked by the driver, and the whole weight of engine, car and passengers being carried

on these wheels, the steam car can be stopped almost instantaneously.

As over two-thirds of the entire weight of the car and passengers rests on the four driving wheels, there is always sufficient adherence on all grades and the adhesion is augmented as the number of passengers carried increases. This peculiarity makes the car specially adapted for lines with heavy grades.

The steam bogie itself is attached to the body of the car in such a way that no vibration from the engine is transmitted to the car and so that it can in five or six minutes be taken out for cleaning or repairs. This is illustrated in Fig. 2, showing one of the smaller type of street steam cars in working order.

In a comparison between the Antwerp steam car and a tramway locomotive, with the same adhesion drawing, with the same number of seats behind it, it will be found

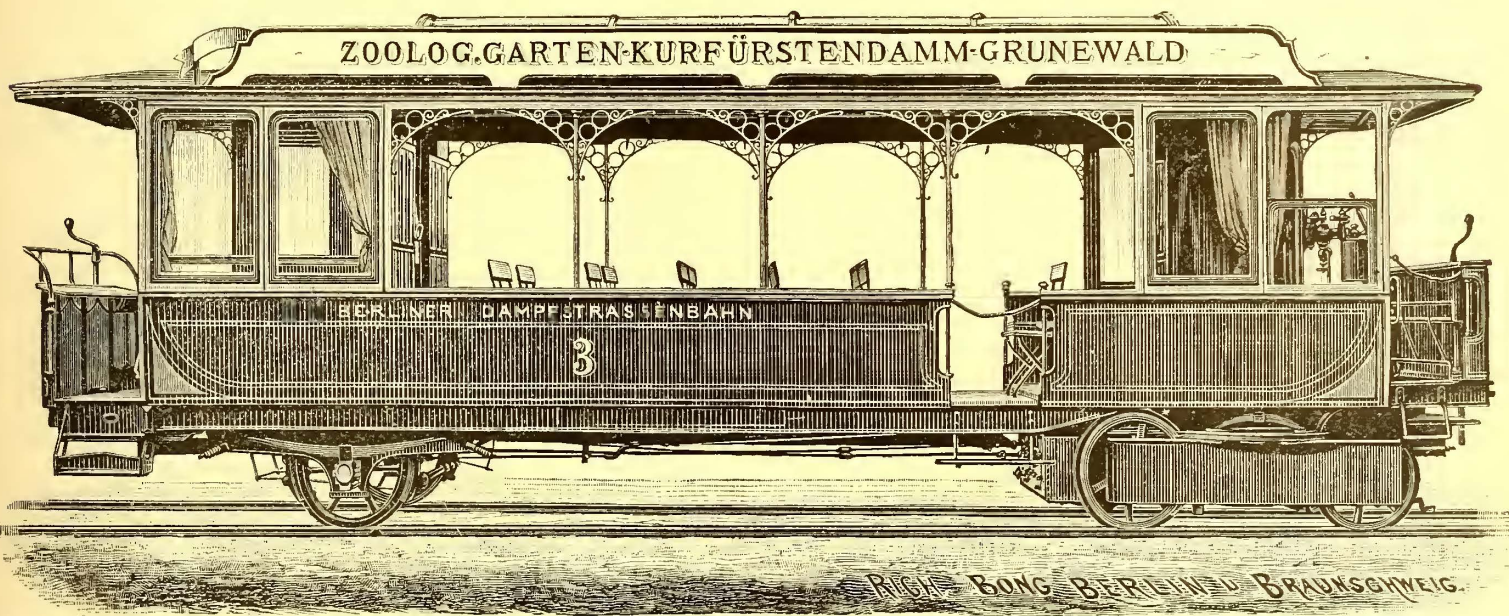
tioned, are worked with adhesion, the last with the cog wheel and rack as well as adhesion. The size of the condenser employed varies from 800 to 1,600 square feet of surface, according to the power of the engine. It will seat 45 passengers and allow standing room for 15.

The length over the platform is 31 feet 2 inches, the length of the body 26 feet 9 inches, while its total width is that of the widest horse cars, namely, 7 feet. The weight of the lightest is 7 3-4 tons; that of the third grade (with a motor weighing 2,600 lbs. and intended for a grade of one in twenty, is 9 1-2 tons. The car will run readily on a curve of a 50 ft. radius, and only one man is required for the work of an engine. It is claimed that two cars together with a capacity of 200 passengers had a dead weight of one hundred weight per unit of passenger capacity.

The same concern also manufacture a

in 1880 Mr. d'Ussel gave a description of his first attempts to thaw the thin layer of ice in the public streets, produced by the compression of snow by vehicles in time of frost. Since that period, owing to the expenditure of nearly \$970,000 in futile attempts to remove the snow in Paris in 1879-80 and 1880-81, the heavy tax has been removed from pounded salt not suitable for ordinary purposes, enabling salt to be largely used for clearing away snow, a provision of 4,000 tons of salt having been made for this purpose in Paris for the winter of 1885-6. A regular service for the removal of snow, on its first appearance, has been organized in Paris, as it is important to clear away the snow before it has been compressed into ice by the passage of vehicles, when it is far more difficult to remove.

"As falls of snow rarely occur at Paris with a temperature much below the freez-



ROWAN'S TRAM CARS. FIG. 2.

that there is no point in which the steam car has not the advantage. They claim there is less dead weight, less time occupied for couplings, axles and springs, a lower consumption of oil and fuel, and that repairs will be less.

The interior arrangement of one of these cars will be like that of an ordinary horse car, with seats along the side and entrance from the platform behind, or with seats running across the car, as shown in our illustration Fig. 1, and entrance at the end and sides.

As there are two entrances, there can be a middle compartment so arranged that it can be closed for winter use and then warmed by steam from the condenser. The general appearance of such a car is very similar to that shown by Fig. 1.

For a car such as we illustrate in Fig. 2, four types of steam engines with their bogie trucks are employed according to the grades on which the car is to be worked. For grades of one in forty they have a tractive power of 1,200 lbs., running to 3,600 lbs. for a grade of one in ten. The first three grades, only one of which we have men-

number of steam cars for light railways, which are built upon the same principle, with various devices to suit the necessities to which they are to be put.

Use of Salt in Removing Snow.

We give below an extract taken from the Engineer of London in regard to the removal of snow from the streets of Paris, and, inasmuch as our street railway companies insist on using salt in spite of the city ordinances, or else have obtained the privilege of doing so, it might be well to consider these methods. It certainly seems they are worthy of imitation, and though it may be rather late to accomplish much this season by their adoption, a snow storm or two in this month may give an opportunity of practically demonstrating the value of the scheme.

"The current volume of the Minutes of Proceedings of the Institution of Civil Engineers contains an abstract of a memoir on this subject by Mr. Barabant, which appeared in a recent number of the *Annales des Ponts et Chaussées*. It appears that

ing-point, salt may be sprinkled on the snow, producing a liquid, of which the temperature may descend to 5° Fahr. without its freezing. The salt should be scattered on the streets as soon as the snow begins to fall fast; the mixture is effected more thoroughly by the traffic, it does not adhere to the ground, and gradually liquefies, so that at the end of four or five hours the streets may be cleared by the sweeping-machine, the caoutchouc rake passed over the footpaths, and the mixture washed to the sewers by the addition of water. This cold mixture does no harm to paved roads, asphalt, and wood pavements; but salt should not be used on macadamized roads, which are disintegrated by the frequent artificial thaws thereby occasioned. This affords another reason for discontinuing macadamized roads in large towns, in France, which possess the great disadvantages of being very muddy in rainy weather, or during thaws, and of discharging quantities of sand into the sewers.

"The employment of salt would probably be very restricted in countries where the temperature often falls below 5°; but every-

where else it furnishes the best means of dealing with snow. It has been suggested that the coldness of the mixture is disagreeable to foot passengers, destructive to boots, and bad for horses' feet; but the latter can be protected by greasing the inside of the hoof, and as the mixture should be removed directly it becomes liquid, the inconvenience, both to men and animals, is very short in duration, and slight compared with the advantages and economy of the system. The salt should be scattered in proportion of about 1 dram per square foot for each four-tenths of an inch of thickness of snow fallen, or a larger amount if the temperature is low. Formerly each centimetre—0.4 in.—depth of snow falling in Paris necessitated an expenditure of over \$11,600, whereas now the cost is only about \$3,800, or a saving of two-thirds. Moreover the use of salt dispenses with sanding the streets, which on the

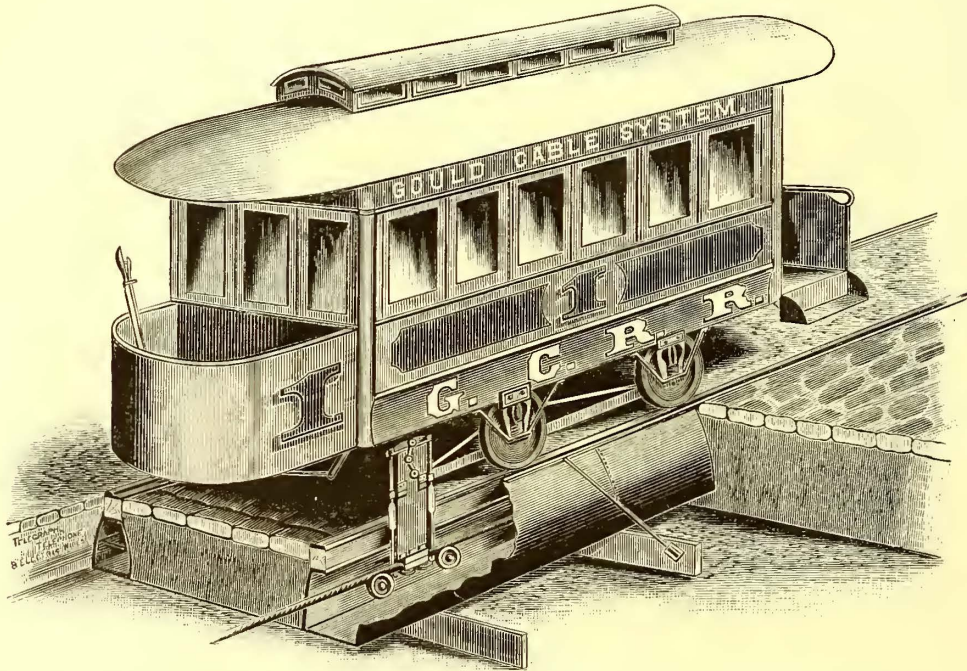
over which there is considerable traffic, the use of only half the proportion of salt adopted in Paris would enable a track of 6½ ft. to 10 ft. in width to be dealt with, along which the snow would be prevented from being frozen to the ground, and thus rendering traffic almost impracticable. The small cost of the system, and the advantages to traffic, are sufficient reasons for an early and wide extension of the use of salt for removing snow."

Gould Cable Car.

Some months ago we illustrated the full details and particulars in regard to the construction and operation of the Gould Cable Railway system*. It will be recollected that in this system the slot for carrying the grip was placed at one side and outside of the rails, so that cross ties up to the level of the street could be used without inter-

Diamond Metal.

The Diamond Anti-Friction Metal is intended for the lining of the brass bearings, etc., for the purpose of reducing the friction of journals, and to prevent "heating" and "cutting", and it is claimed that it possesses qualities that merit the attention of all who are interested in machinery. Tests have been made of this metal with a shaft with two journals, each 14½ inches long, 9 inches diameter, running at a speed of 44 revolutions per minute. One of the journals was run on a brass bearing of the usual composition, and the other was lined with the anti-friction metal. Mr. Fithian, of the U. S. Navy, who had charge of the test, states that at the beginning of the test both journals were 60° Fahr., and the pressure upon each was 5,365 lbs. After running one and a half hours the Diamond showed 107°, and the brass 140°. These



THE GOULD CABLE CAR.

arrival of a thaw, produced quantities of mud in the streets, and deposit in the sewers. Further, if the cessation of interruptions of traffic by means of this process is taken into account, the indirect gain to the people of Paris must be reckoned by millions of francs.

"Several machines have been devised for the removal of snow, but none of them are as cheap as salt; and the author gives a comparative estimate of the cost of melting snow by steam, and by salt, which shows that the method of steam would be much more expensive, besides entailing other disadvantages.

"The use of salt will probably not be confined to the clearing of streets in towns, but be extended to all paved roads, to tramways, and to the approaches to railway stations, and all large manufactories. Perhaps even, in France at any rate, salt might be used for dealing with snowdrifts in railway cuttings, by spreading it in sufficient quantities and sweeping thin layers successively salted. On all paved road

fering at all with the cable gripping attachments. We present in this connection a perspective view of the device, showing the methods more graphically than we were enabled to at that time.

The grip, it will be seen, comes down outside of the rails at the forward end of the car, firmly catching the cable, while the conduit on the other side can be used for telegraph, telephone or electric lighting purposes. The operating lever, which is the only one necessary, is placed upon the front platform, and the general construction will be understood by an examination of the engraving. It will be recollected that the whole is an iron system, and that the conduits are thoroughly and effectively braced against all the strains which may be brought to bear upon them through the action of frost and street traffic.

*J. H. Gould, Ninth and Market sts., Philadelphia.

TWO YEARS AGO THE STREET RAILWAY JOURNAL contained 20 pages; one year ago, 40 pages; now, 72 pages.

tests were continued from time to time with increasing pressure, and in all cases the temperature of the Diamond metal is claimed to have been lower and that no cutting occurred, whereas in the other cutting was almost invariably the result of the long run. It is claimed for the metal that it reduces the friction of bearing surfaces, has great durability, will not heat or cut, and will stand double the pressure when in motion that brass will, without retarding the speed of the rubbing surface.

Plumbago is one of the ingredients of the metal, so that it is claimed it acts as a partial lubricator.

*Diamond Anti-Friction Metal Co., 32 and 34 South Clinton st., Chicago, Ill.

LOCAL PAPERS with street railway items marked frequently reach us, for which thanks to the unknown senders. We are very glad to get them. We can't see all the papers in every street railway town in the country but we do want to know as much as possible about what every street railway is doing.

Scranton Street Railway.

There has been considerable discussion in regard to the exploitation of street railroads where electricity is to be used as a motive power, and although there have been many attempts and many exhibition tests of various devices whereby a car has been actually driven or moved by electricity either at exhibitions or at other places where it was desirable to show what could be done, there have been as yet very few places where a street railway has been actually incorporated and run by electricity, so that it could be called a paying investment.

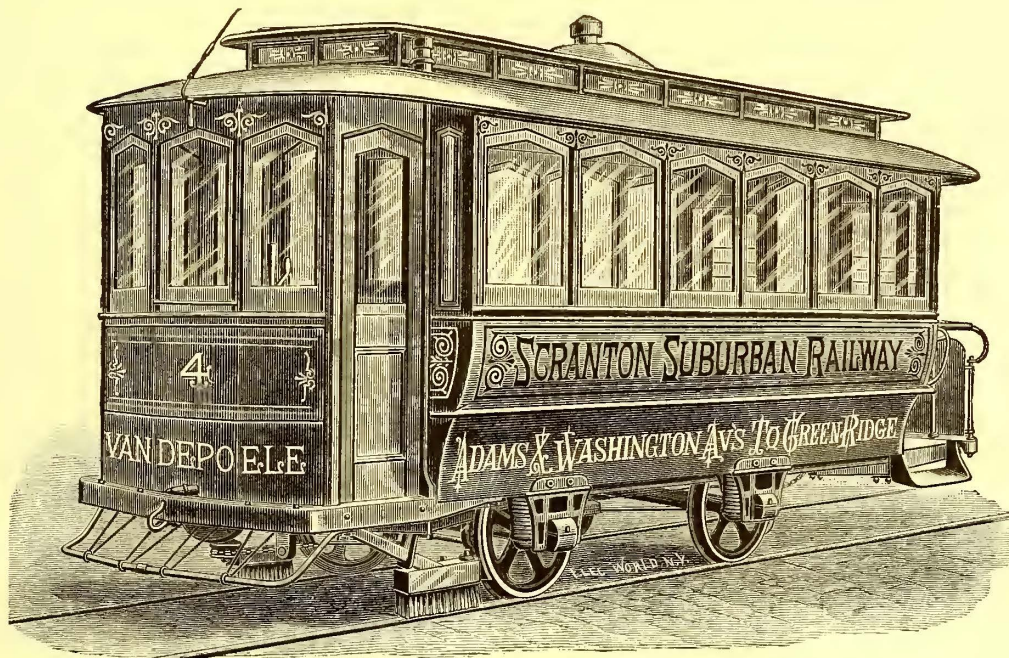
Among the first of these was the Appleton Street Railway of Appleton, Wis., where electricity is used as the motive power and is developed by means of turbine wheels, a fine water power being made available for the purpose.

quite as high as 6 per cent. The motor is placed upon the front platform of the car, turn-tables being placed at each end of the line, and drives the car by means of sprocket wheels and gearing, as shown in our illustration, Fig. 2. This engraving also shows the method of attaching the conductor, which leads from an overhead wire suspended from the center of the track and upon which there is a light traveler drawn along by the car. The car is under almost perfect control at all times, and although the motor is never reversed in their ordinary practice, it is possible to do so. The driver has a powerful brake by which the car may be stopped, and the means of starting is simply that of moving the short handle and making the electrical connections.

The motor is so devised that when the car is running on a level and running rapidly, only so much electricity is taken off from the overhead wire as is absolutely

distance of two miles, making all necessary stops for this large load of passengers, who were entering or leaving the car at all points, in about fifteen minutes, giving an average of about eight miles an hour for actual running, although at times the speed was considerably higher. We are informed by the management of the road that in the month of December the road carried 26,000 passengers. Part of this was attributed to the novelty of riding upon a car driven by electricity, and undoubtedly many passengers were carried upon that account, but the management estimated that their present solid traffic is something like 75 per cent of these figures. At present the station used for generating the electricity is that of the electric lighting plant of the city. The engine is the ordinary slide valve engine with a fixed riding cut-off.

Standing beside the dynamo it was



ELECTRIC STREET CAR OF THE VAN DEPOELE SYSTEM IN USE AT SCRANTON, PA. FIG. 1.

The first street railway which has actually been put in operation and run in the East, is that of the Scranton Suburban Street Railway at Scranton, Pa., which is operated like that at Appleton, on the Van Depoele system. The road is something over two miles in length, starts from the depot of the Delaware & Lackawanna R. R. and runs out into the suburbs of the city. The track is laid with Johnson steel street rail and put down in the best possible manner. The whole roadway is an example of substantial construction, which it would be well for other street railroads to study and imitate, and see that the shipshod method of throwing the track together within a few days and getting the cars to running is not a paying investment, for this road is firm enough to carry any kind of traffic. The cars are heavy and substantial and were built by the Pullman Palace Car Co., one of which we illustrate in this connection. This road runs over the level portion of the city and out into the hilly suburbs, as we have said, and over grades that run up

necessary to maintain the speed of the car, and this arrangement also prevents the engine from laboring more than is necessary in order to develop the electricity, as will be seen later. The wires from the overhead center run simply into and terminate in the air, and when there is no car on the road or the connections are shut off, the circuit is incomplete and no electricity is drawn from the wires.

We recently had an opportunity of riding over the road and thoroughly testing its capacity. In some places the track was covered with water that had come from the melting of recent snows and which had settled in the low portions of the street. In others the track was dry, but this was us ally upon the steep grades. It happened at the time of which we speak that the traffic was very heavy on account of some attraction outside of the city. The car in which we rode was loaded with from 35 to 40 passengers, and at no time was there the slightest hesitation or difficulty in starting, even upon grades. The car traveled the

possible to tell when the cars were started and estimate pretty closely as to when they were upon the heavy grades by the way in which the dynamo acted, and then turning to the engine it could be seen that when the car was started or hauled up a heavy grade the engine would lag a trifle, just the same as the engine would have done had it been hauling the car directly, showing that the amount of power which is actually developed when taken from the engine is strictly due to the amount of work being done by the engine at the time, and not held at a high point by the electricity which is lost and sent into the air. As we have already said, the management of the road have taken every pains and spared no expense in equipping it in the most workmanlike manner, and from the experience of the past few months since the road has been opened they are extremely sanguine that it is to be a financial success.

In fact, the traffic has increased so rapidly that they have ordered four cars in addi-

tion to the two which were put upon the road at the start.

The promoters and builders are certainly to be congratulated upon the success which they have attained.

The Fitting of Horse Collars.

The galling of a horse is often, in fact usually, caused by a poor-fitting collar. It is astonishing how many men there are claiming to be practical harness-makers, who do not thoroughly understand the measuring and fitting a collar.

Cases have come to our personal knowledge, where they were too small, and choked the horse, for which ignorance or carelessness there can be no excuse. More often they are too large, and the suffering

a sore neck. We know very well that at times it becomes necessary to use a sweat pad. If the sweat pad is made as it should be, and stuffed with deer or antelope hair, which absorbs moisture and perspiration, and does not get hard like goat's or cow's hair, it will do.

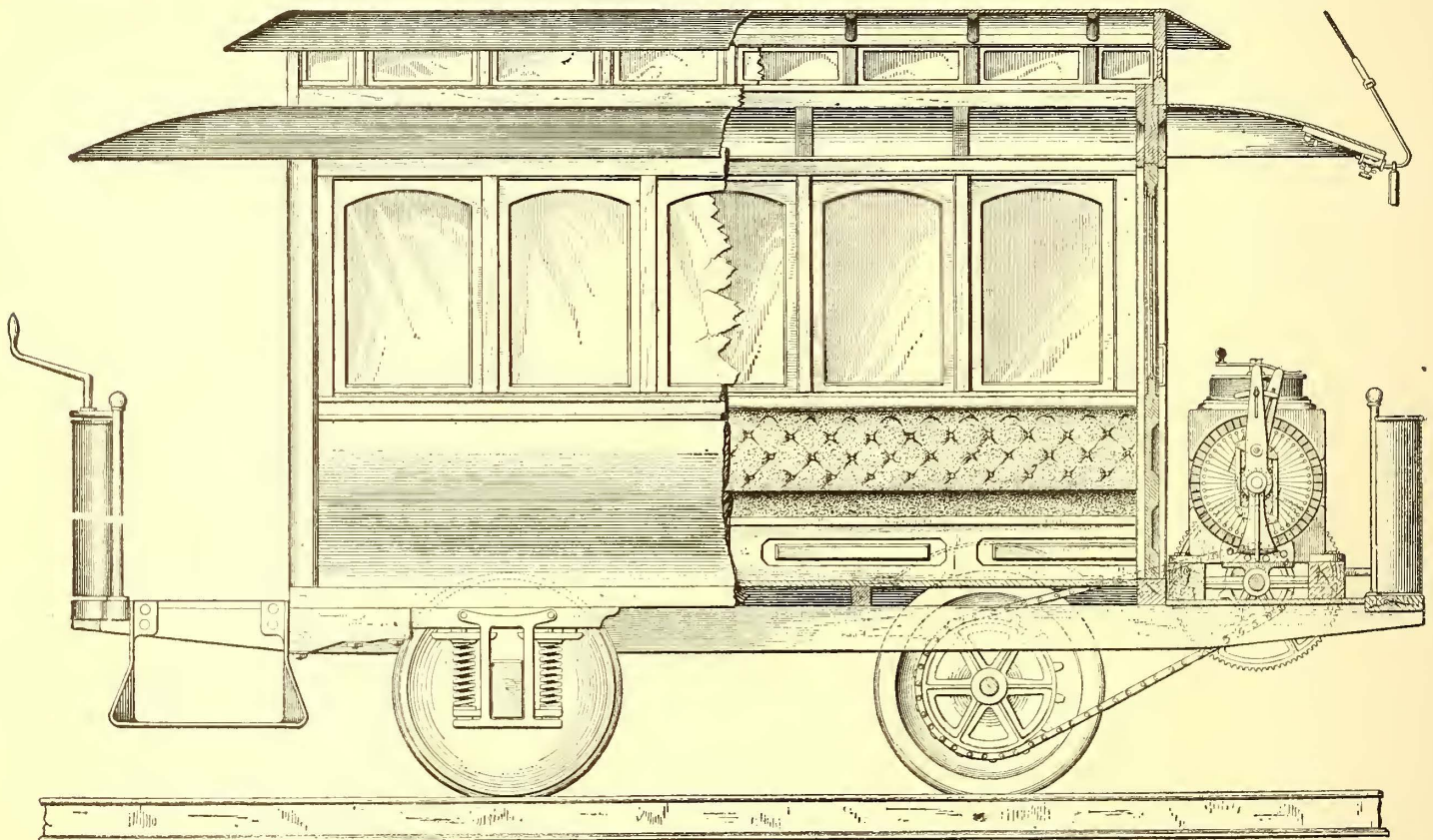
A harness maker has not a practical knowledge of his business if he cannot fit a collar properly, without making a practice of sewing a sweat pad in every pair of collars he makes.

It is interesting to study the formation of horses' necks, and then the measuring and fitting of collars. Nothing is more necessary in the manufacture of harness, and in no way as well as this can a man prove himself a skilled workman.—Saddlery Journal.

make the fare as low as two cents."

"How would it be if your road adopted the cable system?"

"That might make some difference. It is much cheaper to run a road with cable than with horse power, though as yet the cable experiment has not been fully tested in New York, and we don't know whether it is practicable on our crowded streets or not. For our road the traffic would not justify the expense. It takes a good many passengers at one cent profit each—I don't suppose that the profit could exceed that with a cable at a three-cent fare—to pay for the enormous expense of putting in a cable. I don't know what it will be, but some new motive power undoubtedly will be discovered some day for surface lines, particularly the long ones, that will enable



ELECTRIC STREET CAR OF THE VAN DEPOELE SYSTEM IN USE AT SCRANTON, PA. FIG. 2.

animal becomes galled and sore. To remedy this difficulty the harnessmaker is called on, and he puts in a sweat pad, because it comes easy, like the average physician, who leaves the prescription and does not tell the patient the cause of his illness, or how it might have been prevented. The harness maker who does this should be condemned not only for his unpardonable ignorance, but for the lack of principle which induces him to sell a sweat pad, when it has a tendency to ruin a horse forever wearing a collar without one. Measured properly and fitted, with a well constructed collar, the horse will not become galled or sore.

Do not stuff your collar with rags and hair, as it would then destroy the appearance of your whole harness. Fit the horse properly and wash the collar when taken off, with soap and water, and you may be sure you will not have a horse laid up with

The Reduction of Fares.

In a recently published interview, the Superintendent of the Eighth avenue surface road, while denying that his road could be operated profitably at a three cent fare, suggested that two of the short cross-town lines might profitably make the proposed reduction. Superintendent McLean, of the Twenty-third street road, which was one of the roads instanced, was visited and asked what he thought of the suggestion. He said:

"It is out of the question for us. I have investigated this matter pretty thoroughly and I know it can't be done. It costs at present more than four cents to move each passenger. There would be no object for us to make a reduction, any way, because we have no particular competition across the city, and we probably could not carry any more passengers than we do were we to

them to compete with the elevated roads. When that is discovered it will then be time to talk about three-cent fares."

The President of the Chambers street line, which was the other road mentioned by the Superintendent of the Eighth avenue line as likely to be operated profitably at reduced fares, refused to make any statement as to whether such a reduction was either contemplated or possible.—Commercial Advertiser.

Street Railway Traffic in Paris.

The Journal des Chemins de Fer gives the street traffic for Paris for 1884 as 303,000,000 passengers, or 137 trips for each inhabitant of the city. This is divided as follows:—

Omnibus and street cars, 116; steam lines, 13; river boats, 8; total, 137.

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EDITORS STREET RAILWAY JOURNAL:—

Every would-be improver of street railway construction ought to aim at economy, durability in structure, simplicity of design, ease in travel, and reduction in repairs.

All these important points can be attained. If the design is simple and few in parts, rapidity in construction and easement in labor would be insured. If all the parts are made of imperishable material (iron or steel) durability of structure is got. If the parts are so designed that the commonest mind can put them together, simplicity is attained. And if a wedge-shape key will lock rails, track support and yoke together, and so located that it cannot work loose or be struck by the passing wheels, a smooth track and reduction of repairs ensues.

It was on those suppositions that I de-

The yoke proper has grooves on both sides (Fig. 6), into which the conduit plate (Fig. 4) is slid, thus stiffening (bracing) and locking itself to the yoke. The arm is designed to have great strength, the chair or rail support is grooved to receive the web of the rail. The rail is the same as used in my metallic horse car track, and is designed with the web below the flange, so that the flange can have full and even bearing.

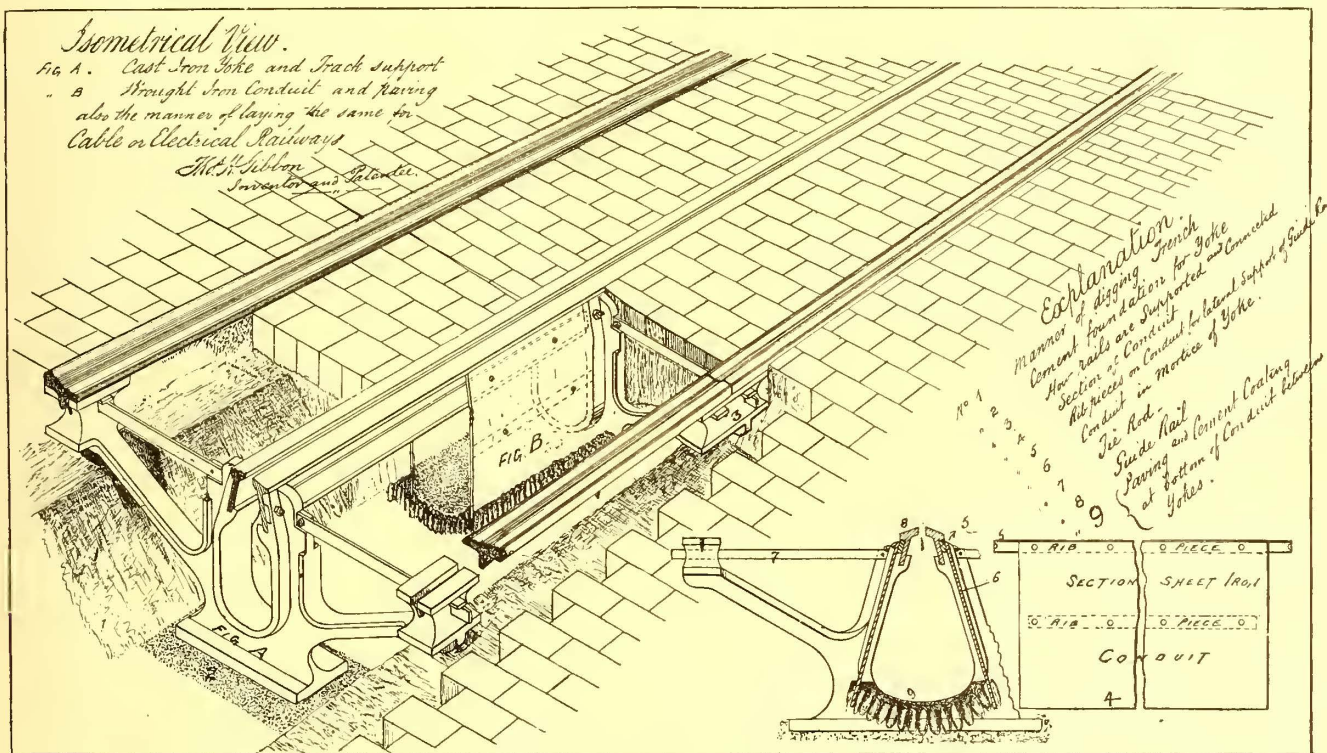
The web is slotted at intervals, so that the mortises in the chair and those in the web come directly opposite each other, and when the wedge is driven through the mortises in the web of rail and chair, it passes over the ends of tie rods and absolutely locks the rails, tie rods, and yoke together, Fig. 3.

The wrought iron conduit, Figs. B and 4, is made in sections which slide into and down the grooves in the sides of the yoke (Fig. 6). This undoubtedly would lock the

dinary labor can slide the conduit plates into the grooves which are on the sides of the yokes, thus giving stiffness to the yoke, and duly fastened thereto, without bolts or rivets. The bottom of conduit can be either paved in grout or cemented, and while this is being done, the track gang can put the tie rods through the mortises in chairs, to be followed up by dropping the rails into the grooves of the chairs, and simply drive a wedge key through the mortises, which locks the track and yoke together. This is simplicity and durability of structure.

Another track gang can be laying the slot rails, after which I should request that sand should be used in filling up around conduit. This would give dry road-bed, thus preventing heaving of track, and giving ease in travel and reduction in repairs.

I estimate that a mile of straight track can be built on this system, for twenty per



THE GIBBON CABLE CONDUIT.

signed my metallic track for horse railways, which has been so favorably received by railway managers for its simplicity and durability. The iron yokes and timber track supports, with its army of bolts, spikes, joint plates, knees, etc., cannot give, or long maintain, that parallelism of track rail with the slot rails which is absolutely necessary to either cable or electrical systems.

The mortising for stringers, knees, joint plates, forms so many receptacles for water, decay soon appears, spikes lose their tenacity, knees their strength, and spreading of track is the result.

The accompanying drawing with the following explanation will give your readers an opportunity to judge whether the objections named will be removed by the adoption of some such system.

Fig A is a view of cast iron yoke arms, and chair for track support in one piece.

yoke and conduit together. The upper rib piece of Fig. 4 fits close to and is designed to give extra strength to the grip rail, to resist earth's pressure, etc.

In laying the structure which constitutes this system, the paving should be taken up only eight feet wide. This gives ample allowances for good bond in repaving. Then the trench for conduit should be dug deep enough and wide enough to receive the yoke, and small lateral trenches should be dug for the arms. (I estimate that 1,200 cubic yards would be excavated for one mile straight track). The engineer in charge should then see that a good concrete foundation be made and accurately leveled for the bed plate of yoke. When the yoke is set in position true grade and gauge of track is obtained at the same time. This, I think, has filled the bill for economy.

After the yokes have been placed or-

cent less and equally as good as the one recently built in Cincinnati.

In conclusion, I would state that the chair or rail support (Fig. 3) can be lengthened and thus give greater bearing surface for track rail. The guide rail having extra support from rib pieces and conduit plate, will sanction an increased distance between yokes.

T. H. GIBBON,

Eng'r Metallic Street Ry. Supply Co.
 Albany, N. Y.

One Thankful One.

Polite Passenger (in street car)—“Where are you going, my pretty maid?”

Pretty Maid—“I am going a-shopping, sir (she said).”

Passenger—“Won't you have this seat, my pretty maid?”

Pretty Maid—“Oh, yes, thank you, sir (she said).”

Isaacs' Cable Road-bed.

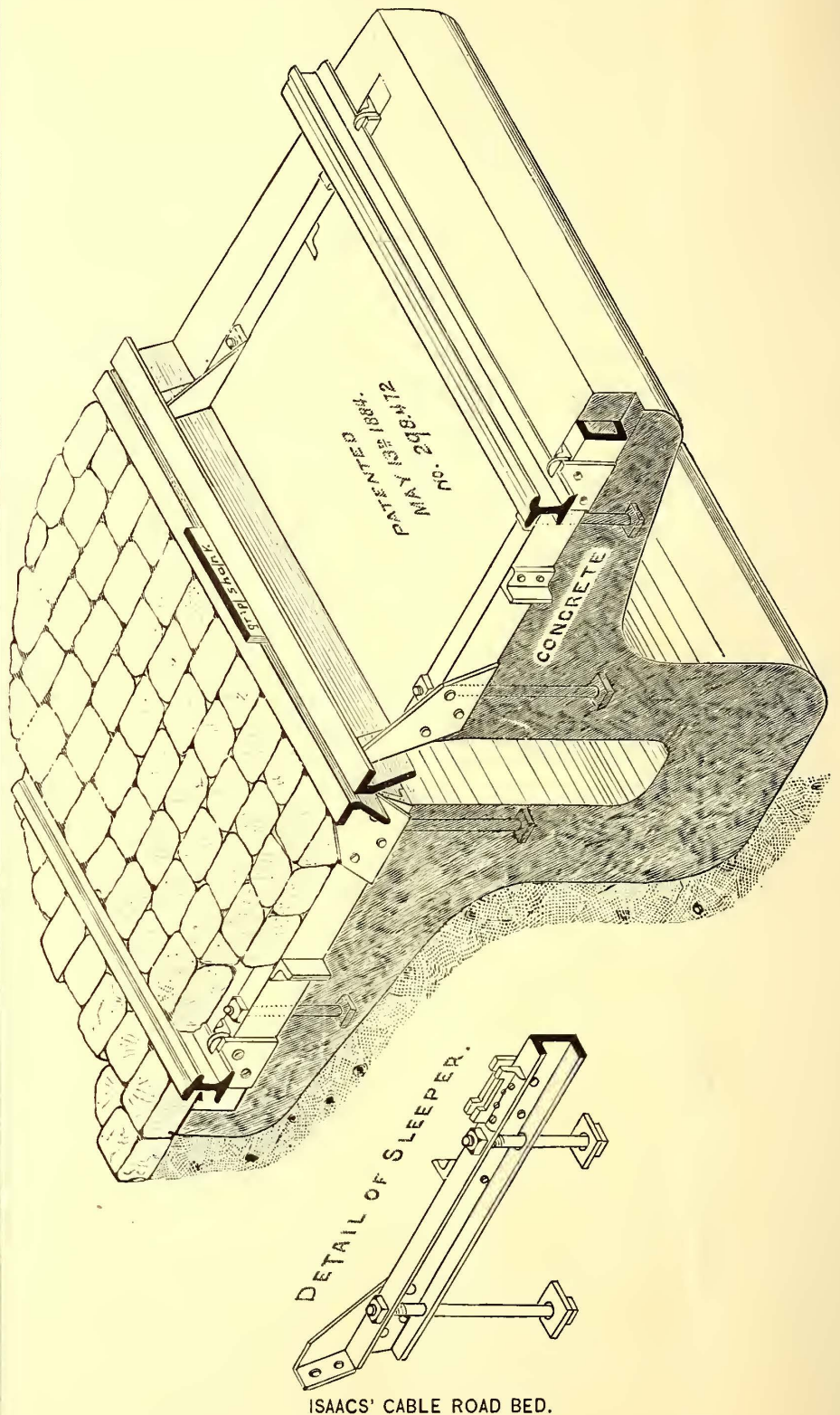
The conduit illustrated in this connection is one which is entirely novel from the fact that it does away with the yokes which have heretofore been considered indispensable to cable conduit construction. The whole conduit is practically constructed of concrete, and this substance will stand all the strains that are brought to bear upon it from the heavy traffic of the street as well as from the road itself. The cut which we herewith present gives an isometrical view of a section of the conduit. As we have said, the whole body is made of concrete, upon the upper surface of which are placed ties at convenient distances, or from 3 to 5 feet apart. These ties run from the outer edge of the conduit to the central groove and have bolted to them pieces or knees of wrought iron, which in turn carry the slot irons which form the edge of the grip slot. The concrete is grooved longitudinally for carrying the cable and the various pulleys which are to be used. The method of construction is to dig the trench in which the conduit is to be laid, and then put in all the iron work, supporting it on suitable props, and putting in the templates which are to give the form to the central groove. The concrete is then dumped in and rammed down against the earth underneath, becoming one solid mass and firmly imbedding the channel irons and anchor bolts of the iron work. At intervals, where the carrying pulleys are to be placed, manholes are located in the usual manner, and they are large enough so that the pulleys can be taken out when worn, and replaced. Half of the manhole slots drop down to the bottom of the conduit and can be used for drawing out any sediment or dirt which may have accumulated. Drainage is accomplished by means of connection with the sewers, and impurities can be washed out at any time by flushing. The paving stones are placed directly upon the concrete and are grouted so that the whole forms one solid mass that offers the best possible resistance to street traffic. It will be seen that no attempt is made to curve the concrete into the form of an arch, but that the arch depends entirely upon the iron for its construction. The sides of the longitudinal slot are made vertical, so that the weights have no chance to exert a tensile strain upon the concrete.

It will also be seen that the strains put upon it are compressive only and very little tensile strain is brought to bear. The only strain of this kind that can occur is when the earth under the edges has dropped away and the concrete projects on each side and is obliged to support the traffic of the road or the street, or a heavy truck passing over the slot irons, a slight tensile strain is brought to bear upon the concrete, but otherwise all strains are compressive. For ordinary specifications it is intended to make the concrete 12 inches deep below the slot and from $7\frac{1}{2}$ to 9 inches thick at the sides, and 8 inches deep at the outer edge.

Inasmuch as the concrete which has been

used for this purpose has been thoroughly tested and found to stand a compressive strain of 200 tons to the square foot and a tensile strain of fifteen tons, there seems to be little danger of breakage. It is claimed that a double track road can be

A curious contradiction of what we have always been accustomed to look upon as a fixed fact, comes to us from France. It is a direct statement that in some cases it is more economical to use animal than steam power. M. Sansom states that upon the



ISAACS' CABLE ROAD BED.

built on this system for \$63,000 per mile at San Francisco prices, with iron at \$80 per ton.

The fastenings for the rails may be of various styles, but those shown consist of a chair with a lip dropping down over the lower flange of the rail, holding it in position. The system has been endorsed by many engineers and is in use on some lines in San Francisco.

Mont-Parnasse-Bastille line of railway he has found that steam traction has cost 57 francs per car per day, while with horses it only cost 47 francs. We have no detailed data in regard to the matter, but think that it must be due to a very small number of cars hauled; although we were given to understand that the contrary is the case.

This is the largest journal of its kind.

Peckham's Elastic Street Car Wheel.

This wheel is constructed in two separate parts. The web portion, which may be constructed with spokes (as shown) for street cars or of solid form for steam cars, is separate from the hub.

Between the web and hub is inserted an elastic cushion made of compressed paper or rubber. The object of this cushion is to prevent the rumbling noise caused by the rigidity of the wheel on the axle as

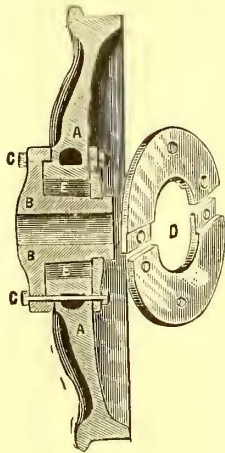


FIG. 1.

ordinarily used, and also to prevent crystallization of both wheel and axle and prevent breakages caused by such crystallization, as well as to prolong their life.

The hub of the wheel is constructed of a soft tough iron and pressed rigidly upon the axle, where it remains until the axle is broken or worn out, it not being necessary to remove the hub to remove the web, which is the only part of the wheel requiring renewal.

To prevent the web from turning upon

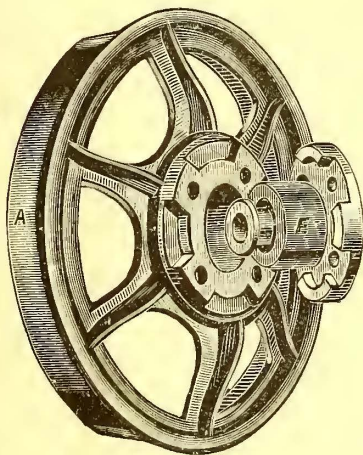


FIG. 2.

hub and to relieve the bolts of shearing strains, the rigid flange of the hub is provided with clutches which lock into corresponding jaws in the base of the web.

The web portion of the wheel is constructed of car-wheel iron, so as to provide a chilled tire, and is secured between the rigid and the loose flanges of the hub by bolts, and when worn out can be easily removed and a duplicate put in its place by the car company, without the use of a press or skilled labor.

The elastic cushion is confined in its place by the hub flanges, and is claimed to be practically indestructible.

In the cuts *A* represents the web and *B* the hub of the wheel, *C* the rigid and *D* the loose flange of the hub and *E* the elastic cushion.

The advantages claimed for this wheel over the ordinary cast-iron wheel are: The additional strength of hub portion due to its increased diameter and the soft iron of which it is made; increased life of tire due to elasticity of wheel and prevention of crystallization; saving in cost of renewals, as only the web portion has to be renewed, and that can be replaced by the car company without the aid of skilled labor or special machinery and without removing the axle from the car; and a saving per mile in cost of wheels, axles, running gear and general repairs of at least fifty per cent.

These wheels are being made by F. H. Andrews, and will be in use in New York by the 1st of March.

Electric Motors on Third Avenue.

President Lyon, of the Third avenue surface road, of New York, has received the report of the experts detailed by that company to determine the feasibility of the Bentley & Knight electric railway system compared with the advantages of a cable road. This system is in operation at Providence. The report says that, with a view to exhibit its workings under all difficulties, it was built with one sharp grade of one foot in twenty, with an abrupt curve of forty-five feet near one end of the line. The road is 800 feet long. Only one car is operated on the road at present. It is a small open car, on the bottom of which, between the trucks, is placed an electric motor of twenty-five horse-power and 1,500 lbs. weight. From this motor the power is applied to the axles of the car by gearing, cranks and side bars, similar to those used on locomotives. Between the rails in a tube is placed the electrical conductor for the transmission of the current to the car from two ten horse-power dynamos located at a central station. Levers to reverse or cut off the current are placed at either end of the car.

The committee found that the motor's work was perfect. The report goes on to show, however, that more power will be required to operate cars with electric motors than where the power is applied directly, as by cable or horse. Furthermore, the electrical system lacks the advantage of counterbalancing cars on the grades of cable roads. Consequently a third more power will be required for reserve force, whether it is in constant use or not. The expense of electricity would be at least 25 per cent greater than that of the cable.

At least twenty-five horse power would be required for each car for the electric motor on Third avenue. It would require at least 3,000 horse-power to work the electrical apparatus on the Third avenue

line, while not over 1,000 horse-power would be necessary to operate the cable system.

President Lyon will probably take an electrician and visit the electric railways of Hamburg and Berlin. Agents of electrical manufacturers in Germany and America have been in consultation with him. Whatever the power adopted, it will not be put in use before next spring. The machinery will be located at the company's depot at Sixty-fifth street.

Smith's Street Car Headlight.

This headlight is especially designed for elevated and cable roads. It has an eleven inch silver plated reflector which is made

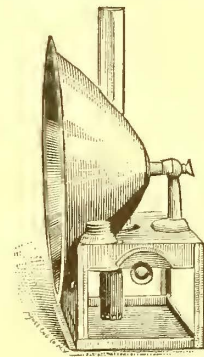


FIG. 1.

to diffuse the rays as much as possible and at the same time throws a powerful light one hundred feet. It has a good strong burner, with extra length solid-woven argand wick. Is equipped with wrought iron brackets at the back to hang on the dash-

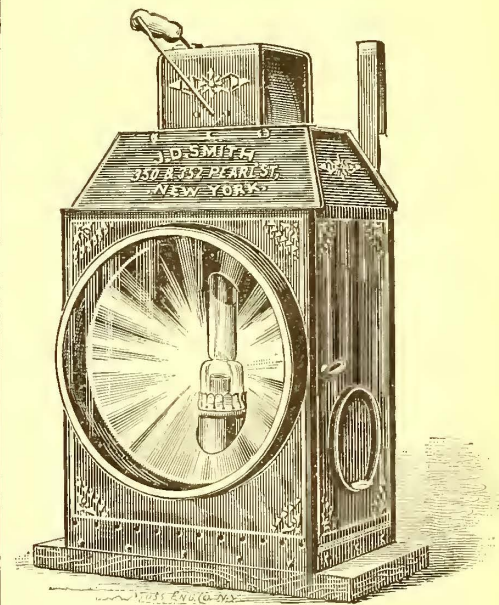


FIG. 2.

board of grip car, also, has rubber cushions on the back of the case to prevent scratching the dashboard. It is made by Josephine D. Smith.

TO A RELIGIOUS NEWSPAPER it does not seem to be quite the thing to depend upon the profanity of the passengers to keep the street cars hot in these cold days.—Chicago Advance.

Electric Railroads.

BY GEO. W. MANSFIELD*.

In taking up the matter of electric railroads, there are two headings under which they must be discussed. First will be the central station where the electricity is produced, and second, the construction of the roadway so that the power which is produced at the central station may be utilized to the best advantage. In the installation necessary for the central station you will find that in all respects it is analogous to that of obtaining electric energy for lighting purposes, but instead of passing the current through the carbons of a high resistance and producing light, it is simply allowed to pass through the motor of the street car, producing motion and work. In the latter case the energy is developed by magnetism causing the rotation of a part of the motor by which the power necessary for mechanical purposes is obtained.

In the central station it will be possible to act in one of two ways. Either the electricity may be developed by one large engine capable of producing all that may at one time be required to run the whole road; or, it may be done by a number of small engines which will aggregate the whole power. Opinions, as to the relative economy of these two, differ, but it will be seen that when the work falls off at night it will be possible to shut down one or more of the smaller engines, thus cut down the expenses, whereas if only one large engine is used, the power required for moving the engine is exerted at all times, although there might be a greater saving at the time of the heaviest traffic. For instance, where it would be necessary to run ten 50 horse power engines for heavy day traffic, one would be sufficient for the night.

In either case your loss is always a certain definite proportion or per cent of the load, varying in the same ratio as the load varies. For light or for heavy loads the loss is the same per cent of the work done. If 20 per cent was the figure of loss, then when you are doing 1 horse power of engine work you lose 20 per cent of 1 horse power; if you do 100 horse power of work, then you lose 20 horse power. Taking this one point and compare with cables. Your loss here is fixed; no matter what work you do on the track, you lose a certain definite amount. If it takes 100 horse power to run your cable at 8 miles per hour, you lose that 100 horse power, no matter whether you do 1 horse power work on the track or 500. Therefore it can be readily seen that you can by no means save coal and money by operating your boilers in exact accordance with your work done on the track with cable as with the electric system. The light traffic of night with the cable either renders it too expensive to run the cable or it must be run at a great loss. Whereas again with your electric station the dynamos could easily be turned

to lighting purposes at night, hence they need have no idle moments.

It can be safely guaranteed that from a well planned and scientifically conducted electric station, from one year's end to the other, with absolute certainty, 90 per cent of the engine energy can be taken from the conductor placed in the street into your motor. Years of electric lighting and scores of exact tests prove this beyond question; while equally convincing proofs give you, counting losses, 70 per cent of the 90 as tractive work done by motor.

Using the storage or accumulator system the essential features of the station would be the same. The only difference would be conducting your electricity into batteries instead of out on to the track for immediate use; these batteries of course demanding more room and attention.

As to the construction of the roadway for electric propulsion, evidently, as in any case, a smooth substantial roadway is necessary. This thoroughness probably will require a greater outlay at first, but the decrease in repairs and operating expenses will fully compensate for the extra investment. As to the arrangement necessary for placing the conductors carrying the electricity from the central station, there are three primal methods which present themselves: The overhead, the surface, and the underground.

These may be summed up as follows:

Overhead or Aerial System.—One wire as outgo, using rails for return. Two wires, one as outgo, the other as return for current.

Underground or Conduit System.—The same arrangements are possible and necessary as in the aerial system.

Surface System.—In this system the rails in the street can be used, one as outgo the other as return, or both as outgo and a third rail as return. Plainly if two tracks are employed a duplication of any of the above systems would be all that is necessary.

Besides the conductor systems, we have the *Accumulator System*, where the conductors are dispensed with and the electric energy is stored by chemical changes in heavy boxes, which are carried directly on the car.

In any case, wherever the aerial system is used, the facility of having perfect insulation, insuring against loss by leakage, is at once apparent.

Furthermore, if high potentials are used they are plainly in a safe locality, not only from danger to the public but also from defective insulation.

In climates where protection from snow and sleet is necessary, a guard cable can be easily stretched just above the conductors and this be made to support a flange of tin or other suitable material which would keep the snow and ice from settling upon the conductors.

Two alternatives now present themselves for supports:—

1. Poles in the street; or
2. Wires or other means placed across the street and supporting the conductors.

The surface system has but a limited field of usefulness, and it is only in suburban and country places, where the company has practical control of the right of way, that such a system would prove itself the best. The underground system, as its name implies, calls for a conduit similar in general construction to that used by cable roads.

In this a copper wire is hung, which is placed under a tension sufficient to keep it in position, and where it must be suitably insulated. It can be easily calculated, from current prices and actual trials, that for transmission of equal amounts of energy, regarding of course the question of time, the copper conductor is more economical than a steel cable. In the construction of the conduit itself care must be taken that it is fit to resist action of frost and strains due to the weight of street traffic, and also be properly drained to provide for heavy falls of rain. It is here that the only danger which the electrician has to guard against, is met; and that is in the matter of floods: but proper engineering skill can easily overcome this. The loss which would be occasioned by the flooding of the line and the defective insulation which would therefore result, would not be, in a properly constructed line, half equal to the loss in cable lines due to the friction at all times; and a five mile line can be so constructed that under ordinary conditions of rain and dry, and losses due to moisture, leakage, etc., the total would not exceed seven-tenths of a horse power when the line is transmitting 500 horse power. Potentials are the controlling factors, and from 300 to 500 volts is a very comfortable potential to handle, and one that will give but small trouble with insulation. If flooding is unavoidable, automatic cut-outs can be so placed that that section can be cut out, being in use only when the car is on it. Other questions are the subject of switching, branches, crosses, terminal facilities, etc., all of which are possible and easily obtainable. They are really the simplest problems of them all. The electrician has only to tap on, put in a switch and go where he pleases. Put a car in the place of an electric lamp, and you can as easily run a car where you will as run your wires and put your lamp where you will. This is true of any system, the overhead, the surface, or the underground.

Regarding the three systems as to expense of construction, the underground would call for from 10 to 15 per cent greater expenditure than the overhead, and yet it would be from 20 to 25 per cent less expense than the cable system.

We have in addition to the three systems already mentioned the Accumulator system. In this all the conductors stretched along the track, either overhead or underground in a conduit, are dispensed with, and the electric energy is stored in boxes placed on each side of the car, thus making the cars relatively units. In comparing with the conductor system, we find that in the latter the electricity passes to

* From Paper read before the Electrical Department of the American Institute.

the conductors from its source, the dynamo, into the armature of the motor, whirls it around, doing its work, and then passes back to its source the dynamo. With the accumulator the electricity passes from its source into boxes containing lead plates and sulphuric acid, and here it causes a chemical decomposition of the acid, forming a gas which collects on the lead plates. These boxes are then carried to the cars, and by completing the circuit, the gases recombine, electricity is the result and this passing to the motor accomplishes its work.

But what has been done? Another step and another means of loss has been introduced between the two centers. For instance, a steam engine indicating 100 horse power is driving an ordinary dynamo with 90 per cent efficiency. Over 95 per cent has been a number of times obtained. We have then 90 horse power in the condition of electric energy on your conductor. A fairly well constructed line would lose, as an average, the 5 per cent given to leakage of current into the ground and another 5 per cent due to the resistance of the conductor. This reduces the horse power to 81 horse power of electric energy ready for absorption by the motor. An efficient motor will return as mechanical energy 80 per cent of the absorbed electric energy. This is a fair figure, since some makers are actually guaranteeing from 80 to 88 per cent; 80 per cent of 81 horse power gives us 64.8 horse power for tractive purposes.

Now with the accumulator we have 90 horse power of electric energy passing into and charging the same. From the best authority, and taking the figure that well represents the returns for months of constant use as 70 per cent, we would have 63 horse power for the motor. This absorbing 20 per cent as in the preceding case, leaves us 50.4 horse power as the output of the motor for tractive purposes. This is seen to be an absolute loss of 22.3 per cent from the direct conductor system, or 14.4 per cent of the horse power developed by the steam engine.

The argument is often advanced by those introducing accumulators that a smaller central plant is necessitated than by the direct conductor system, since the electricity can be continually stored and thus prepared ahead, but when you do a certain amount of work overcoming resistance, gradients, etc., on your track, this work introduces the factor time. If this work were done in one hour then we have 23 hours to store the necessary energy to do the work, hence we could have a smaller engine and run it a longer time, but in the case, as in a majority of roads, where you are doing a certain amount of work for 16, 18, 20, or even 24 hours out of the day, then where does the extra time come in for carrying on your work for storage? You will be obliged, in reality, to have a larger engine and plant than with the direct system, since with the 22 per cent loss you are forced to store as rapidly as you use your energy. Furthermore, the energy stored by the consumption of five tons of coal in

one hour would more than equal that stored by the consumption of the five tons spread over five hours, provided of course that the apparatus was proportioned accordingly. Possibly a saving of original capital outlay and interest may be effected in some cases, but in the greater majority it will be difficult to see where the economy comes in; besides, the deterioration of your accumulators is enormous. In one or two years at the most you would have to almost entirely replace them. On the other hand, we have a direct system of conductors which when once constructed and the work properly done, will last for decades with the minimum of handling and change.

CORRESPONDENCE.

The Street Railway Motor Question.

EDITORS STREET RAILWAY JOURNAL:—

In reply to your favor of the 25th would say we have nothing new here to offer; matters about as usual except more than usual trouble and loss in horse line, having suffered from distemper to quite an extent. This naturally turns our thoughts to a substitute for this kind of propelling power. When it shows itself (which it is sure to do sooner or later) the T. & L. R. Co. will be one of the first to help in.

C. CLEMINSHAW.

Troy, N. Y.

EDITORS STREET RAILWAY JOURNAL:—

Enclosed please find \$1.00 for one year's subscription to JOURNAL. We have organized a company to build a line of street railway, and before commencing operations would like to determine if possible the best kind of a road to lay—cable, horse power, electric or otherwise, and to find out the cost (relative) of same, and probable length of life or endurance. Would be pleased to receive any suggestions or pointers from you that you would deem consistent with your duties to give.

S.

New Castle, Pa.

EDITORS STREET RAILWAY JOURNAL:—

Please find enclosed postal note for \$1.00 as subscription to STREET RAILWAY JOURNAL. Will you give me address, or put me in communication, with any company or companies making motors for street railways, using the storage battery system of electricity? I have looked in vain for any advertisement of them.

F. H. O.

Seattle, W. T.

Apparatus for the electric storage system of street railway motors is made by the Julien Electric Co., 120 Broadway, New York, and we believe one or two other companies. The Julien company has its storage motor in practical operation on the Eighth avenue road of New York.—Eds.

EDITORS STREET RAILWAY JOURNAL:—

Answering yours of the 25th, it seems to me the question of the distance between tracks in street railroad construction, depends to a certain extent upon the width of

the street, though I am inclined to agree with J. D. T.'s views, where the streets are of average width. The space between tracks is a dead waste, so far as the passage of street vehicles is concerned, unless in the extreme case of very broad streets and tracks, located near either curb, leaving the road-bed for street vehicles in the center. In every case but the latter, the most economical net results, so far as the use of the road-bed is concerned, are secured by close location of tracks. The minimum distance between tracks should be such that a man could safely stand between two cars passing him at the same time. We have always considered 4 ft. 6 in. as being a good average to work to.

A. J. MOXHAM.

Johnstown, Pa.

EDITORS STREET RAILWAY JOURNAL:—

I have yours of the 31st, asking me for a more extended statement of my views on the subject of electricity as a street railway motor, than I have expressed in my last annual report to the stockholders of this company. I do not know that I can add a great deal to my remarks given in that report, except it be to relate my personal experience in a practical way with an attempt to carry out my belief, that to run street cars by electric power is just as sure to come as the sun rises and sets. In view of this fact I have carefully examined everything that is now being done in this way both in Europe and this country, and have come to the conclusion that I expressed in my report, viz., that the storage battery or accumulator system is the only one that would answer for us.

The most attractive feature of this system is that it entirely does away with any necessity for expediture upon our road-bed or tracks; nor does it need the laying of a third rail, or conduits, or overhead wires. We shall carry our power with which we propel the motor with us, wherever we go, to be used or shut off as circumstances require; and when we are not using it, it is not wasting. We obtain for actual use over ninety per cent of power: there being no loss whatever from atmospheric or other causes. The accumulators are not costly, and one set can be filling while the other is being used. Any amount of power required, from one horse to forty, will be available at all times. Large or small roads can have a private power plant, consisting of a steam engine and a dynamo, and fill the accumulators themselves; or in cities or towns they can be filled at a very low cost where there is an electric light plant.

In my judgment there can be no question, worth consideration, whatever, between the use of this system and any other yet introduced in this country or in Europe. With all these facts, and all the experience and testimony gained from a most exhaustive examination of the whole subject, I am convinced that my position is the correct one.

Experiments are now being conducted in Philadelphia to ascertain the best kind

of motor to which to adapt this form of power. I am told that is the only question now under consideration: and whether to place the accumulator in a separate motor, or to place them in our ordinary cars, and apply the motor power to that car, will soon be determined. When that is done the enterprise will be ready for us all to adopt if we see fit.

The enthusiasm and the earnest interest now being felt by all live street railroad managers, all over this country and Canada, is not to be wondered at: the discovery and introduction of this system simply presents the most attractive and pleasing prospect that can be imagined. Success or disappointment, with every prospect of the former, is very close at hand.

C. A. RICHARDS,
President Metropolitan R. R. Co.
Boston, Mass.

Fare-Boxes.

EDITOR STREET RAILWAY JOURNAL:—

In the many fare-boxes now on the market, a proper security of the contents of the box has not been provided, and in many this important feature has been utterly disregarded.

Many very ingenious methods have been devised by nefarious persons to rob the fare-boxes now in use by street railways; to such a nicety has this thieving been carried that no violence is employed, the box showing no signs of having been tampered with; and the company unknowingly suffers a loss of its earnings.

In the march of improvement manufacturers have not kept pace with these nefarious persons; and street railway companies have been seemingly content with boxes having but a minimum security. Even to a dolt it would seem that the very first requisite in a fare-box ought to be nothing else than an absolute guaranteed security of its contents, that is, that it cannot be robbed in *any manner* without using extreme violence.

In comparison to this all other requisites of a fare-box are as nothing; without this important feature, what avail beauty of finish, simplicity of construction, ease of cleaning, durability of its parts, or numerous fare rests for accurate inspection of fares, or registering devices for telling the number of the fares in the box, of what little avail indeed would they be if the box was so constructed that any nefarious employee could rob it without violence, and deprive the company of its lawful earnings; by the register number you might know how many fares there ought to be in the box, but not who took them.

By numerous fare rests for inspection of fares and for leaving them up during the whole trip, the driver would of course be enabled to easily inspect and tally passengers with fares and collect them all, and the officers of the company could more certainly know that they were all collected, but that would avail nothing to restore the fares turned or fished out of the box.

Then it is safe to lay down the axiom

that a box which can be robbed or fares be abstracted therefrom in any way without violence is not worthy of the name of a fare-box, and no company should feel safe for a moment in using boxes not absolutely secure. This all important feature is not unattainable, on the contrary it may be reached in several ways, and would have been attained long ago had those who designed boxes used as much ingenuity to prevent the abstraction of fares as nefarious persons have to devise means to abstract them. In designing fare-boxes many have proceeded on the falsely assumed basis that the box is always to be fastened and fixed in the car, but this is not the case; many companies do not have turn-tables, but change the horses from end to end and use movable boxes, and having only insecure boxes many only felt secure in providing two boxes to the car, thus being at double expense. Such boxes were made to retain the fares as long as kept right end up; but if inverted and shaken the fares would readily come out at the pay hole, or the fares could be shaken to a position where they could be fished out at the pay hole. Another faulty construction has been adhered to in making slots through the sides of the box to operate the fare rests and thus where one hole only was provided for the passenger to put in the fares, several holes were thus, it seems almost intentionally, provided for the nefarious person to turn or shake them out at.

Some have thought to provide against turning or shaking out fares by means of dumping apparatus consisting of table traps, etc., but controlled in each case from the outside of the box; this construction is evidently inoperative, because they were controlled or turned from the outside of the box, to dump their contents into the drawer; now while in their normal position they would prevent the fares from being shaken back, yet when turned or dumped, the same space which permitted them to fall into the drawer permitted them also to be shaken out of it. It surely seems a vexatious problem, but heretofore the attention and thought which it deserves has not been given it or a solution of it would long ago have been reached.

If purchasers of fare-boxes would insist on a written guarantee of their security in this particular, a decided improvement would soon be noticed.

T. L. BEAMAN.

Knoxville St. Ry. Co.,
Knoxville, Tenn.

An English Tramway Rail Cleaner.

Mr. Dickenson, the Manager of the South Staffordshire & Birmingham District Tramways Co., which is operated by locomotives, has invented a new rail cleaner, for cleaning the company's rails from snow and ice. Affixed to the front of the engine are two brackets into which are fitted adjustable screws with eyelet holes at the end, through which passes a cross shaft, at the end of which are tool or scraper holders. These latter work on the shaft independ-

ent of each other, and are controlled by a spiral or other spring. The cleaners or tools are made to the gauge of the rail, and the cross shaft working freely in the eyelet holes, allows of any variation in the position of the front of the engine in going round curves or through points, whilst by means of a simple device the whole is under the easy control of the engineer. The cleaner is made of steel, and is a projection fitting into the groove of the rail, being also of sufficient width to cover the tread. By means of an engine fitted with one of these contrivances, the company's rails over a considerable part of their system were freed from hardened snow and ice, the engine making its way freely, even up steep inclines, and leaving the rails quite free from obstructions. Two, and in some cases three, engines were required to drag a tram through the snow where the rail-cleaner had not been used; all this expense of steam power in heavy weather may be saved by this rail-cleaner.

Our Street Railway Directory.

We have recently received a letter which throws a somewhat new light upon the fact that in certain instances it has been difficult to obtain answers to our inquiries concerning changes for our street railway directory. An officer of a Western road, to whom we made application, sends us our card filled out in due form, but encloses it in a letter in which he furnishes this information to be used in our directory, but with the understanding that it must be used without charge to his company. Possibly there are other officials who are laboring under the misapprehension that the insertions in our directory are paid for. There is nothing of the kind, as the majority will understand. The directory is published purely and solely for the benefit of the patrons of the paper and as a matter of news.

The only reason we publish it every month is because of the numerous corrections which are necessarily made. There is not a month in the year in which street railroads in some part of the country do not have an annual election, and these elections frequently mean a change in the personnel of the road; therefore we send the cards every month and are obliged to make from fifty to a hundred corrections in each issue in order to keep our directory correct. These facts are becoming thoroughly appreciated, and we are informed by one prominent street railroad supply dealer that in sending out catalogues which were addressed to each road indexed in our directory, only two were returned. The name of one he had forgotten, and for the other, it was found that the road was operated by a road under another name, who received the catalogue all right. We therefore take this opportunity to inform all street railway officials that there certainly will never be any bill presented for anything in the street railway directory, and trust they will give us information of any changes as soon as they occur.

The Sprague Electric Motor.

In speaking of the Sprague system of street railways it is well perhaps to give very briefly the history of the company.

It was organized in the fall of 1884, and for two years was strictly a private corporation, no treasury stock being issued, and its control and practical ownership being in the hands of two men, Mr. E. H. Johnson and Mr. F. J. Sprague. Its success was remarkable, and by the end of 1886 it had nearly 250 machines, varying from one-half to fifteen horse-power, in operation in different parts of the country on a great variety of work. On the 31st of December, 1886, the capital was increased, and a portion of its treasury stock issued. So strong was the belief in the success of this company, and so thoroughly good a record had it made, that nearly double the amount of stock which was authorized to be issued was at once subscribed for by the few people who knew of this change in its organization. The wisdom of the Sprague company's course seems in this way to have been made apparent. It proceeded on the basis that if it established a record and proved the success of its own experimental work, there would be no difficulty in raising whatever capital was necessary to exploit it commercially. The company now numbers among its shareholders some of the best known scientific and financial men in the country, and it seems to be well started on a very prosperous career.

In addition to the now thoroughly well established business of this company for transmission of power for stationary purposes, they have taken up the street railway problem with characteristic vigor, and in order that they may not be handicapped by the manufacture of their standard machines, a large proportion of this work will be done in Schenectady. The company has recently leased, and equipped with the finest tools that can be purchased, the old Union Lead Works in this city, and having lately added to their room are going to devote this shop entirely to the manufacture of special types of motors.

The Sprague system has a great many novel features about it and they may be considered under the heads of generation, distribution and recovery.

When the entire contract for putting in the system is taken, the steam plant is of the best known character, horizontal tubular boilers being used, preferably with the Jarvis setting so as to burn a cheap grade of fuel and get the largest return for the least amount of money.

The electrical part of the generating station consists of two or more dynamos, depending upon the size of the plant. These are wound for constant potential of from 300 to 500 volts, depending upon the distance over which the line is to be operated, and the number of cars in use. Two dynamos are used, so that when operating late at night or during hours of light traffic one dynamo may be thrown out of circuit. The aggregate capacity of the two dynamos is something more than is

necessary for handling all the cars on a line, but this is so provided in order that if there should be a break down of one generator the other can for some time take care of the road under ordinary conditions. Such failure, however, on the part of a machine, need never disable it for more than half an hour, or less, because an additional armature is kept on hand and can be quickly put in use.

All machines which are run from generating stations are run in parallel circuit. 500 volts is the highest potential that Mr. Sprague allows, because a much higher electric motive force would be apt to cause serious personal inconvenience in case of touching the lines.

These generating stations are preferably placed near the center of the line, because with any given electro-motive force or electrical pressure the size of wire which is necessary is only one-fourth of what would be required if it were placed at the end of the line. In distributing the current, the rails are generally grounded and form one side of the circuit. If they have a good connection from one to the other they form a path of very low resistance. Where such connections are poor the rails are reinforced by a continuous conductor running the entire length of the line. The other part of the circuit consists of a very light steel, copper-plated, or hard-drawn copper wire of small size but great tensile strength, which is suspended 17 to 18 feet above the track. This wire is supported at intervals of about 100 feet, either by brackets which extend from poles placed on the side of the street or by a special support carried on cross wires, which run from side to side of the street.

Where a double track system is used, a single wire only follows each track; but where a single track with double turnouts, two wires of the same potential are carried overhead, diverging at the switches. In this way all changing of the trolley which is carried on the wire is avoided when passing the turnouts. The size of this wire is independent of the number of cars operated or the distance over which the line extends. The main current, however, is not carried by this small wire, but is carried by a main conductor running the entire length of the line, and supported directly on the poles in the same manner as a telegraph wire. The size of this wire depends upon the number of cars, and the distance over which they are operated.

It will be seen then that the current is carried over double ladder-like conductors, the main conductor carrying the greater part and the sectional or working conductor the smaller part. In this way it is impossible for any accident to the middle overhead wire in the street to disable the entire line, which is a matter of very great importance. Again, where there is an extension of the road or an additional number of cars, no change being necessary in this middle overhead wire, there is no stoppage of travel or falling off of efficiency. The current is taken from this overhead wire to the car by a very simple self-balancing

trolley, which runs with very little friction, and follows the line of the overhead wire without difficulty.

In attaching the motors to the cars Mr. Sprague has avoided as much as possible changing the character of the car and taking up any sitting or standing room. Belts, friction ropes, sprocket wheels and chains are discarded entirely. The motor, of very powerful form and of very simple construction, is carried underneath the car. At each end of the motor it extends so as to grip the axle of the car, and is held in position by heavy iron caps. Inside of these are split liners to take up the wear. The axle is turned off to a smooth surface, and just outside the hangers and close to the hubs of the wheel are two split gears. These differ in character. One is keyed and bolted directly on to the axle and is a fixture. The other is composed of four parts, two being inner webs which are keyed on to the axle; the two outer ones form the geared section and are bolted together and have corresponding webs projecting inwardly, and fitting snugly both on the outer edge and on the face of the webs which are keyed to the axle. The outer and inner webs are held together partially by the method in which they are turned up, but principally by bolts passing through them which work in curved slots. These then constitute adjustable split gears.

The cut gear wheels are of an especially fine grade of cast iron, and have the same face as forged steel pinions carried by the armature shaft which mesh into them. The teeth in these gears are of the involute cut, so that if the motor should be slightly moved to or from the axles the gears will still run true, with only a little more or less closeness of meshing. The pinions on the armature shaft are set so that the one is half a tooth in advance of the other. Ordinarily, it would be a very difficult matter to get the splines cut on both the armature shaft and the axle and in the pinions and gears so that they would mesh smoothly in running forward and backward, and it was for the purpose of getting rid of this trouble that the adjustable split gear was designed. It is now only necessary to key the two pinions, one fixed gear, and the web of the other gear in position, without any regard to their meshings. The motor is then swung into position, the hangers made to engage the axle, the caps are put on, and the motor being moved forward and backward two or three times while the bolts of the adjustable are slack, this gear will assume a correct position. The bolts are then tightened up, and there is thus a nest of double pinions and double gears all meshing with absolute precision, no matter whether the motor runs backward or forward. The method of mounting produces a concentric motion, and by this means the driving and the driven axle are maintained absolutely parallel in two planes under all circumstances.

To allow the motor freedom to follow all the movements of the axle over frogs and

(Continued on page 277.)



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Lawlessness has scored a victory and law and order have suffered a humiliating defeat when, as was the case in Boston, the police merely disperse a reckless mob, make two or three arrests, but lack the ability or the inclination to protect the company in the further running of its cars.

The fare register, or bell punch, is no more a brand of dishonesty than the cash book or the system of checks and accounts employed in a majority of places where the money of others is handled. In any of these cases the honest agent welcomes a system by which his accounts are kept more easily and accurately.

The South Boston Railroad, Daniel Coolidge, Superintendent, notwithstanding the severe financial strain to which it was put by the defalcation of its Treasurer Reed, has shown courage and grit in its fight with striking employees, and as we go to press we are advised that the company has completely defeated the strikers and has now in operation its full complement of cars.

It is an interesting sign of the times to note how almost universally street railway managers are looking toward some mechanical method of propulsion that shall solve once for all the problem that now puzzles them. Roads that a few years ago would not have been thought large enough to in any way be worthy of using mechanical tractions, are now being examined, with a view to the substitution of electricity or the cable in the place of horses.

The First Step.

"The officers of the street railway were advised by the officers of the law not to run any more cars that day, as trouble from the mob was feared." For shame! Has it come to this, that street cars can, or cannot, be run according to the whim of a lot of "hoodlums?" Do, or do not, the street railways pay taxes? If so are they, or are they not, entitled in common with other tax payers to the protection of the law? Does the fact that they are employers invalidate their claim to the protection they have paid for? These are some of the questions which, in our simplicity, we ask ourselves when we read of such shameful affairs as that which just occurred in Boston, and which have also been enacted in Chicago, San Francisco and New York. As to the grounds on which the employer and employee will ultimately come together, there may be room for much difference of opinion. In fact the difficulty of the question is most apparent to those who have given the subject most thought, but of one thing there is no sane doubt, viz: *Employers have rights* which both employees and "hoodlums" are bound to respect, and the law bound to protect. When this protection is granted, the first step towards the settling of the labor question will have been taken.

The Motor Problem.

As the man with one suit has no difficulty in deciding what to wear, so in the former days, a dozen years ago, the street railway man had no trouble in making up his mind how to haul his cars. The horse was the only available means of propulsion and was accepted as a matter of course.

But now the whole is changed. We have not only electricity, steam, air and ammonia motors and cables, but a multiplicity of devices of each and every sort, each claiming the first place in economy. Without attempting to discriminate between the various devices and systems, it may be well to glance at what has actually been done by the representatives of each. Inasmuch as electricity is divided into two methods of propulsion, one a special conductor and the other storage batteries, it may be best to separate the two.

Electricians have been working at the motor problem for years and now claim to have put their wares upon the basis of economy that can successfully compete with the present standard method, namely, the horse. When we come to investigate the facts in the case, however, we find that

the electricians have done but little in the direct line of practical exploitation. They have published treatises, made elaborate demonstrations of economy upon paper, and given exhibitions of their powers to move a car, but comparatively few roads have been built and operated. Hereafter each exploitation of an actual road will be one more nail in the superstructure of success or the coffin of failure, as the enterprise proves a paying one or otherwise.

Hard cash is the only basis upon which the system will be judged, and it must meet the requirements of horse competition or go under.

At Scranton, it has been demonstrated that a short line with a light traffic can be economically and successfully operated upon a paying basis, by electricity. And the success of this road will contribute not only to the prosperity of the particular system adopted but to all others working upon the same general plan. We may consider, then, that the electrical conductor system has been practically demonstrated to be a commercial success upon short, light traffic lines, and it remains for its advocates to do the same upon heavy city roads.

The storage batteries are still in what may be called the experimental stage. It has been thoroughly demonstrated that a storage battery will run a car, that no insuperable difficulties exist, and its advocates claim economy for it. It remains, however, for it to meet, in this country at least, the practical requirements of everyday traffic and show by actual returns that it can be made to pay. This will undoubtedly be done before long and the system will rise or fall away according as the first installation is a success or failure.

Steam traction has tried hard to get a foothold, but cannot be said to have made any headway on street railways as yet. The cable, then, rises as the competitor to the dynamo. Here we have a heavy expense for the first construction, and considerable power required for the moving of the unloaded cable. The system has proven itself a most decided success in those cities where a heavy traffic is obtainable, and has met all the requirements on the dollars and cents side of the question. In one case we know of a road being abandoned because of insufficient traffic, and this will go far to demonstrate the necessity of an abundant passenger supply before it can be undertaken.

It seems then that the case stands in this way; the cable must have such a large traffic that the percentage of waste will fall below the waste on horse maintenance and also that of the electricity on light roads.

Again the waste on the electric system in light roads must meet the same percentage of the cable roads. That there is a point where these two systems meet has not been practically demonstrated as yet, and it remains for the electricians to show that their percentage of waste will drop below that of the cable men on heavy traffic, and if they can do this the day will be theirs and until that is done it will simply be a war of words.

As to the practicability of either system there can be no grounds for hesitation. A cable or an electrically driven car can be handled with safety in a crowded street. And this has been demonstrated in actual work.

It has been shown that horses are not frightened by an invisibly propelled car, that the lives of foot passengers are not endangered, that wagons and carriages do not interfere with its motions, and that it can be started or stopped gradually or suddenly. Therefore, there is no reason why a road should not be granted full liberty to use any of the electrical or cable methods that are upon the market, and we have no doubt that when their advantages and the economy with which they may be worked has been more thoroughly demonstrated, the horse will have to go.

Vacuum Brake Street Cars.

There has been in use upon the Brooklyn bridge for some time past a vacuum brake in which the vacuum is produced by means of a pump driven by an eccentric placed upon the axle of the car. We understand that the same device has been modified to adapt it for use upon cable, electric and ordinary street cars. It is extremely simple in all of its arrangements. It consists simply of an eccentric placed upon the axle of the car and connected by means of a grip and rod to the plunger of a small air pump. This air pump is in direct communication with a reservoir which is so constructed that it is strong enough to resist the external pressure of the atmosphere when the contained air has been exhausted. The pump runs at all times and is furnished with an automatic valve which, when the vacuum is at the highest point attainable, allows the plunger to work to and fro in the air without any resistance from the atmosphere. The reservoir, or vacuum chamber, is connected by means of a pipe with a three-way cock placed convenient to the driver of the car. From this cock the pipe runs to an ordinary diaphragm such as used with the brakes of the Eames Vacuum Brake Co., who are also the manufacturers of this device. When the driver desires to put on his brakes he simply puts the reservoir in connection with the brake diaphragm, and the air contained in the latter is immediately exhausted into the reservoir and the brake applied. The pump immediately exhausts this air, which of course lowers the vacuum to a certain extent. When it becomes necessary to slacken off the brakes the driver turns the three-way cock so that air will be admitted to the diaphragm and connection with the reservoir, or vacuum chamber, be cut off. The springs then tend to throw back the diaphragm and leave it in its normal position, ready for re-application of the brakes. It would seem that such a brake, which is in constant readiness for use after the car has been run a short distance from the starting point, will be of great advantage to cable and electric roads which wish to put their drivers in complete control of the movement of the cars.

Personal.

FRANK DE H. ROBINSON is president of a base ball club.

AARON FRENCH thinks the proper spring for a street car is the elliptic.

J. H. MCGRAW of the STREET RAILWAY JOURNAL has just returned from a trip West.

JOS. T. SPEAR, Manager Pittsburg, Allegheny & Manchester Railway of Pittsburg, is in Cuba.

EGUINE, formerly with Gardner & Co., having resigned that position, has accepted a similar one with Frost & Petersen.

T. C. WHITE has taken the Western agency for the Carpenter turn-table and other products of the Fulton Foundry of Cleveland.

COL. THOMAS LOWRY of Minneapolis, D. F. Longstreet of Providence, and Walter A. Jones of West Troy, were at the Fifth Avenue Hotel this week.

E. H. MARWEDELL of California called at the office of the JOURNAL. He is East looking after the interests of Isaacs' patent conduit and other business matters.

JOHN D. HAINES, of Haines Bros., whose illness was mentioned in our last issue, died at Newburgh January 25th. Both the Journal and Register of Newburgh speak very highly in his praise.

F. J. SPRAGUE, Treasurer of the Sprague Electric Railway and Power Co., is one of the busiest men in New York. He is full of enthusiasm regarding the future of electricity as a practical motor and transmitter of power.

Among the recent callers at the STREET RAILWAY JOURNAL office have been Gen. A. K. Stiles and W. H. Gillett of the Van Doopele Co., R. K. Runyan of the Eames Vacuum Brake Co., F. M. Eppley of the new Orange road.

Mr. JAMES W. FOSHAY, ex-President of the Broadway & Seventh Ave. R. R. Co., died at his residence in this city, No. 50 West Fiftieth street, Feb. 17. The cause of death was rheumatism, with which he has been afflicted for some time past, and which, taking a sudden turn to the heart, brought life to an end. He leaves a widow and an unmarried sister. He was not a rich man, and had nothing like a controlling interest in the corporations over which he presided. He was born in what is now the upper part of the city in 1824. The young man was first employed in Smith & Howe's wholesale grocery, and later secured an interest in the Wall street stage line, running up Broadway to Forty-second street. This was the old Wall street line, and when, in 1863, the Broadway & Seventh avenue line of horse-cars was started, Mr. Foshay sold out the stage line to that corporation, and went into the circus business, with an interest in Sands's Great American Circus and soon after in Howe's Great European Circus. He still kept up his interest in matters of city transportation, and when, in 1870, Mr. Kerr, President of the Broadway & Seventh Avenue Railroad Co., died, Foshay accepted the invitation to take his place, and this he retained until June last, when the Philadelphia syndicate took control.

Notes and Items.

The Editors would consider it a favor if those who are interested in street railway matters will send in any items that may come to their notice of changes, extensions or improvements. These memoranda will be duly inserted under this heading, and the proper changes made in our Street Railway Directory.

Allegheny, City, Pa.

THE PEOPLE'S PARK PASS. RY. CO. now has 52 miles of track, of 45 lb. rail. The Treasurer is James Boyle, not hitherto reported in our Directory.

Asbury Park, N. J.

A FRANCHISE is asked for a new road through the principal streets by a New York company. Property owners along the line favor the scheme, but the Board of Commissioners believe that the town ought to receive some compensation for the franchise, which the company is disinclined to grant.

Athens, Ga.

THE CLASSIC CITY ST. RY. CO., not hitherto reported in our Directory, has 3½ miles of track, of 4 ft. gauge, 16 and 20 lb. T rail, 4 cars, 30 mules. Officers: President, George M. Snodgrass; Vice President, R. B. Russell; Treasurer, Lamar Cobb; Superintendent, J. H. Dorsey.

Auburn, N. Y.

THE PHILADELPHIA SYNDICATE have bought up the street railways, and are making extensions, among which is the construction of a dummy road to Owasco Lake.

Augusta, Ga.

THE AUGUSTA & SUMMERVILLE R. R. Co. contemplate extending their line about two miles. They report at present 6 miles, 13 cars, 42 horses.

Baltimore, Md.

THE BALTIMORE CITY PASS. RY. CO. increases to 155 cars and 1,065 horses.

THE ELECTRIC ROAD in Baltimore is having the third rail torn up and the overhead wire plan substituted.

THE BALTIMORE, BROOKLYN & CEDAR HILL RY. CO., a new line, will be running cars by the 1st of May. It is 4 miles long, of 4 ft. 8½ in. gauge, with 25 lb. T rail, 16 cars, 50 horses. S. C. Long is Solicitor.

Battle Creek, Mich.

THE BATTLE CREEK ST. RY. has been re-organized with the following officers: President, G. L. Beveridge, Chicago; Vice President, Lucius Clark, South Bend, Ind.; Secretary, H. H. Brown, Battle Creek; Treasurer, H. H. C. Miller, Chicago; Superintendent, Geo. Wolf, Battle Creek. The company has now 4 miles of track and 20 horses.

Beaver Falls, Pa.

THE BEAVER VALLEY ST. RY. CO. will pave one mile of track to complete their paving. They have now 31 horses.

Belleville, Ont.

THE BELLEVILLE ST. RY. CO. reports 1½ miles of track, with 14 horses.

Birmingham, Ala.

THE BIRMINGHAM & JONES VALLEY ST. R. R. is a new scheme, in which Heflin & Knox are interested. Proposals have just been received for building 6 miles, with 45 lb. steel rail.

THE BIRMINGHAM ST. RY. Co. increases to 10 miles of 4 ft. 8½ in. track, of 16 lb. rail, with 24 cars and 90 mules. G. J. Stubblefield is Secretary, Treasurer and Superintendent.

Boston, Mass.

THE WEST END ST. RY. Co. has definitely decided to use electricity, and the storage system has received the most favorable consideration.

THE SOMERVILLE HORSE R. R. Co., operated by the Boston Consolidated Street Railway Co., has 5.405 miles of track, of 4 ft. 8½ in. gauge, with 48 to 60 lb. rail.

THE BOSTON & CHELSEA R. R. Co., operated by the Boston Consolidated Street Railway Co., has 4.154 miles of track, of 4 ft. 8½ in. gauge, with 52 to 60 lb. rail.

THE SUBURBAN ST. RY. Co. proposes to lay tracks through Park, Beacon, Arlington, and Marlboro streets to West Chester Park, using a portion of the tracks of the Metropolitan road from the corner of Clarendon street to West Chester Park.

THE WEST END ST. RY. Co. will have a road about 8 miles long, to 4 ft. 8½ in. gauge. They hope to use electricity as a motive power, intend to begin work this spring and to operate a portion of their road at least this year. H. M. Whitney is President and G. D. Braman Treasurer.

THE SOUTH BOSTON RY. Co.'s employees tied the road up Feb. 7, asking for ten hours' work instead of twelve, another grievance being opposition to the present Superintendent. The company offered to arbitrate but the men refused, whereupon on the 11th, the company began running the cars with non-union men.

This company has lately obtained new locations in the city of Boston, and will begin laying track soon. J. M. Jones' Sons, West Troy, are building 30 cars for the new route.

THE METROPOLITAN R. R. Co.'s directors, says a Boston dispatch, have accepted the proposition of the Cambridge Railroad directors for a consolidation, and the matter now awaits the sanction of the stockholders of each road. The united company, which will be called the Metropolitan Street Railway Co., will have a capital of \$4,000,000, divided into 40,000 shares of \$100 each. The present capital of the Metropolitan is \$2,000,000, the par value of the stock being \$50 a share, though the market value is about \$118. The Cambridge capital stock is \$1,950,000, the par value \$100 a share, while the market value is about \$160. It is proposed to have the Cambridge road increase its capital stock by the issue of 500 shares. Then in the consolidated company the Cambridge road is to receive \$1,500,000 for its \$2,000,000, while the Metropolitan stockholders will get \$2,500,000 for their \$2,000,000. Every four shares of the Cambridge road, par value \$400, will equal three shares of the consolidated stock, par value \$300, while eight shares of Metropolitan stock, par value \$400, will receive five shares of the consolidated stock, par value \$500. The corporation will have nearly 150 miles of single track, exclusive

of sidings; over 5,000 horses, about 700 cars, and nearly 500 open cars, and 2,300 employees.

THE BOSTON CONSOLIDATED ST. RY. Co. At the first annual meeting the directors reported "that the time has nearly arrived when the cable or electricity will be substituted to a considerable extent for the horses as a motive power. Should either or both be adopted, our road is peculiarly well adapted for it. Our real estate and buildings could be utilized for cable or electric purposes without any great expense. At the present time there exist some few defects in regard to the cable system, which will doubtless be remedied within a short time. Electricity has not as yet been quite fully or satisfactorily demonstrated as a success for the propelling of street cars. Electricians, however, claim that in a short time it will be made a success as a motive power for street railway purposes. Your directors, feeling that it was desirable for this company to make an early move in regard to the substitution of other motive power in place of horses, at their first meeting, appointed a committee, of which Mr. Merrill is chairman, to take into consideration the expediency of substituting in part the cable or electricity. The committee have given considerable time and attention to the subject, having visited other cities for information, and they will doubtless be able to make a definite report upon the matter in the course of a few weeks."

Brantford, Ont.

THE NEW WILLIAMSBURGH & FLATBUSH R. R. Co. increases from 255 to 278 horses and from 74 to 78 cars.

THE BRANTFORD ST. RY. Co., now first reported in full, has 4 miles of 3 ft. 6 in. track, 25 lbs. to the yard, 6 cars and 20 horses. D. A. Flack is President; R. A. Pringle, Vice President; Charles H. Flack, Secretary, Treasurer and Manager.

Brooklyn, N. Y.

THE LEWIS & FOWLER MFG. Co. have recently made contracts to furnish their fare registers to the Frankford & Southwark R. R. of Philadelphia, Pa., the Baltimore Union of Baltimore, Md., and the North Adams R. R. of North Adams, Mass.

THE BROOKLYN, BUSHWICK & QUEENS COUNTY R. R. increases from 41 cars to 50 and from 117 horses to 161. The board of officers has been reorganized as follows: President, George W. Van Allen; Secretary, William B. Wait; Treasurer, C. B. Cottrell; Superintendent, Charles E. Harris.

THE BROADWAY R. R. Co., acting under a permit from the Board of City Works, broke ground in Central avenue Feb. 1, with the object of extending its track. This is part of the same route adopted by the Atlantic Avenue Railroad for its cable line, recently leased to the Brooklyn Cable Railroad, as reported in our last issue. On the 9th, on the application of the latter company, Justice Brown of the Supreme Court granted a temporary injunction restraining the Broadway Railroad Co. from laying its tracks. The cable

road proposes to connect Fulton Ferry to Evergreen Cemetery.

THE BROOKLYN CITY R. R. Co. reports 88½ miles of track, an increase of 1½ miles. It has now 501 close cars, 335 open cars, and 3176 horses. The company applied to the Common Council Feb. 14 for permission to extend its tracks in Flushing avenue from Graham avenue to Bushwick avenue, and also along Flushing avenue from Knickerbocker avenue to the city limits. Expert Accountant Thompson, of the Railroad Commission at Albany, has resigned to accept the position of Secretary of the company. A lot of new cars has just been bought of J. M. Jones' Sons of Troy, N. Y. It is possible that the Flushing avenue extension may go beyond the city limits.

THE LEWIS & FOWLER MFG. Co. have issued an exceedingly handsomely illustrated catalogue of the various articles which they manufacture, and of which they are the agents. These articles comprise everything which can be needed for street railway purposes, all the details necessary for the construction of a car, the furnishing of a stable, and the equipment of the machine department of a road. Some of their illustrations are exceedingly amusing, as showing the difference between the new and the old way of operating street cars. The catalogue also contains considerable very interesting data in regard to the necessary expense of equipping a road in the way of rails, number of spikes, knees and joints necessary. The engravings are very handsomely gotten up, and are printed on an extremely heavy and fine quality of paper.

THE BROOKLYN RAILWAY SUPPLY Co. are receiving the most flattering reports from sweepers in various parts of the country, and are still at work on them, although not as busy as early in the season. They are now perfecting their improved self-feeding sand cars and a two horse power street or dirt sweeper. Boss & Walkaway machines are selling rapidly, their low price bringing them within the reach of the smallest companies, and the ease with which they are handled making them extremely valuable to the largest roads. They are certain to come into general use in the East another season. Their agency has been extended so that they now have the Eastern and Southern States in addition to territory first granted. Some turn-tables are being sold, and the enquiry for them is good, and they expect a good trade a trifle later in the season.

Burlington, Ia.

THE UNION ST. RY. Co. expect to build about half a mile of new track this season. The company has now 20 cars and 80 horses.

Cambridge, Mass.

THE CAMBRIDGE R. R. Co.'s employees went out Feb. 8, causing a complete tie-up. They ask for a reduction in the hours of labor per day from twelve to ten.

Cedar Rapids, Ia.

THE CEDAR RAPIDS & MARION RY. report an increase to 13½ miles of track, from 11

cars to 20 and from 40 horses to 44. A. J. McKean is now Vice President.

Calais, Me.

THIS TOWN will soon have a street railroad some four miles in length, which is also to extend through St. Stephens and Middletown, or four miles further, making in all eight miles. It is the intention to build the four miles on the Maine side this spring.

Chattanooga, Tenn.

THE CHATTANOOGA ST. R. R. Co. increases to 12 miles of track, from 12 cars to 25 and from 54 horses to 120.

Chicago, Ill.

THE CHICAGO CITY RY. Co. this year put stoves under a number of its cars as an experiment. The company will equip all its cars with heaters if the experiment is a success.

BIDWELL'S ELECTRIC RAILWAY AND MANUFACTURING Co. are preparing to supply during the coming season electric plants for several roads, for which the charters have been granted, in Illinois, Michigan and Indiana.

THE PULLMAN PALACE CAR Co., among other orders, are now building at their Pullman shops the following cars: Eight grip cars for the St. Louis Cable & Western Railway, four closed cars for the electric road at Lima, Ohio, five closed cars for the Milwaukee City Railway Co., ten cars for the Rochester City & Brighton R. R., ten for the Metropolitan Cable R. R., Kansas City; and at their Detroit shops they are building cars for the Highland Park electric road.

OUR CHICAGO LETTER.

The winter here thus far has been very favorable for street railways, as but little snow has fallen at any one time and the tracks have been easily kept clean. But there is time enough yet for a big snow storm, and if it comes the Chicago Passenger Railway Co. will have an opportunity to test a new Flexible Self Adjusting Track Cleaner invented by Mr. G. G. Gibson of St. Louis, where it has been successfully used since the season begun.

Mr. H. W. McNeil, manager of

THE RASMUSSEN CABLE,

has succeeded in convincing the experts that he has got a good system, and as soon as the weather permits he will commence building a road 2½ miles long in Sioux City, Iowa.

A new form of street rail has been invented and patented by D. C. Cregier, Superintendent of the West Division road, which has a groove between the two trams deep enough to receive the spike heads and protect them from wearing off and the rail becoming loosened.

The North Chicago Street Railway Co. have their new cable station nearly completed, and the United States Construction Co., who have the contract, will push the construction of the track as soon as the weather will permit.

THE VAN DEPOELE ELECTRIC MFG. CO.

have a contract to supply the electric plant for a new street railway to run six cars at

Binghamton, N. Y., also an order from the Street Railway and Power Co. of Lima, Ohio, of which Mr. B. C. Faurot is President, to equip five cars with electric motors which are now run with horses. They have just finished a 250 horse power generating dynamo to go to Montgomery, Ala., and it is believed to be the largest machine for the purpose ever constructed in the world, weighing nearly twelve tons. Mr. Stiles of this company is now on a visit to Eastern cities, where investigations of electric motors for street cars are in progress. I learn that a syndicate of Eastern capitalists are contemplating the construction of an elevated road to South Chicago, to be operated by electricity, provided they can get the right of way.

The matter of organizing a

STREET RAILWAY CONSTRUCTION COMPANY for the purpose of co-operating with local capitalists in the towns and cities of the West is under consideration by some enterprising gentlemen here, and there is certainly a splendid field for it. If properly conducted such a corporation could not fail to earn large dividends, as they could combine under one management all the various patents relating to street railway construction and make use of those best adapted to each particular case.

I have often thought how much better it would be for the public if governments would repeal all patent laws and grant pensions instead for worthy inventions, thereby enabling mechanics to make use of the best devices to accomplish their purposes without being obliged as they now are to injure their products by substituting inferior parts simply to avoid the payment of royalties. Such a step on the part of our government would not only be of immense benefit to the nation but would carry out the intent of the patent laws by giving the inventor the benefit of his invention, whereas in most cases he is now cheated out of it.

W. H. B.

63 Lakeside Building,
Chicago, Feb. 15, 1887.

Chicopee, Mass.

A NEW COMPANY has been formed here under the leadership of the Haines Bros. The capital is \$25,000. Among those interested are John B. Wood, George S. Taylor, J. W. Cumnock and Frank H. Morton of Chicopee, and George W. Stetson of New York. The tracks will connect with the Springfield Street Railroad Co.'s tracks at Brightwood. Work will begin in the spring.

Cincinnati, O.

THE MT. ADAMS & EDEN PARK INCLINED R. R. Co. has now 7 miles of horse railway track, 8 miles of cable railway, 20 horse cars, 40 cable cars and 175 horses, being an increase in every department.

THE PRICE HILL INCLINED PLANE R. R. Co., not hitherto reported in our Directory, has the following officers: President, M. W. Oliver; General Manager, Rees E. McDuffie; Secretary and Treasurer, George T. McDuffie. It reports 1-13 miles of 5 ft. 6 in. track, 60 lb. rail, 4 cars.

Cleveland, O.

THE WOODLAND AVENUE & WEST SIDE ST. R. R. Co. increase from 128 cars to 140 and from 605 horses to 630.

THE EAST CLEVELAND RY. Co. are building 12 new open cars, to be finished in May. They are being fitted with the new Worswick Journal Box, made by the Cleveland Street Railway Supply Co.

THE EAST CLEVELAND R. R. Co. has the following lines: Euclid avenue and Prospect street; Cedar avenue; Garden street. The company has 110 cars and 517 horses. It is building 12 additional open cars at its own shops for next summer's business.

THE NEW DOOR FASTENER for street cars made by Mr. W. E. Haycox of Cleveland is attracting considerable notice. It is a handy device for opening and shutting doors, is inexpensive, and is highly recommended by those using it. It is in use on the different lines in Cleveland and on several outside of that city.

THE CLEVELAND STREET RAILWAY SUPPLY Co., manufacturers of the Worswick and Higley journal boxes, whose works were burned some months since, have rebuilt and are in running order again. They say the large number of orders they are receiving for the new Worswick box is the best testimonial possible in its favor.

Columbus, O.

THE COLUMBUS CONSOLIDATED R. R. Co. report an increase to 25 miles of track, from 92 to 97 cars and from 350 to 383 horses.

Dallas, Tex.

THE DALLAS CITY & DALLAS ST. R. R. Co. increases to 6 miles of track, 12 cars and 84 mules. The officers are now as follows: President, R. A. Ferris; Secretary, John H. Gaston; Superintendent, C. E. Keller.

Dayton, O.

THE WAYNE & FIFTH ST. R. R. Co. have sent in an order to the Johnson Steel Street Rail Co., of Johnstown, Pa., for 12,500 ft. of track with which they will double part of their track and renew the balance. This will leave them but one switch at each end of the road, and they will then have about 5 miles of track instead of 4½. They will get their iron about the latter part of April. They will do this work with the steel girder material and tie plates, the rail weighing 38 lbs. to the yard, side bearing. They have already in use part of this rail, and Superintendent Routzahn writes us in regard to it: "There is none better; it far surpasses all the stringer rail of old pattern heretofore in use in Dayton."

Decatur, Ill.

THE CITIZENS' ST. R. R. Co. has 9 cars and 48 horses, and reports the following officers: President, D. S. Shellabarger; Treasurer and General Manager, W. L. Ferguson.

Durham, N. C.

THE DURHAM ST. RY. Co. has been organized. It is to be from 5 to 8 miles long, of standard gauge, rails of medium weight, 2 cars per mile. Officers: President, W. T. Blackwell; Vice President, J. S. Carr; Secretary and Treasurer, R. D. Blackwell;

Construction Committee, R. D. Blackwell, W. W. Fuller, J. W. Blackwell. Work will be commenced within a few weeks, and the road will be opened within 90 days. The capital stock is \$10,000.

Detroit, Mich.

THE FORT WAYNE & ELMWOOD RY. Co. will this season extend their road from its eastern terminus to the Boulevard. A two-story brick car shed, 50 by 150 feet, to cost \$7,000, will be built on Clark avenue. Four new two-horse cars, 16 feet long, and four new open cars are to be added immediately to the rolling stock.

Elgin, Ill.

THERE IS A PROJECT on foot for the building of a street railway, but the City Council has not yet provided the right of way, and so it is still in embryo. We are unable to give further particulars on the subject except that Mr. George P. Lord is interested in the matter.

Evansville, Ind.

THE EVANSVILLE ST. RY. Co. has now 12 miles of track, 32 cars and 220 mules. Officers: President, John Gilbert; Secretary and Treasurer, W. S. Gilbert; Superintendent, William Bahr.

Flushing, N. Y.

THE NEW ROAD along Jamaica avenue, for which a charter has been obtained, will likely be constructed this spring. It will run from College Point to Flushing Cemetery. Supervisor Dykes, John Henderson the florist and D. Master are among those interested.

Hartland, Kan.

THE HARTLAND ST. RY. Co. is a new organization. It is proposed to commence work this spring, and the President writes us that the road depends on how the town "booms" this year. It will be 2 miles long, of narrow gauge, light rails, with 2 cars and 1 mule. The capital stock is \$5,000. Officers: President, E. S. Snow; Secretary and Treasurer, Logan A. Garten; Superintendent, W. S. Handy.

Huntington, N. Y.

A NEW COMPANY has been organized in Huntington, L. I., for the purpose of constructing and operating a horse railroad. The route proposed is through the highway extending northerly from Huntington station on the Long Island Railroad, New York avenue, Main street and the main road or highway along the east side of Huntington Harbor. The distance is three miles. The amount of capital stock is \$30,000, divided into 3,000 shares of \$10. The shareholders are Casper D. Schuberth and Richard G. Phelps, both of New York, and William H. Rushmore, Henry S. Brush, Douglass Conklin, George M. Tileston, and E. D. Davidson, all of Huntington.

Kansas City, Mo.

THE GRAND AVENUE RY. Co. is changing its horse-car line to cable. It has 8 miles of track, an increase of 2, but has now only 15 cars and 75 horses. The capital stock of this company is \$1,200,000.

THE KANSAS CITY CABLE RY. Co. has now 26 grip cars and 40 passenger coaches. They have in operation 8 miles of road, and 6 miles are in process of construction.

The rail on the old line is a 45 lb. flat rail and on the new line a 56 lb. girder rail. Clift Wise is Chief Engineer of the line.

The Kansas City Commercial says: "We are better supplied with cable street railroads than any city in the country. Two lines are now operated; two more will be running before spring, and work is about to commence on two others. We have, including horse car lines, 32 miles of track at present in the city limits. New York is the only other American city where the exigencies of rapid travel have necessitated the construction of elevated steam roads. There are at present operated in Kansas City and immediate environs seven miles of double track elevated road and the system will be more than doubled during 1887, extending from its present terminus to Grand avenue and thence south. To compass this extension a difficult feat of engineering will be encountered. The bluffs will have to be tunneled from the west bottoms to Grand avenue. In addition to these lines of local transit we have an electric road running about two miles."

Laconia, N. H.

LACONIA & LAKE VILLAGE HORSE R. R. has 20 horses. The company carried 158,766 passengers during the past year, an increase of 10,633. Among the items of expense were the following: Feed, \$2,137.95; shoeing, \$236.97; miscellaneous, \$1,038.80; wages, \$2,941.56. A dividend of \$3 per share was paid Feb. 1.

La Crosse, Wis.

THE LA CROSSE CITY RY. Co. increases from 5 miles to 5½ and from 65 horses to 70.

Malden, Mass.

THE STONEHAM ST. RY. Co. desires to build from the terminus of the Boston Consolidated Co.'s tracks to the Revere line; but there is some opposition to the scheme.

Mansfield, O.

A NEW COMPANY is organizing, and proposes to use electricity.

Meriden, Conn.

THE NEW ROAD here is about completed. Horses and cars are on hand, and the managers are waiting for a thaw to help them in clearing up the track. If the present weather holds, they will probably open about March 1st.

AT A MEETING of the directors of the Meriden Horse R. R. Co., held a short time since, the number of directors was reduced to five, and John M. Douglas elected President and James K. Guy Secretary and Treasurer. Mr. Joseph Lane has resigned as Superintendent, and Mr. Walter Baldwin, formerly a driver on the road, has been appointed in his place.

As we go to press we learn that the above company has already begun operations. Eighty horses are in use.

Minneapolis, Minn.

THE ENTIRE STREET CAR SYSTEM of Minneapolis, which is capitalized at \$5,000,000, has been sold by Thomas Lowery to a syndicate of Eastern capitalists, represented

by Lee, Higginson & Co. of Boston, for \$3,000,000.

Montreal, Can.

THE MONTREAL ST. RY. Co. has now 30 miles of track, of 4 ft. 8½ in. gauge, 80 cars, 80 sleighs, 40 'buses and 700 horses.

New Britain, Conn.

THE ROAD in this city has passed into the hand of parties in New York City.

Newburyport, Mass.

THE PLUM ISLAND ST. RY. Co. is the name of the newly organized company here. It will be 4 miles long, of 35 and 40 lb. steel and Johnson rail, and will have about 10 cars, 20 horses and dummy or electricity. The route is from Fair street or Water street, Newburyport, to and over Plum Island to the mouth of the Merrimac river.

New Castle, Pa.

THE NEW CASTLE ST. RY. Co. has been organized, but the method of propulsion has not yet been determined. Chas. S. Wallace is Secretary.

New Haven, Conn.

THE FAIR HAVEN & WESTVILLE R. R. Co. has now 207 horses.

New Rochelle, N. Y.

THE NEW ROCHELLE & PELHAM R. R. Co. has 10 miles of 4 ft. 8½ in. track, 38 lb. rail, 8 cars, 30 horses. Officers: President, W. R. Bergholz; Secretary and Treasurer, Eugene Durnin.

New York, N. Y.

THE JULIEN ELECTRIC MOTOR, running on the Eighth avenue road in New York, has developed a speed of 8½ miles an hour.

FRANK H. ANDREWS has awarded to Messrs. Bacon Bros., 377 St. Paul st., Montreal, Canada, the exclusive agency for his products for the Dominion of Canada.

THE JOHN STEPHENSON Co. are just about to ship a new 22 ft. car to the Chattanooga Street Railway Co. at Chattanooga, Tenn. They are also filling orders for roads in Memphis and Knoxville, and will start on the work of building the cars for the new Park avenue line in Brooklyn.

DRY DOCK, EAST BROADWAY & BATTERY R. R. The employees in the mechanical department were notified Feb. 11 that a Saturday half holiday would be given to them hereafter. A project is on foot to get the same holiday on all the other roads.

THE SIXTH AVENUE R. R. Co. asked the Aldermen Feb. 8 to extend its tracks. One branch is to go from Varick street through Clarkson street to the Hudson river at West street, with double tracks; the other branch, from Varick street through Watts street to the Hudson river, at West street, also with double tracks. This was referred to the Committee on Railroads. The stockholders held their annual meeting the same day and re-elected all the old Board of Directors.

NEW YORK CABLE R. R. Co. The Court of Appeals decided recently that this company, which proposed to build a gridiron of seventy miles of cable roads in this city, had organized under the wrong law and had no legal existence. The company procured new sittings of the Commission which created its routes, to cure defects in its

charter, and it went to the Court of Appeals with a motion for reargument. Feb. 8 the Court denied this motion with costs.

THE CHAPLIN MANUFACTURING Co. has moved its general office to 69 Wall street, New York. Its President is Michael Chauncey of Brooklyn and Treasurer R. A. C. Smith.

AT JOSEPHINE D. SMITH'S factory, 350 and 352 Pearl street, they are very busy, having orders for railroad lamps on file from all parts of this country and from London, England.

THE JORDAN-MILLS MANUFACTURING Co. is the name of a new company organized for the purpose of manufacturing an automatic sand distributor. The device has met with favor where used. We hope to show it in these columns later.

FROST & PETERSEN have rented a cabinet factory at 161 West Eighteenth street, and will enter extensively into the manufacture of veneer specialties for steam and street cars. The new factory will be 40 by 100, six stories, and will be specially fitted for the work in hand. They will manufacture all kinds of veneer car seats, sides, ceilings and panels, and will make a specialty of a new roof. Frost & Petersen own their own forests in Vermont and Wisconsin, and manufacture their own veneer. W. P. Seguin is their representative.

TWENTY-THIRD ST. R. R. Co. The original grant for the route of the Bleecker Street & Fulton Ferry Railroad required the payment by that road of one per cent of its gross receipts to the city treasury. The road was leased for ninety-nine years to the Twenty-third Street Railroad Co. in 1879. These percentages being claimed from the Twenty-third Street Railroad Co., it answered that there were no receipts by the Bleecker Street & Fulton Ferry Co. Judge Van Brunt has now decided that the obligation to pay license fees was one which followed the road into the hands of whatever corporation it might come, and the percentage is to be calculated on the receipts of the road and not of the company. The result of this decision is to require the road to account for one per cent of the gross receipts of the Bleecker street road from 1879 to the present time.

THE THIRD AVENUE R. R. Co.'s directors held a special meeting Feb. 7 to consider the report of the committee appointed to decide whether electrical motors or the cable should take the place of horses in Third avenue. The members of the committee were all in favor of the cable system. They found no electrical motor that in their opinion would answer the requirements of the road. In this conclusion all the other directors, who have been making private examinations on their own account, agreed, and hence the question of motor power may now be looked upon as settled. A full abstract of the report will be found in another column. The problem which still confronts the board is what kind of a cable system it will be the best to adopt, and on this subject has been given to the committee for consideration. President Lyon

said recently that the board proposed to put down a plant which would necessitate tearing up the streets and keeping them open as little as possible. One plan under consideration could be carried out without causing the streets to be left open for more than a day or two, one block being finished at a time. There was no doubt, he said, that the board would settle the question within a short time, so that the work would be begun early in the spring. Some of the directors do not look upon the matter as so near a settlement as that. One of them, a heavy stockholder, said: "The only objection to the cable is its cost, which is simply tremendous. We are trying to see if we cannot get a plant that will do the work and yet not cost us quite so much as the one we have already in use." President Lyon says the rolling stock will be the finest New York has ever seen. At a meeting of the directors on the 14th it was formally decided to build a cable road, and application will be made in a few days for a permit to open the streets. The work will be begun early in the spring, and will probably be finished in time to put on the new summer cars.

Omaha, Neb.

A SECOND CABLE LINE is to be started here, to be built by a Kansas City syndicate. It is intended to have three miles in operation by next fall.

Orange, N. J.

THE ORANGE CROSSTOWN & ORANGE VALLEY ST. RY. Co. have about two-thirds of their road built, and all the material is now on the ground. It will be 2½ miles long, of 5 ft. 2 in. gauge, 25 lb. Johnson girder rail, and they will have 5 Stephenson cars and 25 horses. They are experimenting with the Daft electric system. The capital stock is \$20,000; bonds, \$20,000. Officers: President, Francis M. Epey; Secretary, James E. Brown of Orange; Treasurer, Henry W. Pope of Orange.

Passaic, N. J.

THE NEW HORSE RAILROAD project is bitterly opposed, and it is now thought that a line of herdic coaches will be substituted.

Petersburg, Va.

THE PETERSBURG ST. RY. reports 40 horses.

Philadelphia, Pa.

THE PEOPLE'S PASS. RY. Co. increases its mileage from 44 to 45 and number of horses from 1,080 to 1,153. Charles S. Whitney is now General Superintendent.

PHILADELPHIA TRACTION Co. In the case of Charles F. Orban, a newsboy, against this company for damages, the jury Jan. 29 rendered a verdict for the plaintiff for \$18,000. Orban while selling papers on one of the company's cars was pushed off the platform and fell under the wheels of a second car attached to the one from which he was pushed. One leg had to be amputated and the other was badly injured.

Pittsburg, Pa.

THE FEDERAL ST. & PLEASANT VALLEY PASS. RY. Co. has 5½ miles of track, 22 cars and 165 horses.

IT IS UNDERSTOOD that a horse railroad will be constructed from a junction of the new cable road to Squirrel Hill, and will utilize the old rails and rolling stock and horses of the road replaced by the cable.

THE SAFETY ELECTRIC RAILWAY AND POWER Co., operating the Daft patents, are now building a road to be run by their system in Pittsburg, to cost \$120,000. The grades are over 750 feet to the mile, and the company have guaranteed a successful operation at an average speed of eight miles an hour.

A MOVEMENT is on foot in the street car men's assemblies of the Knights of Labor, to form a national trade district, to include street car men in every city where they are organized. The membership would probably exceed thirty thousand. One of the main objects is to secure the general adoption of twelve hours as a day's work on street car lines throughout the country and the passage of laws by the legislatures of the various States rendering it illegal to work longer hours.

Port Chester, N. Y.

THE PORT CHESTER & RYE BEACH ST. RY. Co., one of the new roads to be built by the Haines Bros., is to be 3 miles long, of 4 ft. 8½ in. gauge, 30 lb. rail, with 6 cars and 25 horses. Work will be commenced June 1, and the road will be opened by the 1st of July. The officers are: President, Charles D. Haines; Vice President, Andrew G. Haines; Secretary, Frank H. Skeele; Treasurer, George W. Stetson. The capital stock of the company is \$40,000.

Richmond, Va.

THE RICHMOND CITY RY. Co. has received permission to lay tracks in a number of new streets, but is to pay one-tenth of all its receipts to the city; and the same permission with the same condition has been granted to the new Union Passenger Co.

Rome, N. Y.

ROME CITY ST. RY. Co. Arrangements are being completed by Messrs. Hill and Dayton, of New York, for the prompt construction of this railway as soon as the ground will permit. About five miles will be built on Dominick, James, Turin, Elm, and Madison streets, and the road must have an immediate effect on the business interests and accommodation of the city. Mr. McElroy, Chief Engineer, has just returned from Rome, and is preparing the plans and specifications for contracts, so as to have all the materials and force ready to commence work promptly, and press it to a speedy completion; and the consents of property owners have now been obtained. Mayor Comstock and other prominent citizens are favoring the work, and the Common Council have granted the requisite franchise.

Roudout, N. Y.

THE KINGSTON CITY R. R. Co. has now 8 cars and 40 horses. Peter E. Schoonmaker is now Secretary and Treasurer, and Oscar L. Eastman Auditor.

St. Louis, Mo.

THE JEFFERSON AVENUE RY. Co. will have a new equipment of summer cars. The

Brownell & Wight Car Co. are building them.

THE LACLEDE CAR MFG. Co. have recently received orders from the Kansas City Cable Railway Company; from Beatrice, Neb.; Ottumwa, Ia.; Salina and McPherson, Kan.; and are figuring on a large amount of work which will be let in the near future. Their shops are reported crowded, and the outlook for the year very bright.

THE ST. LOUIS CABLE & WESTERN RY. Co. are having the 30 cars now under way by the Pullman Company built in the most substantial and elegant manner. These cars, which are to have double trucks similar to those used on steam railways, will be equipped with the Bemis box and bearings, which are said to be especially adapted for this class of trucks.

OUR ST. LOUIS LETTER.

There are so many applications for charters for street railway privileges now before our Council that I have lost the run of them. One would suppose there was money in the business from the way some of these fellows are trying to catch on, and I suppose there must be, for I don't see any of the roads advertised for sale or any of their officers or employees looking like they didn't have enough to eat. I notice they always dress well, and that's a sign the world over that they must be making money. Some of the roads are making arrangements to spend this money next summer.

SUBSTITUTING CABLE FOR HORSES.

Mr. Julius S. Walsh made a statement before a committee of the Council, when asking for permission to change the motive power on his Citizens' Line, that he proposed to build a cable power house at the corner of Grand and Easton avenue, from which he would run the down-town and Fair Ground cars, and that he would also furnish power for a cable to Forrest park if granted the franchise. He has received permission to make the change and is now experimenting with the different systems in order if possible to get something that will be second to no system in the country. He will have the best, no matter what it costs. He is now looking into the merits of the Terry Grip, so is also Mr. Christian Peper, President of the St. Louis R. R. Co., who has built a short stretch of it in order to test its staying qualities.

EXPERIMENTS WITH ELECTRICITY.

Messrs. Maffit and Maxon are looking for electricity to solve the problem. They are experimenting with the Julien Electric Motor. If that don't fill the bill Mr. Maffit will immediately put down a cable. So you see we are coming to the front.

A company has been organized here (by the way) for the purpose of developing an electric storage battery system for street cars. It is to be hoped they will be successful. Mr. James L. Huse is the President of the company, Mr. James F. Ewing Secretary and Mr. D. P. Slattery Treasurer.

I noticed the Gibson Track Cleaner you illustrated in your February number at

work on the Broadway line here during one of our storms recently, and if I am any judge of the merits of a plow I will stake my reputation on it that that plow i. It goes over the track like a snake and takes everything with it, no matter what shape it's in.

I see some new cars running on the cable line, which have just been built by J. G. Brill & Co. of Philadelphia. They are elegant cars and are greatly admired.

MESSRS. BROWNELL & WIGHT

have collared an order for 45 open cars for Mr. Scullin here. Another company has large orders from Kansas City and other Western points. Altogether our car builders are in a very flourishing condition.

While talking about cars I would suggest that the car builders make an improvement in the construction of the lamp house, so that the corrugated glass used as a reflector will not become blistered from the heat. There is certainly room for improvement in the construction of the lamp house or in using some other reflector.

St. Louis.

Feb. 14.

San Francisco, Cal.

THE GEARY STREET CABLE ROAD was the scene of another dynamite explosion Feb. 6. Just as a train going west had reached the corner of Fillmore and Geary streets a loud explosion occurred. The whole side of the dummy was blown to splinters. There were no passengers on it, and the only person aboard besides the gripman and conductor was a policeman who was detailed to discover obstructions on the tracks. He was riding on the front of the dummy, and his complete escape from injury and that of the brakeman and conductor are marvelous. The conductor had stopped the train a minute before to permit a party of ladies and gentlemen to leave it. The concussion was felt for a distance of a mile. The wrecked dummy was quickly replaced by a new one and traffic was not interrupted. There is no clue to the perpetrators of the outrage.

Savannah, Ga.

THE PULLMAN PALACE CAR Co. will furnish the cars for the new street railway in this city.

Selma, Ala.

THE SELMA ST. RY. has changed its officers. H. L. McKee is now President and J. F. Brown Secretary.

Springfield, Mass.

THE BEMIS CAR BOX is used with satisfaction by the electric roads at Detroit, Lima, Ohio, and Scranton, Pa.

Springfield, Mo.

THE CITIZENS' RY. Co. increases to 7 miles of track, of 4 ft. 8½ in. gauge, 33 and 40 lb. rail, 15 cars, 28 horses and 48 mules.

Springfield, O.

THE CITIZENS' ST. RY. President D. W. Strond has recently ordered an equipment of summer cars, of a new and improved pattern, to be used with fare-boxes, from the Brownell & Wight Car Co., of St. Louis, who have built all the cars operated on that road. They will have the Volk Patent Gear.

Stamford, Conn.

THE STAMFORD HORSE R. R. Co., whose opening we announced last month, has 5½ miles of 4 ft. 8½ in. track, 10 cars and 40 horses. Officers: President, F. M. De-

lano; Treasurer, Philip Richardson; Superintendent, A. H. Hubbard.

Steubenville, O.

HAINES BROS. propose building a new line from the Riverside Iron Works through the city via the Jefferson Iron Works to Mingo.

Toledo, O.

THE TOLEDO CONSOLIDATED RY. has placed a large order for new cars with the Brownell & Wight Car Co., of St. Louis.

Toronto, Ont.

THE TORONTO ST. RY. Co. increases from 160 cars to 180 and from 750 horses to 850.

Troy, N. Y.

THE TROY & LANSINGBURG R. R. Co. contemplates laying a double track from Cohoes to Green Island.

Utica, N. Y.

THE UTICA BELT LINE ST. RY. Co. is to receive about a dozen new cars from Troy.

West Haven, Conn.

THE NEW HAVEN & WEST HAVEN HORSE R. R. Co. has now 6½ miles of track. W. W. Ward is Treasurer.

West Troy, N. Y.

J. M. JONES' SONS are running their works to their utmost capacity on street car work. They have just delivered twenty cars to the Consolidated Street Railroad, Boston, and have an order for forty more. They are also building thirty for the South Boston, ten for North Woburn, eight for Worcester, ten for Fall River, seven for Springfield and eight for Lawrence, Mass. For the West they are building twenty-five for Detroit, several for Milwaukee, Pittsburg, Buffalo, Cleveland, and other Western cities, also a lot for Montreal, Can.

Wheeling, W. Va.

THE CITIZENS' RY. Co. has 16 cars and 60 horses. It is now officered as follows: President, George B. Caldwell; Secretary, Frank P. Hall; Superintendent, Michael Loftus.

Wilkesbarre, Pa.

THE WILKESBARRE & KINGSTON PASS. R. R., not hitherto reported in full in our Directory, has 3 miles of 5 ft. 2 in. track, 30 and 45 lb. rail, 10 cars, 22 horses. Officers: President and Manager, Wm. J. Harvey; Secretary and Treasurer, A. J. Davis.

Wilmington, Del.

THE FRONT & UNION ST. PASS. RY. Co. has 7 cars and 22 mules.

Wilmington, N. C.

THE WILMINGTON ST. RY. Co. has been chartered. The incorporators include Lieut. Gov. Stedman, John D. Bellamy, Jr., and J. C. Devine of Wilmington. The company will build two and a half miles of road at once and have contracted with the Sea Shore Construction Co. of New York for the construction and entire equipment.

Worcester, Mass.

THE WORCESTER ST. RY. Co. has 32 cars and 150 horses. Officers: President, George H. Seeley; Treasurer, H. S. Seeley; Superintendent, John N. Akarman; Assistant Superintendent, Isaac B. Chapin.

Wymore, Neb.

THE WYMORE & BLUE SPRINGS RY. Co. reports 3½ miles of track, 4 cars and 10 horses. The officers have been changed as follows: President, J. H. Reynolds; Vice President, Ben Reynolds; Secretary and Treasurer, E. P. Reynolds, Jr.; Superintendent, A. N. Bradfield.

Yonkers, N. Y.

THE YONKERS R. R. Co. was opened on the 14th. They have about five miles nearly ready for business. In the spring they expect to build about two miles more and increase the rolling stock and horses proportionately. At the annual meeting of the company in January the following officers were elected: President, D. N. Stanton; Secretary, John F. Brennen; Treasurer, D. Perry Stanton.

The Sprague Electric Motor.

Continued from page 269.

switches, and also for taking part of the weight of the motor off the body of the axle and to throw it on to the boxes, one end of the motor is supported at its center by double compression springs playing upon a loose bolt, which is supported from a cross girder in the bottom of the car.

It will be seen also that since the motor is suspended at one end by the truck axle and at the other by compression springs, operating in both directions, that whenever the axle is in motion, there is always a spring touch of the pinion upon the gears. Barring friction, a single pound of pressure exerted in either direction will lift or depress the motor a slight amount.

One of the great objections which has been met with in applying motors, whether steam, electrical or of any other character, to the propulsion of street railways has been the difficulty of getting sufficient track adhesion to operate the car under all conditions of track, load and grades.

In experiments made by Mr. Wright on the North Chicago Railway, the strain on the draw-bar ran as high as 1,500 to 1,700 pounds. If a car should weigh, say, 17,000 pounds, this would require a tractive adhesion of one-tenth.

switch controlling both the speed and the direction of movement of the motors.

From this independent driving, the very highest results in traction can be secured, because either wheel is free to skid until it gets a grip.

The Sprague company is now entirely ready to take contracts of any size for equipping roads with the overhead line where this is permissible. They are meanwhile conducting experiments in a private way in combination with storage batteries, so as to develop an independent system of motor cars, and they are also going to bring out a system of shallow conduits of entirely new structure and design, and which promises to go far to settle the questions of direct supply in cities where the overhead line is not permissible.

Safety Electric Railway & Power Co.'s System.

Mr. John Murray Mitchell in a recent letter advocates very strongly the use of the Daft Electric System, and quotes as a reason why it should be adopted the success which has attended the use of the electric system upon the Baltimore & Hampden Railway of Baltimore.

It is only two miles long, and has been pronounced the most difficult road for its length in this country, if not in the world. It was formerly operated by mules, at a cost of \$6.50 per day, and was run at an average speed of about three miles an hour.

He also quotes from the General Manager's report the expense of running the road and its earnings under the two systems of using mules and electric motors. The increase of receipts on the electric system was \$4,199, the total receipts being \$15,557, the average cost of horse power per car per day was \$6.50, using the mules, while the total cost of the electric power per day on the road now is

Table with 2 columns: Item and Price. Items include 1 1/2 Tons of Coal at \$3.50 per ton, An Engineer at, A Fireman at, Oil and Waste, Interest and Depreciation of Plant.

Making.....\$12.00 the cost of ample electric power to run 3 cars and 3 motors, an average cost per car per day for electrical power of \$4.00.

STREET RAILWAY STOCK QUOTATIONS.

Corrected by H. L. GRANT, 145 Broadway, N. Y. City.

Table listing New York Stocks with columns: New York Stocks, Par, Amount, Period, Rate, Date, Bid, Asked. Lists various stocks like Bleecker St. & Fulton Ferry, Broadway & Seventh Avenue, etc.

Phila. Street Railway Stocks.

Corrected by ROBERT GLENDINNING & Co., 303 Chestnut street, Philadelphia, Pa.

Table listing Philadelphia Street Railway Stocks with columns: Name, Par, Period, Amount, Rate, Date, Bid, Asked. Lists stocks like Citizens, Continental, Frankford & Southwark, etc.

The Julien Electric Company.

OFFICE, 120 BROADWAY, N. Y.

FACTORY, CAMDEN, N. J.

Electric Street Cars on Secondary Battery Principle.

EDMOND JULIEN, Engineer, of Brussels, Belgium, is the inventor both of the Traction System and Secondary Battery System of this company. The present car is the result of six years of unceasing experiments, carried on at his works in Brussels and on the streets of that city, at great cost.

The leading principle of Mr. Julien's System has been the application of an Electric Motor and Batteries to the present existing rolling stock of street railways, and to construct a car so simple in its management that the drivers and conductors at present in charge of horse cars may take to the new service as easily as to the old. Mr. Julien, after running an Electric Car on the Rue de la Loi in Brussels, during the years 1884 and 1885, and ascending a grade of 5 per cent on that street, put his car in service at the Antwerp International Exhibition of Mechanical Traction in May, 1885, and ran it daily a distance of 57 miles, sometimes drawing an ordinary street car, both cars filled with passengers, and in competition with steam and compressed air motors; and the jury, consisting of eminent Engineers from England, Germany, France and Belgium, awarded Mr. Julien the First Prize and Diploma of Honor for the best System of Mechanical Traction for street cars.

At the end of this Exhibition, Mr. Julien placed two cars on the streets of Hamburg, and afterwards added a third. Those cars have now been running since February, 1886. They each make 69 miles a day and in one place over a 4 per cent grade, carrying passengers; and, although the municipal requirements of Hamburg were very exacting, yet the Electric car has so satisfactorily met them, that it has been adopted in that city. Readers are requested to write to Hamburg to satisfy themselves. The batteries used upon these cars were examined by the municipal officers two months ago, and were found in as perfect condition as when they were first put in the cars.

In April, 1886, Mr. Julien closed a contract with all the Brussels street railways, whereby they have agreed to adopt his System and to put 107 cars in use in Brussels. They are now ready to put three lines of Mr. Julien's system in service, if they have not already done so. The street railways at Rio Janeiro have also adopted Mr. Julien's system.

Last June, Mr. Julien placed two of his cars in service on the Champs Elysees under the supervision of ten members of the International Society of Electricians of France, M. Fontaine at the head. They did service between the Place de la Concorde and the Palais de l'Industrie during the entire summer, and, at the end of the Exhibition, were awarded a first prize and Diploma of Honor. Mr. Julien's Batteries were also put in competition there with those of Faure and Plante under the supervision of Mr. Hospitalier, an eminent Electrician; and Mr. Julien was awarded the first prize and a Diploma of Honor. The Faure and Plante batteries received a third prize and silver medal. Mr. Julien's car, which is now exhibited on Eighth Avenue, New York City, is working its way into favor and has been so adapted to the new conditions arising from sharp curves and an irregular track, as to travel easily at a rate of eight and one-half (8½) miles an hour and carrying a full load.

COST.

The cost of Installation of Mr. Julien's System is about the same as that of horse system. It is, in all probability, less; and, once installed, the expense of maintaining it is, of course, much less. In Brussels, this expense has been found, after an examination, covering a period of nearly a year, by a committee of Street Car men, to be a little over Three Dollars (\$3.00) a day for each car. In this country, the expense will not exceed Four Dollars (\$4.00) per day. From our observations on the Eighth Avenue line, it will be less than that on that line, owing to the favorable nature of the grades. The cost of horse traction is deemed to be at least Seven Dollars (\$7.00) a day. We speak, of course, of two-horse cars.

The manipulation of the System is far easier than that of the horse system. Each car will require about three horse power in the way of steam engine, so that a road maintaining, say, 40 cars, would require three 60 horse power engines, one engine being in reserve. The dynamic power required is the same. Each car will require about three tons of battery; this will enable the car to be run about 80 miles a day with but one change of battery. It requires

about eight hours to charge each battery. The three tons will be divided into two batteries, one being charged while the other is being used on the car. The batteries are ranged on either side of the car on benches; when the car comes in from service and its batteries are exhausted, it is run up between empty benches, which are on a level with the panels of the car, the panels are let down and the batteries are easily drawn out on greased rods. Adjoining the empty benches are the benches with the charged batteries, which take the place of the discharged ones.

Mr. Julien's batteries being made on a new principle—that is, *inoxidizable support plates*—are found to have an unlimited life and to be capable of being run up to a very high intensity without any injurious effect. In heavy grades, and going around curves, the current may be run up to 70 amperes without any fear of injury to the battery. As all Electricians know, Mr. Julien's is the only battery that can pretend to stand so high an intensity. Yet it may be seen every day on the Eighth Avenue road. The motor required for a large car will vary, according to the grades of the road, from 7 to 10 horse power. We do not consider it economical to overcome long grades of more than 5 per cent, though of course the car may be made to overcome much higher grades than this, especially for short distances. Curves should be at least 40 feet radius, although, on the Eighth Avenue road, we are compelled to run around curves of only 29 feet radius; yet there is an element of danger to the gearing of the car in so short a curve.

Next to Mr. Julien's motor, which is especially adapted, by its simplicity, for use on a Street Car, the Electrical Regulator is worthy of admiration. It is placed at either end of the car and controls so effectively and so methodically the application of power that an ordinary driver may learn the use of it with entire success in less than a few hours. Of course, railroads using this Company's cars will be enabled to light their stables with the Secondary battery employed in the service; the cars are, of course, lighted from the same batteries. One company now adopting Mr. Julien's System are undertaking to light the streets along which the cars will run from their stables, thereby reducing the cost of their installation by getting a profit from the City.

HAINES BROS.,

STEAM & STREET RAILWAYS,

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Promoters of Steam and Street Railways.

Builders of over a score of Railroads. Unlimited Capital furnished for Building and Extending Railways.

Purchase Street Railway Franchises.

Information upon Railway Materials and Matters pertaining to any branch of the Railway Business cheerfully given.

PUBLIC BENEFACTORS.--Burlington Free Press and Times.

ACCOMPLISHING WHAT FEW MEN WOULD UNDERTAKE TO DO.--Rutland Herald.

THEIR REPUTATION AS BUILDERS OF STREET AND SHORT LINE RAILWAYS HAS BECOME NATIONAL.--New York World.

THEIR WORK IS A GREAT TRIUMPH OF CONSTRUCTIVE GENIUS AND FINANCIAL SKILL
--Syracuse Herald.

THEY NOT ONLY MAKE HAY WHILE THE SUN SHINES, BUT THEY SEEM TO BUILD RAILROADS AFTER THE ORB OF DAY GOES TO SLEEP IN THE WEST.--Newburg News.

THESE GENTLEMEN, AS THEIR WORK AND HISTORY SHOW, ARE THE MOST EMINENT IN THE UNITED STATES ENGAGED IN THEIR PURSUIT.--Newburg Journal.

THOS. F. GRIFFIN & SONS,

Buffalo, N. Y., U.S.A.

ST. THOMAS CAR WHEEL CO.,

St. Thomas, Ont., Canada,

MANUFACTURERS OF

STREET CAR WHEELS

Ghilled Curved Rail of any Radius,

Turnouts with adjustable Tongues,

Track Crossings, Chairs,

**Castings of every description for Street Rail-
way Construction.**

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LONDON AGENCY,
Q. A. McCONNELL & GEORGE LOUTHIAN,
35a GREAT GEORGE ST.,
WESTMINSTER, LONDON, S.W.

THE SPRAGUE ELECTRIC RAILWAY & MOTOR CO.

16 and 18 Broad Street, New York City.

This Company is the Owner of Patents 313,247, March 3, 1885 315,180; and 315,181, April 7, 1885; 324,891, Aug, 25, 1885 and Twenty-six Others, Issued to Frank J. Sprague, for the Transmission of Power by Electricity.

These Patents are fundamental, and cover the only possible methods of automatically operating constant speed motors on constant potential circuits, and also a complete system of electric railroads, as now being demonstrated in New York. Suits for damages will be promptly brought against infringers.

The Sprague Motors have been formally adopted for use on the Edison Circuits, and they are being introduced on these and also on Westinghouse, Brush-Swan, Thomson-Houston and United States Circuits, in New York, Chicago, Boston, Des Moines, Elgin, Oskaloosa, Pittsburg, Chester, Williamsport, Lancaster, Shamokin, York, Detroit, Topeka, Cincinnati, Springfield, New Brunswick, Fall River, New Bedford, Milford, Taunton, Lawrence, Woonsocket, Fort Meyer, Waterbury, Annapolis, St. Louis, Abilene, Pawtucket, Syracuse, Canada, the Argentine Republic, Italy, Germany, and Japan.

This company has recently increased its capitalization, and has ample means to undertake any desirable contract for the transmission of power for any purpose, under suitable guarantees. The company now possess the best facilities for manufacture of any motor company in the world. Arrangements are about to be made with the Edison Machine Works to manufacture and carry in stock large numbers of standard machines, and a special factory—the only experimental factory devoted exclusively to that work in existence—has recently been started in New York, and is equipped with the finest tools that are made.

At present there are being operated in Boston nearly fifty motors, varying from 1-2 to 15 horse power, and from these motors is derived a revenue to the local Edison Company of an amount equal to 10 per cent of their recent capital, of which four-fifths is profit.

This is the only company in the United States devoting its entire energies to the various questions involved in the transmission of power, and it is putting into practical use more Motors of and over one-half horse power than all other companies combined.

Correspondence invited, and estimates furnished for complete Central Stations or Special Transmissions up to 1,000 horse power on the basis of limited or exclusive rights.

This company having now perfected a Street Railway System in all its details, is prepared under suitable guarantees of successful operation, to take contracts for equipping new roads with all the appliances, both electrical and mechanical, for operating street railroads, and also for equipping roads now in operation.

This system offers the following advantages:—

Greatly Increased Traction.

Entire Freedom from Disagreeable Noises.

Most Compact, Simple and Powerful Form of Motor.

Greatest Return for Given Amount of Coal Burned.

Absence of all Ropes, Belts, Sprocket-Wheels and Chains.

No Useful Room in the Car taken up by the Motor.

Use of Single Sets of Brushes for both Directions of Driving.

Impossibility of an Accident at any Point of the Line Interfering with the Operation of the Remainder of the Road.

We are prepared to furnish exact estimates for the cost of equipping and operating any road, provided complete details—on blanks which will be furnished by this company—are supplied to us.

**New York Office, Western Union Cable Building, 16 & 18 Broad St,
Boston Office, 55 Oliver St.**

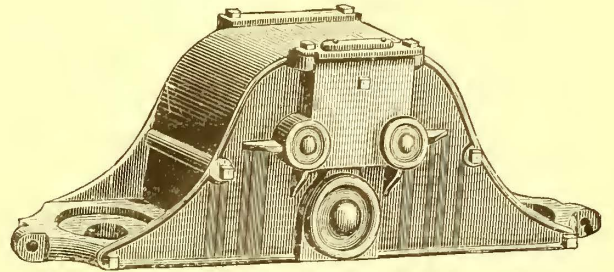
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STREET RAILWAY SUPPLY COMPANY,

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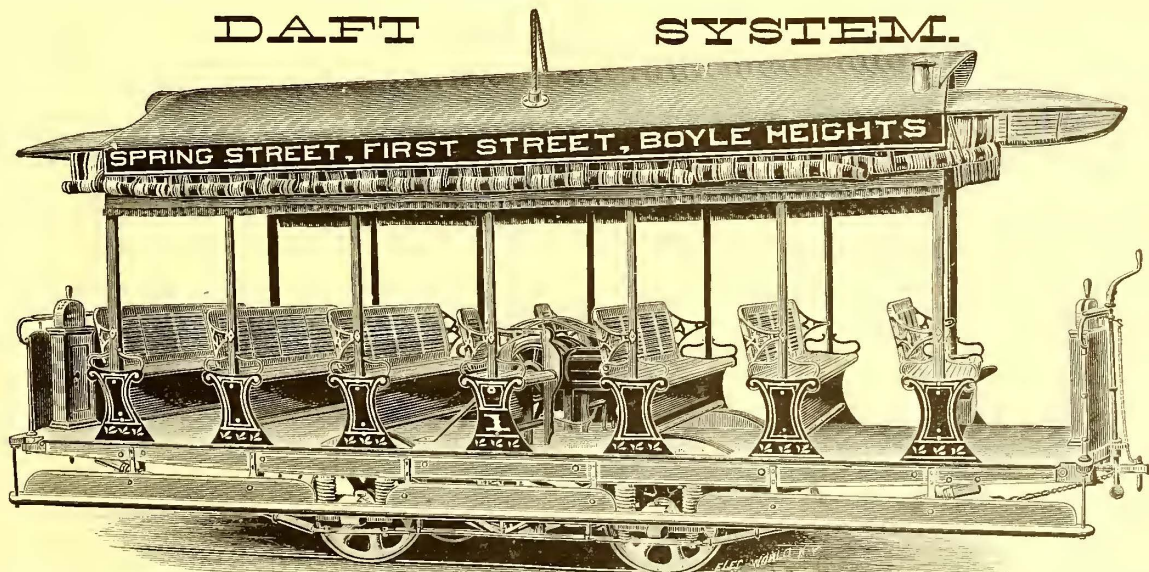
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Electric Railway Motors, Separate, or Attached Directly to Street or other Cars.

ELECTRIC LIGHT AND POWER MACHINES. ELECTRICAL CONDUCTORS.

DAFT SYSTEM.



We are prepared to equip railways with our electric system and supply Power and Light machines at the shortest notice. The ONLY street railway in practical and economical operation by electricity in America is run by our system. We guarantee the successful operation of our system. Heaviest grades no obstacle. We are now building, in the city of Pittsburg, a road which will cost \$120,000. This road has a 14 per cent grade, and has overhead and underground conductors, and five motors. The cost of electric power per car per day on the Baltimore road, operating our system, is \$4.00. Fifty or more cars could be run at an average of \$1.50 per day. The grade on this road is 350 feet per mile. Average speed, eight miles per hour. By horse power the speed was only four miles per hour, and the cost under the old system was \$6.50 per car per day. SEND FOR ESTIMATES. On receipt of full particulars of your road, or of power wanted, we will send you exact estimates for equipping and operating it by our system. SEND FOR CIRCULARS.

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J. S. Pugh,

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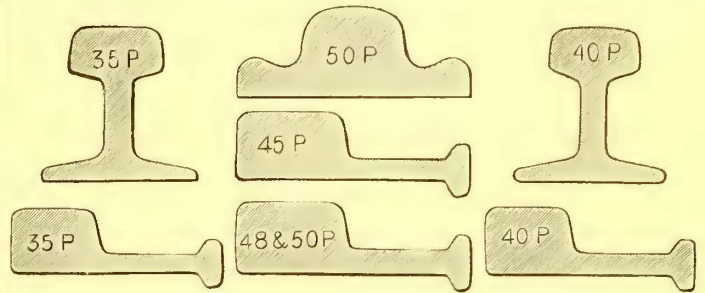
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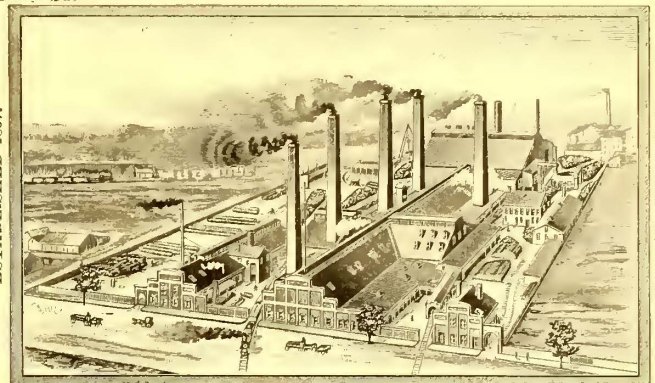
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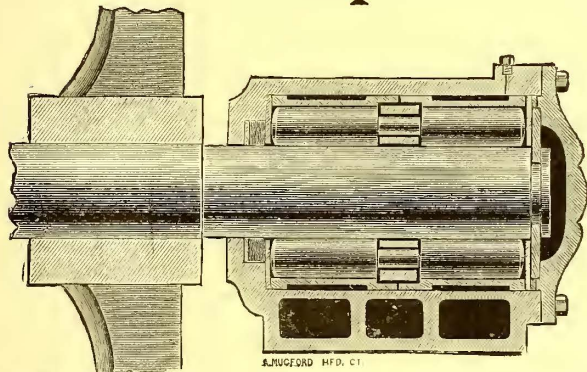
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CAR BOX AND GEAR.



LIGHT DRAFT EASY RIDING DURABLE
POSITIVELY DUST PROOF AND OIL TIGHT

Boxes Hold Sufficient Oil for One Year. No Waste Used for Packing nor Babbitting for Boxes.

Overcomes Friction in Taking a Curve.

SUPERINTENDENT'S OFFICE, HIGHLAND STREET RAILWAY,

No. 827 SHAWMUT AVE., BOSTON, August 19, 1886.

CHAPLIN M'FG Co., MESSRS.:—In reply to your note I will say we have had a set of your Gear under car, "Gov. Rice," for the past four years and it has proved very acceptable, so much so that we have decided to put on 50 sets of your improved pattern. The wear on the journal is imperceptible, and it is beyond question the easiest running gear in the market.

Respectfully, J. E. Rugg, Supt.

SEND FOR CATALOGUE.

General Office: 69 Wall Street, New York.

Berry's Patent Hames and Regan Snap.



They have the advantage of easy adjustment. No buckles or straps are used. They can be applied in an instant, being fastened to the collar. The collar is divided and there is no strain upon the collar or the eyes of the horses. In case of accident the whole harness can be removed at once. They are adapted to the use of Fire Departments, Horse Railroads, Express Wagons, Teams and Light Carriages, and are in use in over one hundred cities and towns in the United States and Canada.

REGAN PATENT SNAP.

They are made of the best gun metal and malleable iron, with a brass spring which is inclosed in a water-tight socket and made rust and dust proof. It is an impossibility for it to become detached. Write for illustrated catalogue and prices.

CHARLES E. BERRY, Cambridge, Mass.

PERSONAL DIRECTORY OF STREET RAILWAY SUPPLY MEN.

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 Car starter and brake. No. 356,491. J. C. Mitchell, Lancaster, N. H.
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 Fare box. No. 356,465. J. W. Greer, Austin, Travis county, Tex.
 Harness pad. No. 356,435. A. A. Allen, Fall River, Mass.
 Harness pad. No. 356,683. W. R. Emroy, San Jose, Cal.
 Electric locomotive No. 356,579. H. Erhardt, Boston, Mass.
 Cross tie for cable railways. No. 356,595. H. Martin, Cincinnati, O.

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 Cable railway. No. 357,162. C. Wise, Kansas City, Mo.
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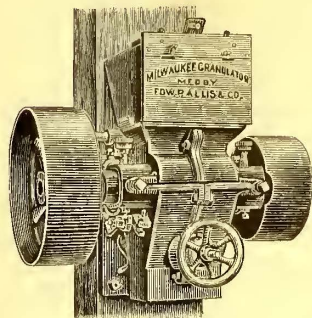
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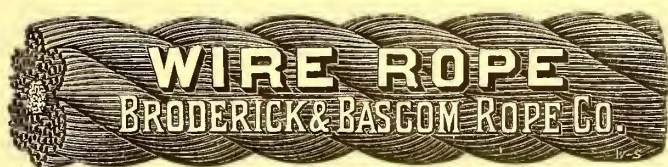
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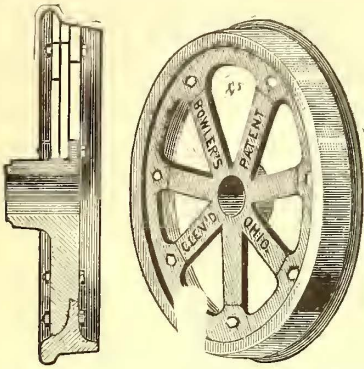
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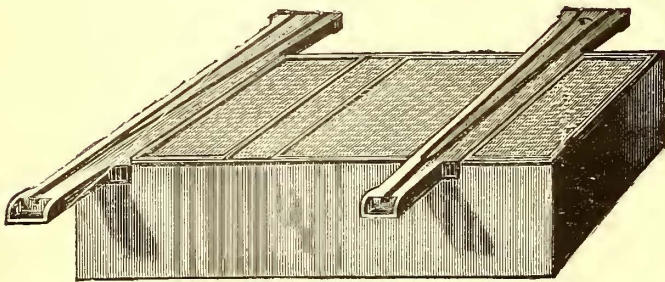
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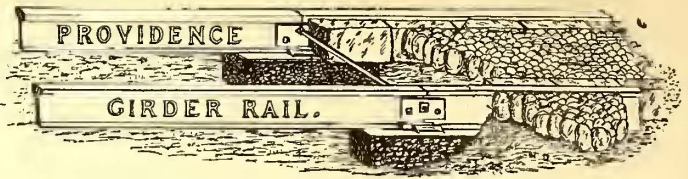
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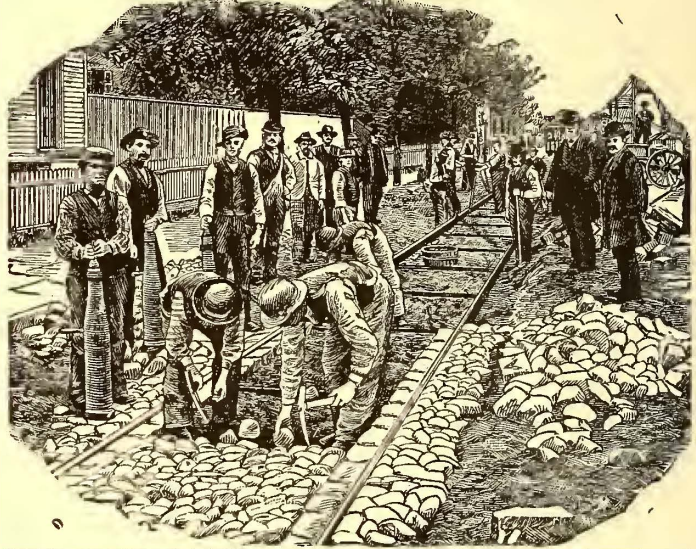


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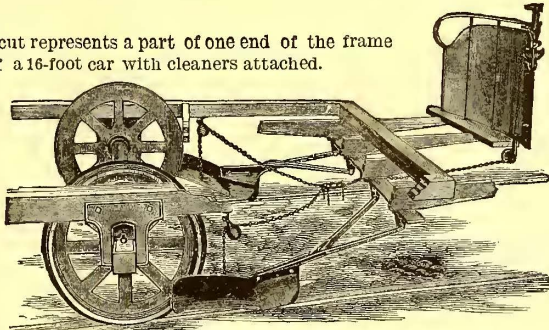
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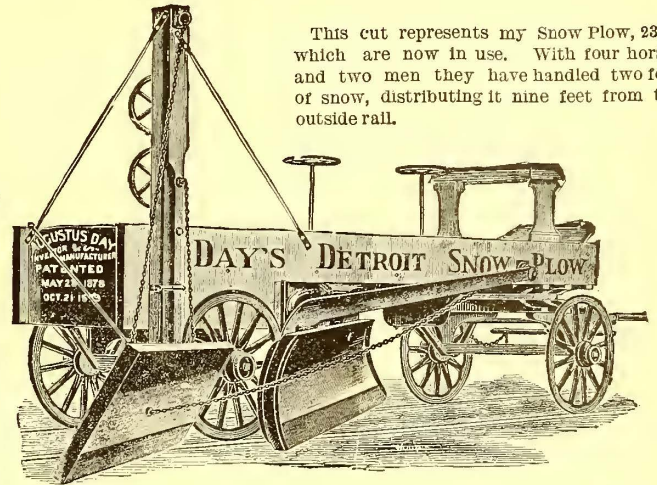


These Track Cleaners need no extended statement of their great superiority over all others invented. The fact of over three thousand pairs being now in use is sufficient evidence of their necessity and utility. Are adaptable to all kinds of rails and styles of cars. Clean Snow, Ice, Mud and Stones from the rail. The driver can raise or lower them instantly with one hand. To secure the largest benefit they should be attached to every car.

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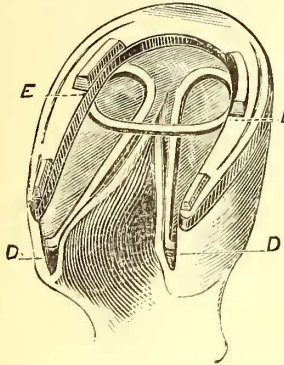
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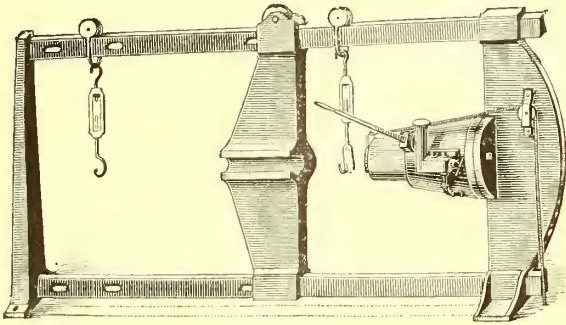
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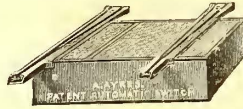
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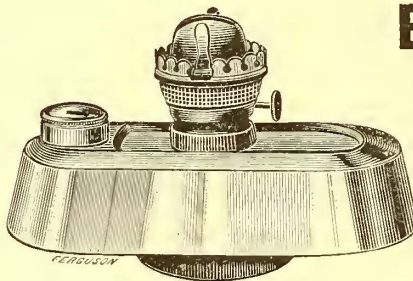


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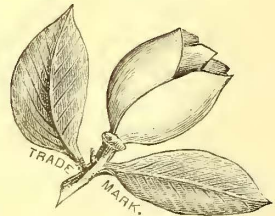
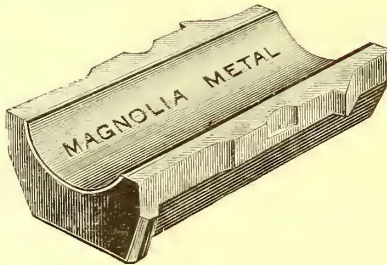
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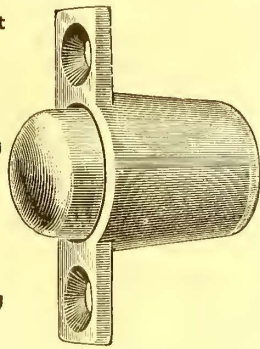
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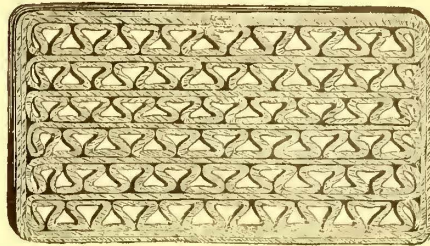


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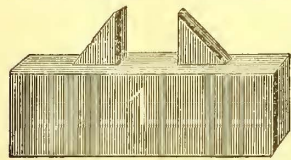
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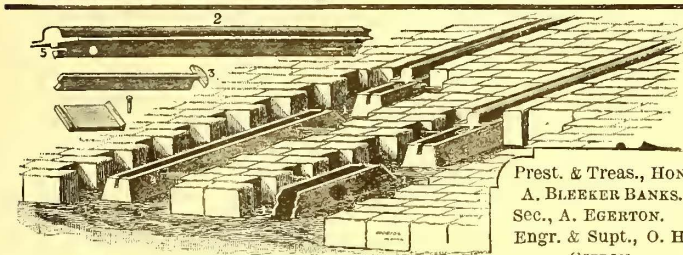
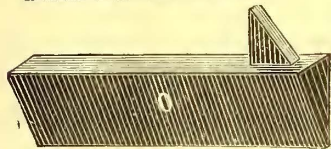
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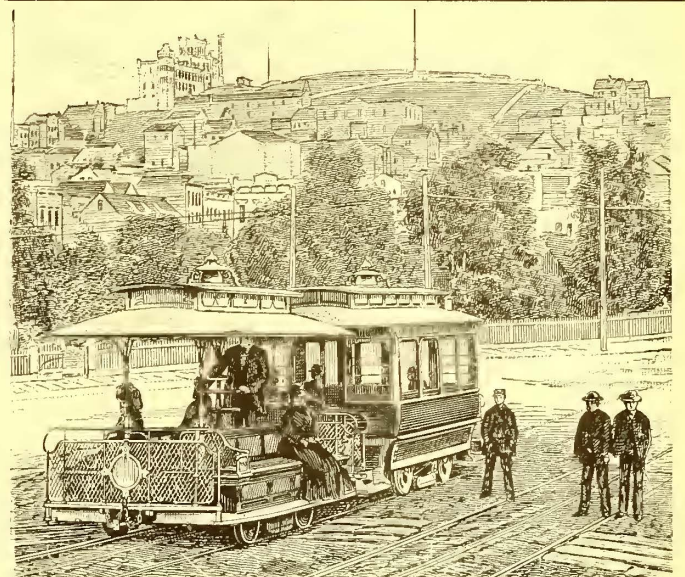
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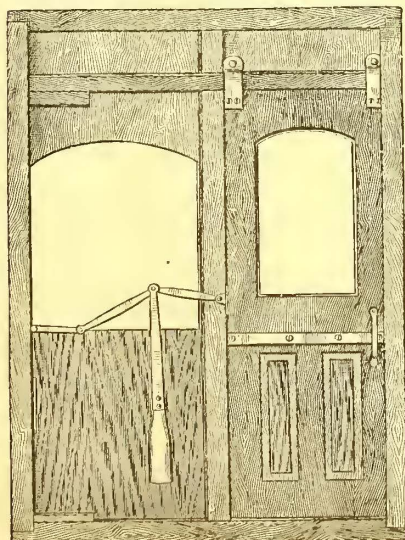
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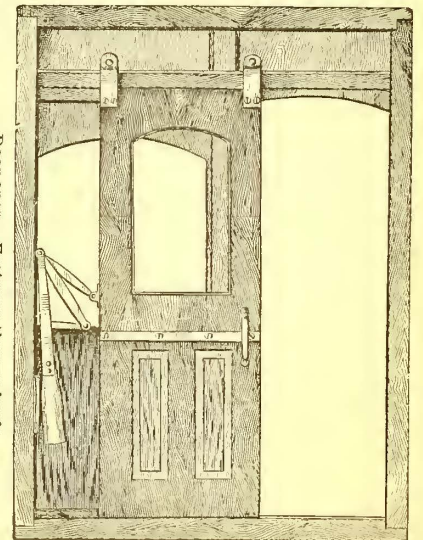
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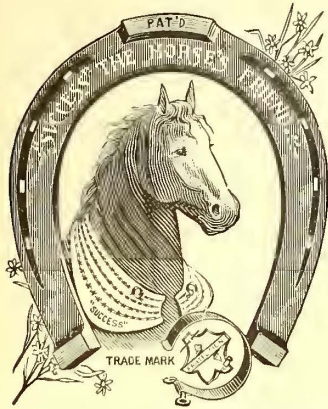
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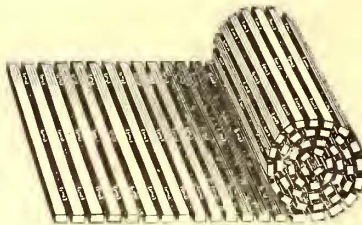
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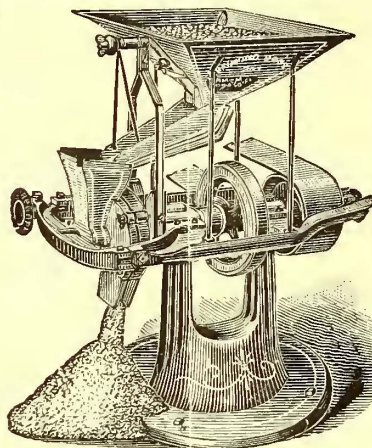
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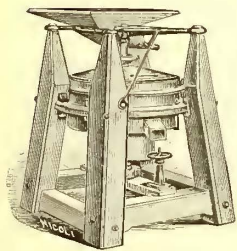
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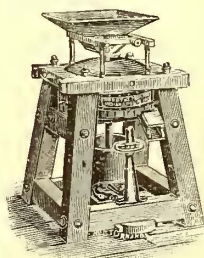


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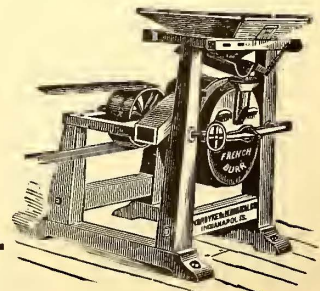


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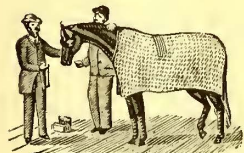
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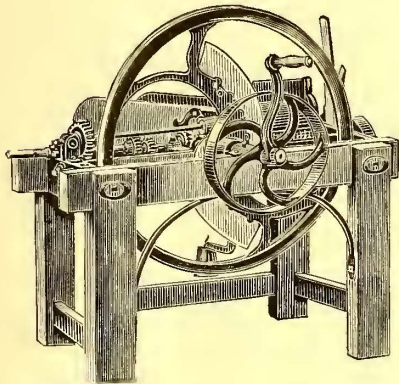
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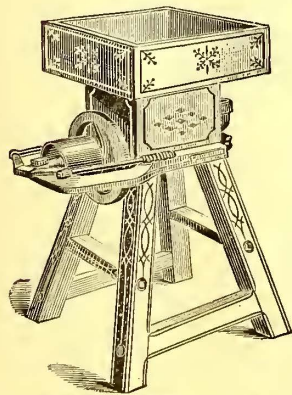
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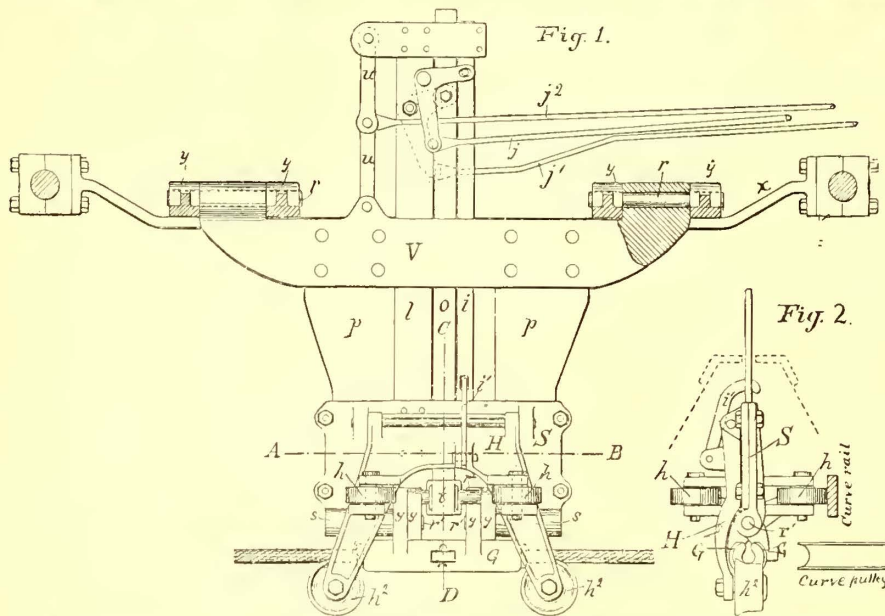
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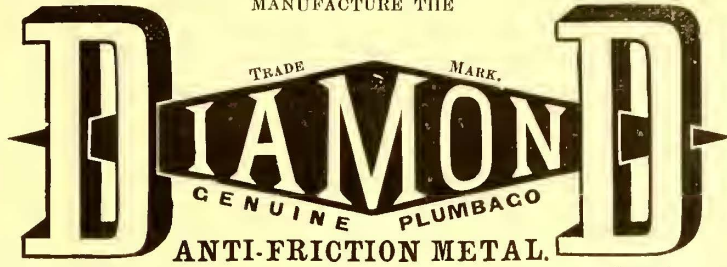
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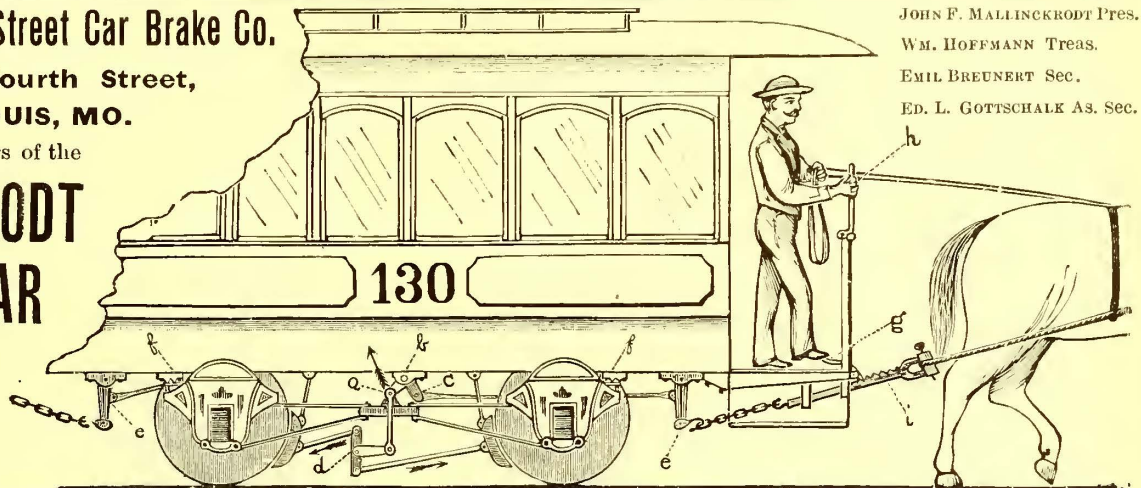
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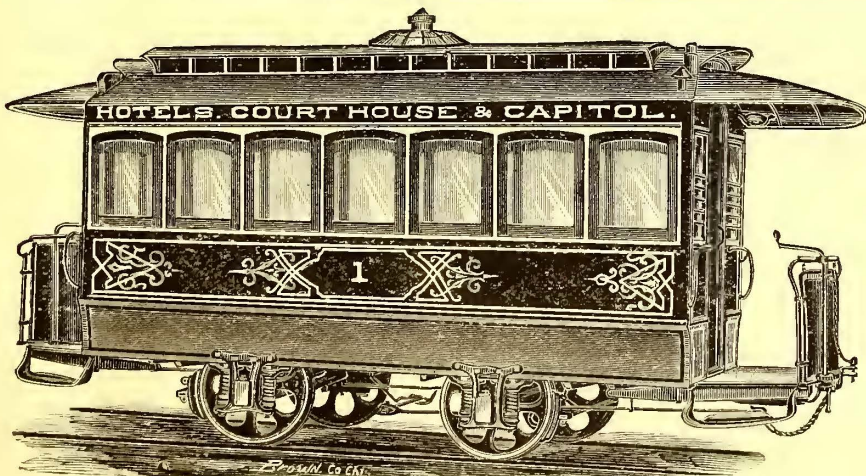
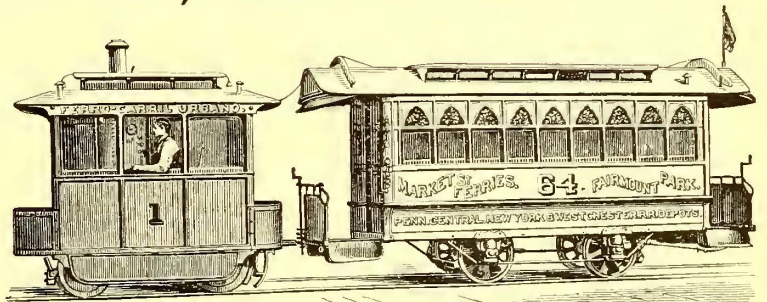
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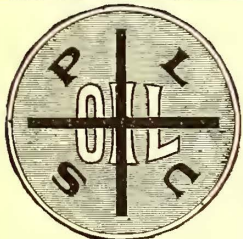
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PHILADELPHIA, PA.

CABLE RAILWAYS, GRIPS,

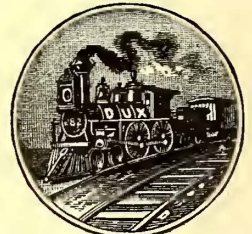
And All Appurtenances.

The Oldest and Largest Manufacturers of Street Railway Track Appliances in the World. Responsible parties contemplating Building, Renewals or Extensions will find it to their interest to correspond with us.



Trade Mark Pat. Mar. 13, 1883.

DUX LUBRICANT.



Trade Mark Pat. Mar. 13, 1883

The Leading New Grease for Street Railways.

The Best Lubricant for Street Railways Known.

Will run for One Year on One Packing. Cars will run easier packed with Dux, than with oil and waste. Why? Because we give you a better lubricant. No drip from Car Boxes when packed with Dux, and, therefore, keeps the car boxes and trucks clean.

Try it and you will use no other Lubricant.

DUX FOR STREET RAILWAYS.

PITTSBURG, ALLEGHENY & MANCHESTER RY. Co., PITTSBURG, PA., Aug. 13, 1885.

Leib Lubricating Co.:

GENTLEMEN—We have used Dux Lubricant for the past nine months. It has given entire satisfaction; in fact, it is the best I have ever used. Think it fully as good as represented.

Yours Truly,
J. C. COTTON, Supt.

OFFICE OF CAMDEN HORSE RAILROAD Co., CAMDEN, N. J., Dec. 14, 1886.

The Leib Lubricating Co., 196 and 198 Chicago st., Buffalo.

We have used your "Dux Lubricant" for about two years and regard it as the best and cheapest lubricant ever used by this company.

JOHN HOOD, Supt., etc.

OFFICE OF ACUSHNET STREET RAILWAY Co., NEW BEDFORD, MASS., Dec. 11, 1886.

The Leib Lubricating Co., Buffalo, N. Y.:

DEAR SIR—We have used several packages of your "Dux" and like it very much. We can recommend it to any one using axle grease.

Yours very truly,
A. P. SMITH, Treas.

BYRON WESTON, FIRST-CLASS LEDGER AND RECORD PAPER, }
DALTON, MASS., Oct. 15, 1886.

Leib Lubricating Co., Buffalo, N. Y.:

GENTLEMEN—Yours of the 13th inst. received. In reply; we like your Dux

Lubricating Compound very much, and when this is used up that we have on hand shall order more. I find on heavy bearings where no other oil or grease would cool it yours did the work.

Yours truly,
HARRY W. HITT, Supt.

FAULKNER MILLS.—F. J. HASTINGS & Co., MILLERS.

So. ACTON, MASS., Dec. 23, 1886.

Leib Lubricating Co., Buffalo, N. Y.

GENTS:—Your favor of the 17th inst. duly received. In reply we would say, that for several years we had much trouble and annoyance to find a lubricant for our heavy bearings that would stand, and tried various articles on the market without being satisfied, until a friend connected with a large manufacturing concern gave us a few pounds of the Dux Lubricant to try. It worked so much better than anything we had ever had that we ordered enough from you to give it further trial, and as a result have used it ever since, and can truly say it is the best lubricant we ever used. It will stand heat, gives off no drip and is economical, and we are very much pleased with it and do not hesitate to declare that it is our firm belief that there can be nothing ever made to equal it. Our experience on wagons has been equally satisfactory; our first attempt being on a heavy wagon used every day, heavily loaded, ran 21 days when it went into the shop to be painted, and then was in a good condition to run longer. The only thing we regret is that we did not at once try and arrange to sell it in this locality, still one of our townsmen to whom we gave your address, Mr. Littlefield, has since obtained the agency, we learn, and we can obtain it through him.

Yours Truly,
F. J. HASTINGS & Co.

MANUFACTURED BY

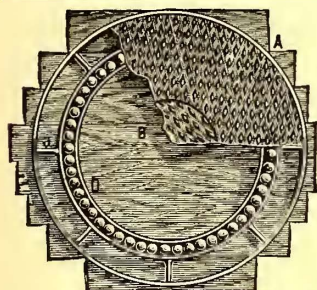
The Leib Lubricating Co., 196 & 198 Chicago St., Buffalo, N.Y.

Castings for Crossings, Frogs, Switches, Curves, Turnouts, &c. Joint Plates, all sizes of Knees, and Standard Castings always on hand.

H. B. WAY.
WM. S. RHODES.
J. B. BLANKLEY.

City Passenger Railway Iron Foundry,
THE WAY FOUNDRY COMPANY.
Twenty-Third and Wood Streets,
Philadelphia, Pa.

Contracts taken and Estimates given for Construction of Street Railways and Supplying of all Materials used. Steel Grooved and Tram Rails Furnished at Special Rates.

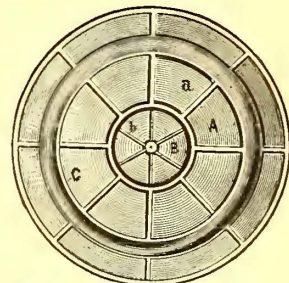


S. M. CARPENTER, Prop.

C. J. LANGDON, Secy.

FULTON FOUNDRY,

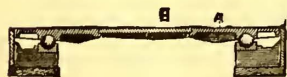
MANUFACTURERS OF



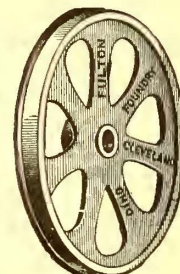
STREET RAILWAY SUPPLIES, Carpenter's Patent Turn-tables and Transfer-tables,

Open Wheels of all sizes and weights. Wheels and Axles of all sizes fitted on short notice.

Chilled curve rail, Turnouts, Switches, etc., etc. Blue prints and Bills Furnished on Application. Send for Illustrated Catalogue. Address,



FULTON FOUNDRY,



202 MERWIN ST.

CLEVELAND, OHIO.

"PAY HERE."

Fare Boxes and Change Receptacles FOR STREET CARS.

OUR NEW FARE BOX NO. 3

Is pronounced by the many Street Car Companies using it to be the best.

The following are some points of superiority in this box over others:

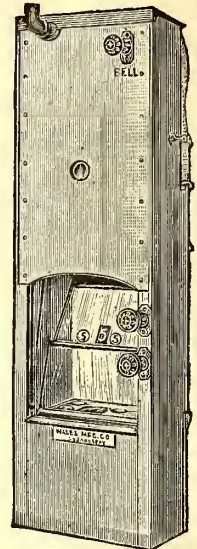
Simplicity of Construction, Quickness and Convenience of Cleaning, Security of Money Drawer, Beauty of Finish and Much Cheaper in Price.



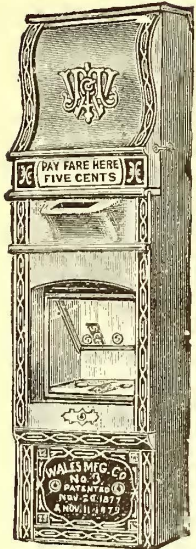
CHANGE RECEPTACLE.

Descriptive and Illustrated Circular on application.

Examine the merits of this box and get our prices before buying.



Box No. 3. Back or Driver's View.

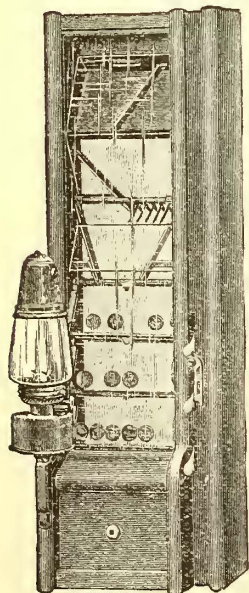


Box No. 3. Front or Passengers' View.

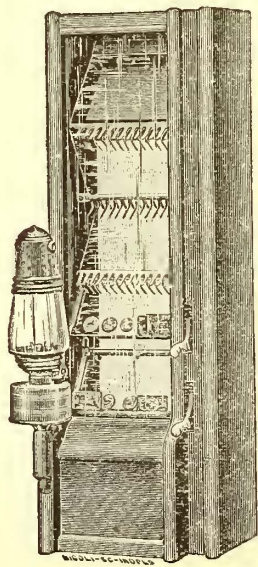
The only satisfactory arrangement in use for making change with the driver.

WALES MANUF. CO., 76 & 78 E. Water St., Syracuse, N.Y.

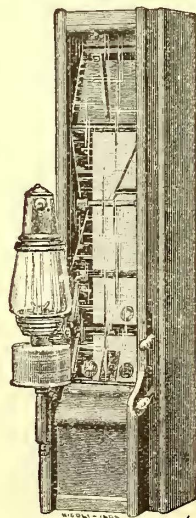
TOM L. JOHNSON'S IMPROVED FARE BOX.



BOX NO. 1.



BOX NO. 2.



CHARIOT PATTERN.

NOW IN GENERAL USE IN CITIES THROUGHOUT THE U. S.

FARES CANNOT BE EXTRACTED OR BOXES ROBBED WITHOUT VIOLENCE.

SPECIAL SIZES BUILT TO ORDER.

ROADS EQUIPPED WITH BOXES ON TRIAL, AND IF NOT SATISFACTORY, RETURNED WITHOUT ANY EXPENSE TO THE COMPANY TRYING THEM.

Patented Oct. 14, 1873.

REDUCED PRICES.

Write for Descriptive Circular and Price List. Address all correspondence to A. A. ANDERSON, INDIANAPOLIS, IND.

ROBERTS' PATENT WOVEN-WIRE Car Seats and Backs,

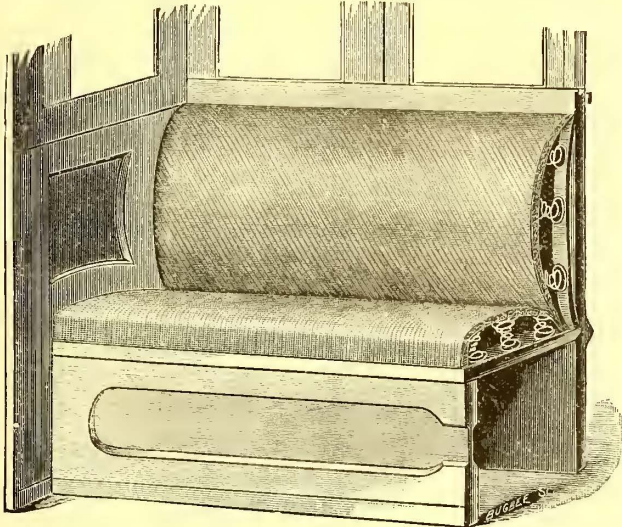
Especially adapted to Street Car use.

Cleanly, Durable, Economical, Cool, Comfortable.

Cannot be Cut, Injured or Defaced.

Being entirely of Metal will last indefinitely.

Can be covered in Rattan, Carpet, Leather or other material, with less labor in covering and less expense in material than any seat in the market.



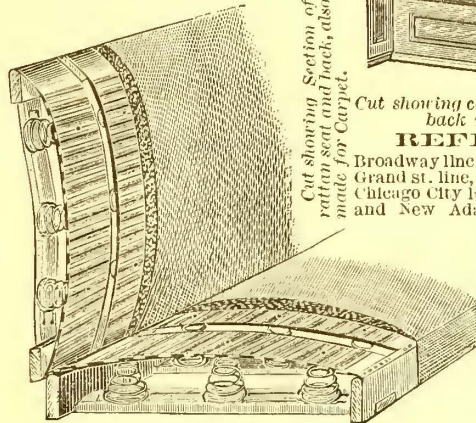
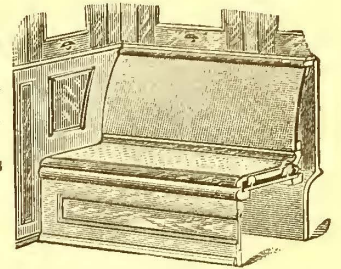
Send for Catalogue with illustrations. Prices and estimates cheerfully given on application to

THE HARTFORD WOVEN-WIRE MATTRESS CO.,
P. O. BOX 363, HARTFORD, CONN.

THE HALE & KILBURN MANFG. CO.,

Extensive makers of Patented
Street Car Seats
of every description.

Our Patent Spring Seats covered with Rattan or Carpet are fast being adopted by the best railroads in the country. Seats for Steam Cars a Specialty. owners and makers of all the Cobb patents



Cut showing Section of rattan seat and back, also made for Carpet.

Cut showing car with rattan seat and back without springs.

REFERENCES:

Broadway line (Pullman cars) New York
Grand st. line, 3d and 4th ave lines, NY
Chicago City R.R. Chicago W. Div. line,
and New Adams street line, Chicago;
East Cleveland R. R. Co.
and Woodland Ave. and
West Side R. R. Co.
Cleveland; Union Line,
St. Louis; 2d & 3d St. R.
R. Co., Frankford and
Southwark R. R. Co.,
Union Line, Chestnut &
Walnut R. R., Ridge Ave
R. R., or any other road
in Phila.; and 100 others
elsewhere.

Many R. R. Co's use our Rattan Pat. Canvas Lined Seats for Summer and cover the same with carpet for Winter. This method of seating we recommend as durable and economical, for the reason both a Summer and Winter seat is obtained in one.

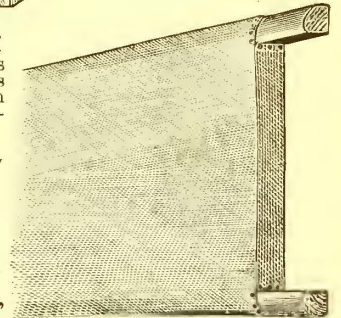
Estimates & Particulars cheerfully given (mention this paper), satisfaction guaranteed

A TRIAL SOLICITED.

OFFICES: 48 & 50 NO. SIXTH ST.,

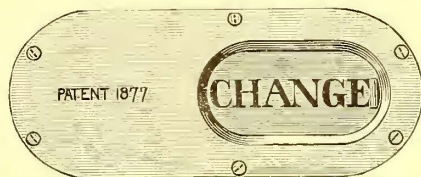
FACTORIES: 615 to 621 Filbert St.,

PHILADELPHIA, PA. Cut of section of cross for summer car.

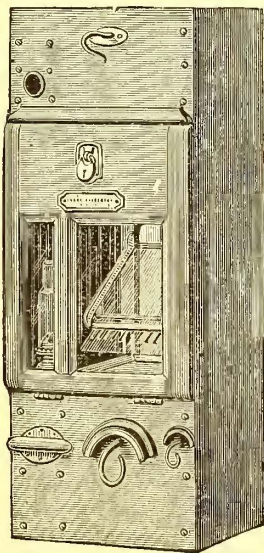


SLAWSON'S PATENT FARE BOXES

These Boxes are of the latest and most approved pattern, and contain a front door, by opening which all of the glass inside can be conveniently cleaned. This is a late patent, and is a very valuable improvement over the old method of taking the boxes apart for that purpose. They are well made and not liable to get out of order, cannot possibly be picked, and even if all the glass is broken no fare can be extracted from the drawer. The late J. B. Slawson originated the "FARE BOX SYSTEM," and all of his Boxes, Change Gates and Drivers' Change Box are protected by several patents, and parties using them are not liable to claims for infringements, as may be the case with some boxes which are now being offered for sale. These Boxes, etc., are now in use not only in the United States and Canada, but in Mexico, South America, Europe, Asia, Africa and Australia—in fact, nearly all places where street cars are used.



C. Front View.



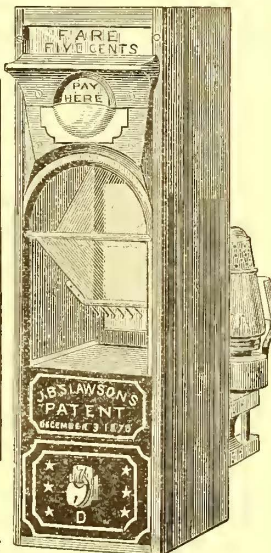
C. Back View.

Change Slide. Outside View.

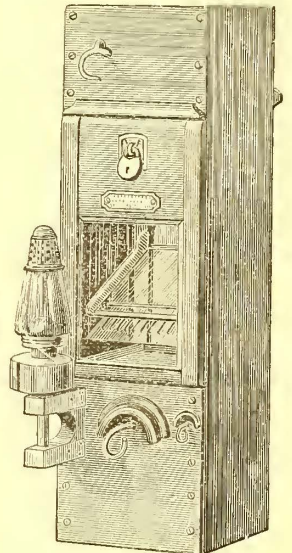


Change Gate. Outside View.

The prices have been greatly reduced, and are made to fit the times. Orders will be promptly filled by addressing,



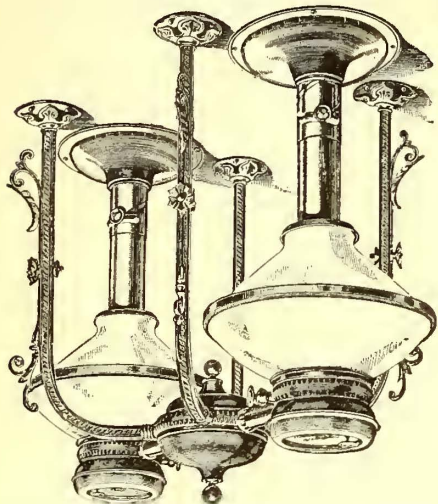
D Front View.



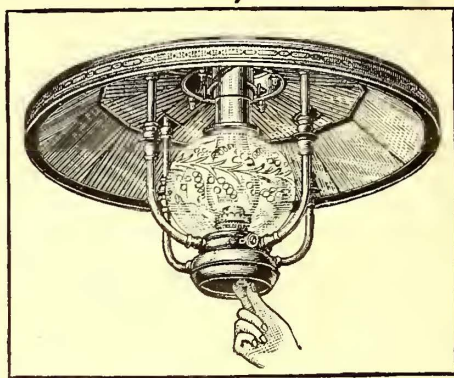
D Rear View.

MILTON I. MASSON, Agent, 365 AVENUE A, NEW YORK.

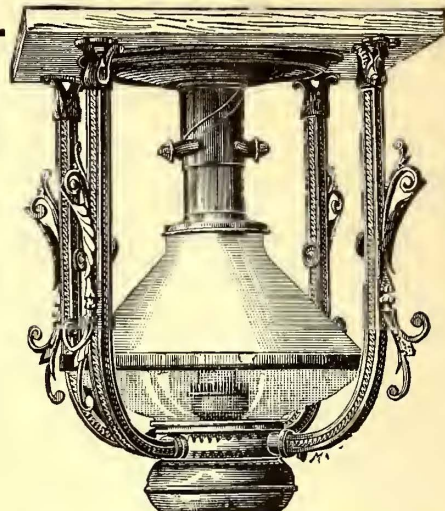
JOSEPHINE D. SMITH, Successor to the late WILLARD H. SMITH, 350 & 352 Pearl Street, New York.



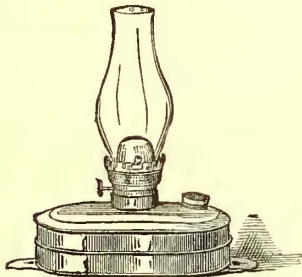
No. 13.--Two-light Car Lamp as used on Tenth Avenue (N.Y.) Cable road.



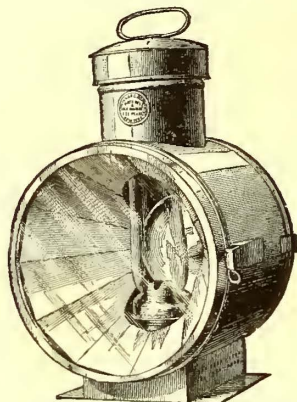
No. 14.—Center Car Lamp.



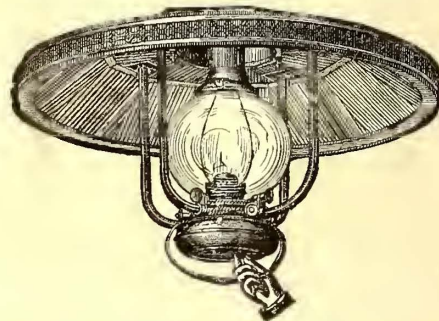
No. 8.—Center Car Lamp as used on Tenth Avenue (N. Y.) Cable road.



No. 3.—Box Lamp with drip cup.



Small Head Light for Grip Cars and Stages.



No. 1.—Center Car Lamp in general use throughout the United States and Canada.

All kinds of trimmings pertaining to car lamps.

MANUFACTURER OF W. H. SMITH'S PATENT RAILROAD CENTER LAMPS AND REFLECTORS.

THE PUTNAM NAIL CO.

LOOK WELL

TO YOUR

Highest Award at the

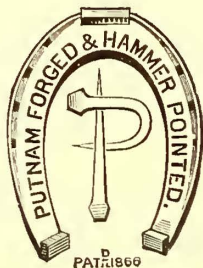


Fig. 1.

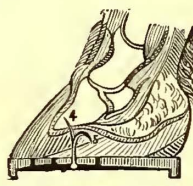
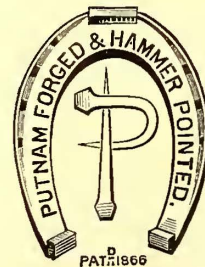


Fig. 2.



Centennial Exhibition.

HORSES' FEET

These drawings show how many horses are made lame and permanently injured by the use of the COLD CUT and SHEARED-POINTED Nails. This process of manufacture produces lamination, causing the iron to form in layers, and when driven into the foot, the horny fibers of which the hoof is composed cause the nail to separate at the point, and one portion passes INTO the foot.

No. 4 represents one of these nails which was driven into the hoof and SLIVERED in driving, one THIN blade passing into the quick or sensitive sole; No. 5 the THICK blade of the nail passed out of the wall of the hoof clinching. After a few days the horse was returned lame, and upon the removal of the shoe, a nail similar to the above was broken off, leaving the sliver in the foot; LOCK-JAW ensued, from which the horse died. Upon dissecting the foot a portion of the nail was found to have penetrated through the coffin bone, as seen in Fig. 2, letter A, thus sacrificing the life of a valuable animal.

It requires but little observation and reflection, one would think, to arrive at the conclusion as to the kind of nails to be used in the horse's foot, whether a mangled piece of iron rendered DANGEROUS by the COLD ROLLING AND SHEARING process, or one made from the rod at a welding heat, where all the fibers remain intact and a perfect ONENESS maintained and being pointed by the hammer, rendering such an accident as slivering utterly impossible.

The foot is the most important member of the animal's body, to which the greatest care and attention should be directed: for when it becomes injured or

diseased, no matter how perfect the other parts may be, the horse's services are diminished or altogether lost. Hence the value of a horse depends upon the condition of his feet.

The horse at every step brings an immense power and weight to bear upon the foot. The hoof is a *thing of life* and yields to the pressure. The PUTNAM NAIL being forged accommodates itself to the pressure of the hoof. It is far otherwise, however, with stiff rolled and cut nails. They remain rigid and their sheared edges are therefore pressed like sharp knives against the horny fiber. This is what causes the broken and rotten appearance so frequently seen in horses shod with cheap cut nails. Can a horse owner afford to attempt to save a few cents in price of nails and ruin his horse? Surely not, for the old adage is true as ever, "NO FOOT, NO HORSE."

As the remedy lies with the owner of the horse, it is for him to prohibit any cold-rolled or sheared nails being used in his horse's feet.

The only Hot-Forged and Hammer-Pointed Horse-Shoe Nail in the World

that is not cut, clipped or sheared upon the point, and will not split in driving, is

THE PUTNAM NAIL.

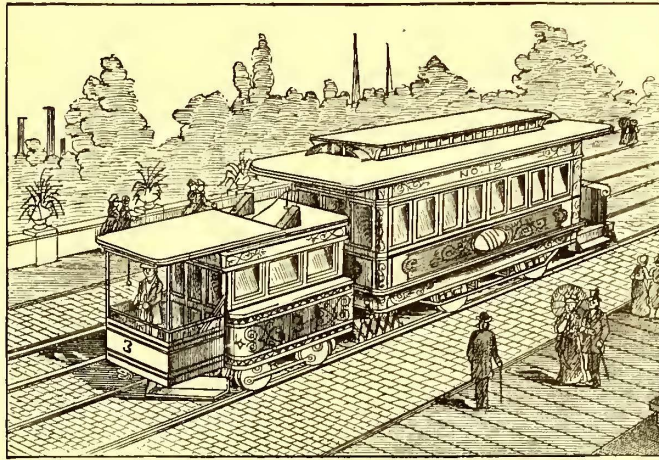
Address for Circulars, etc.,

THE PUTNAM NAIL CO., NEPONSET P. O., BOSTON, MASS.

POLE STREET CAR

Differential Lever Car
Starter, Runner & Brake.

Starts easily, Brakes as certainly and effectively as the air or Steam brake.



Standard No. 3 Motor
Is operated by a
Specially Designed Low Pressure
Condensing Engine
of great power in small space and
having no escapes on the street.

MOTOR SYSTEM.

The system can be operated by compressed air and is so recommended where good all-the-year-round water power can be secured to compress the air. Can be operated by storage battery, electricity or soda, ammonia, and other motive powers.

Warranted to climb hills, start on hills, and when the track is so slippery that the driving wheels will slip round under the motor, we still guarantee the motors starting by a system of ground levers.

WE ARE FULLY SECURED BY PATENTS.

We claim the only motor system capable of starting and going when the tracks are slippery, excepting only the cable motor. Ours is a cheaper outfit.

Correspondence solicited.

Pole Street Car Motor System,

150 South Fourth Street, Philadelphia, Pa.

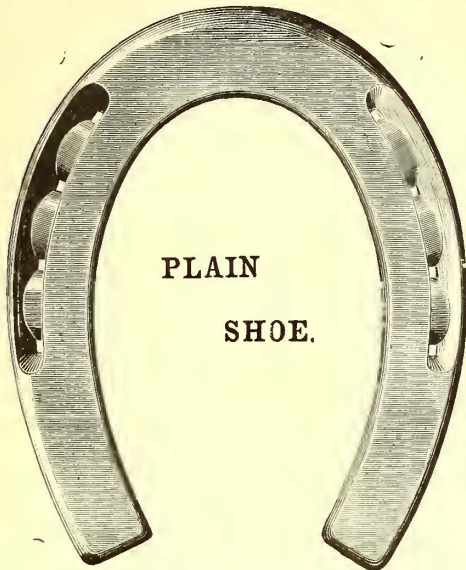
THE BRYDEN FORGED HORSESHOE WORKS, Limited, CATASAUQUA, PENN.,

MANUFACTURERS OF

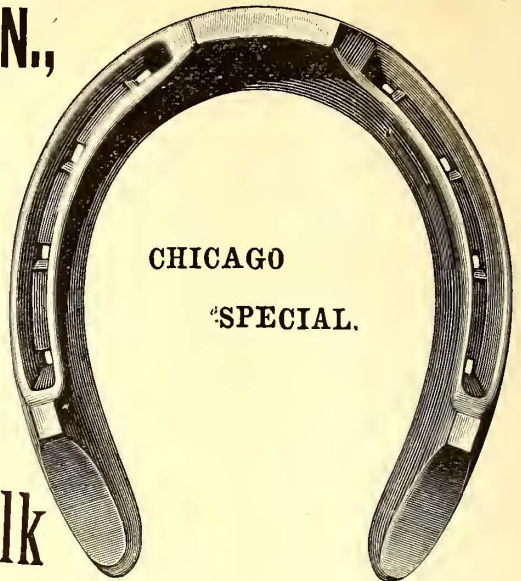
THE BRYDEN

Forged Solid Calk

HORSE & MULE SHOE.



PLAIN
SHOE.



CHICAGO
"SPECIAL.

These shoes are forged into shape under heavy drop hammers, greatly condensing the iron and adding very much to wearing qualities, making it nearly equal to steel in durability.

The distinctive feature of our system of manufacture is, that it produces a *finished* shoe, calked, or plain, ready for attaching to the hoof.

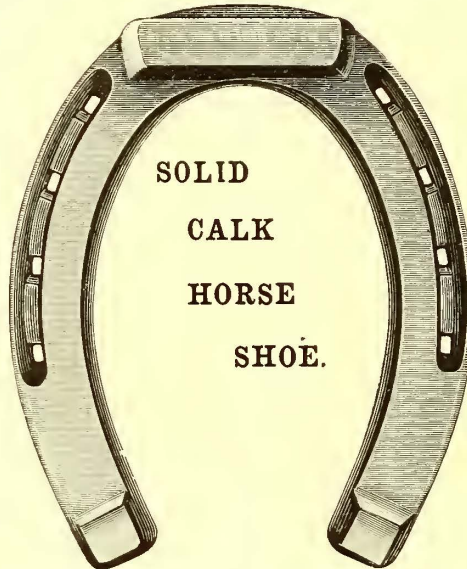
The crease is made low and the nail holes are punched well in and beveled to permit the nailhead to be well driven in, reducing the strain on the nails and insuring a firmly fastened shoe.

The foot bearing of the shoe is level, thus materially aiding in the preservation of the hoof.

It is not necessary to heat the shoe in order to fit it.

There are no welds in the shoe to break, the calks being solid forged up from the web.

OUR CALKED SHOE. A good, strong, reliable shoe to have on hand. The calks will not come off. Always ready to nail on. A handy shoe for the Winter, easily sharpened, and, as the calks will not break, will give as much service as steel. Made in sizes No. 1 to No. 6. Front and hind of steel or iron.

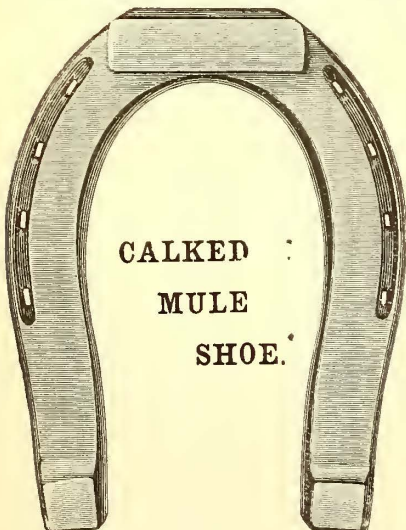


SOLID
CALK
HORSE
SHOE.

The shoes have a good substantial clip drawn up from metal driven outside the regular outlines of the shoe for that purpose. The outer edge of the clip, when drawn up, coinciding with the outlines of the shoe, requires no robbing of the hoof wall to let in the clip.

Among the street railways using our shoes are, the Third Avenue R. R. Co., Eighth Avenue R. R. Co., Broadway & Seventh Avenue R. R. Co. of New York city; Bushwick R. R. Co., Brooklyn City and Newtown R. R. Co. of Brooklyn; Philadelphia Traction Co., Citizen's Passenger R. R. Co., Second & Third Street R. R. Co. of Philadelphia; Metropolitan R. R. Co. of Washington, D. C.; North Chicago R. R. Co., Chicago City R. R. Co., West Division R. R. Co. of Chicago, Ill.; New Orleans City & Lake R. R. Co. of New Orleans, La.

We present illustrations of some of the many designs of shoes manufactured by us.

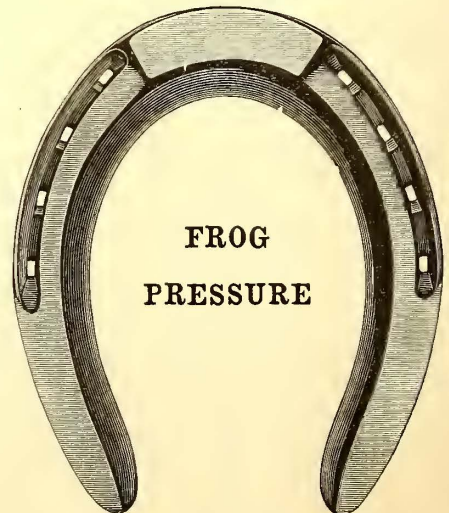


CALKED
MULE
SHOE.

OUR FROG PRESSURE SHOE. The advocates of the frog pressure system of horseshoeing have in this shoe the very thing they want. The best shoe made for curing corns or contracted feet. Made in sizes No. 1 to No. 6. Front and hind, iron, or steel.

OUR PLAIN SHOE. "The best railroad shoe made," so says one of the largest consumers of horseshoes in New York city. This shoe is used by the largest street railroads in New York city and Philadelphia. Made in sizes No. 1 to 6. Front and hind.

OUR CHICAGO SPECIAL. Designed to meet the wants of many of our western customers. Extensively used in Chicago, on the principal railroads and for custom work. A light calked shoe for shoeing trotting and driving horses. Made in sizes No. 1 to No 4 of iron or steel.



FROG
PRESSURE

OUR CALKED MULE SHOE. Just the thing for street railway and coal mining work; solid calks. Made in sizes No. 1 to No. 5 in iron or steel.

J.B. WHITE, Manager, Sales Department.

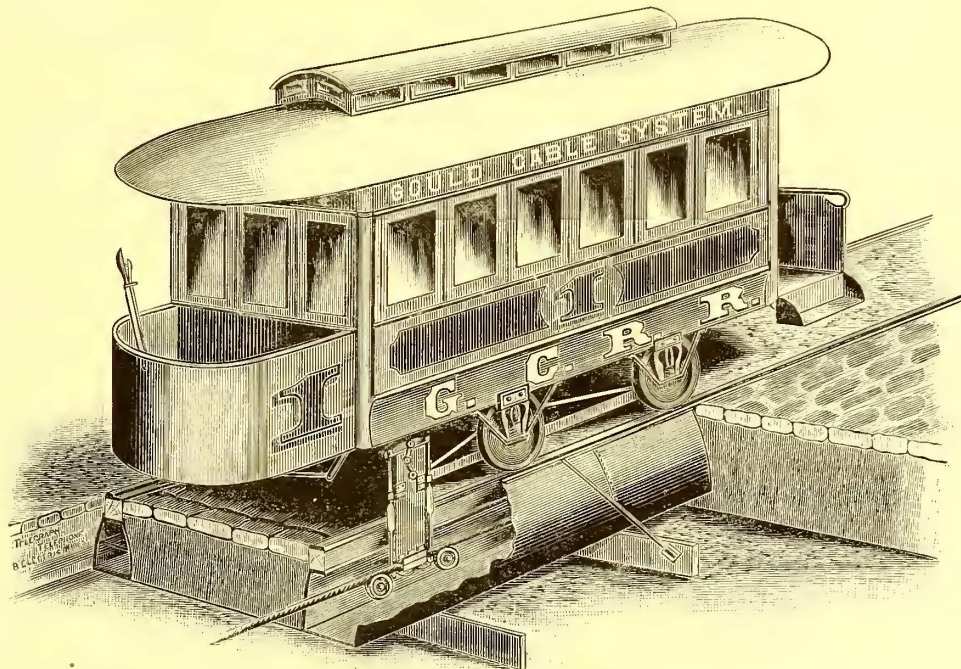
The Gould Cable System

OF

STREET RAILWAY CONSTRUCTION.

Fully covered by patents in the United States and England. Patents applied for in other European countries.

CONSTANT TEARING UP OF THE STREETS AVOIDED.



The conduit is placed at the side, doing away with the central conduit entirely. A conduit is supplied for natural gas, steam, electric and telephone wires, etc.

THE RAILS ARE TIED TOGETHER AT THE SURFACE.

The construction of the grip is the simplest known.

The slot which admits the grip is placed outside the rails.

The inventor will make favorable terms with parties desiring to put this system into operation.

A capital chance for the right man to organize a company.

N. B.—Parties Infringing on this Grip will be Prosecuted to the full Extent of the Law.

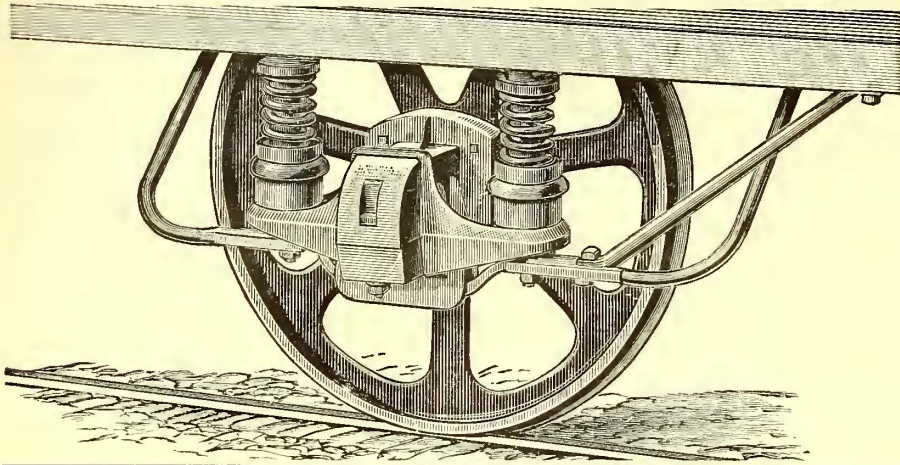
Address all communications to

J. H. GOULD, Ninth and Market Streets, Philadelphia, Pa.

THE BEMIS CAR BOX COMPANY,

MANUFACTURERS OF

The Bemis Patent Journal Box.

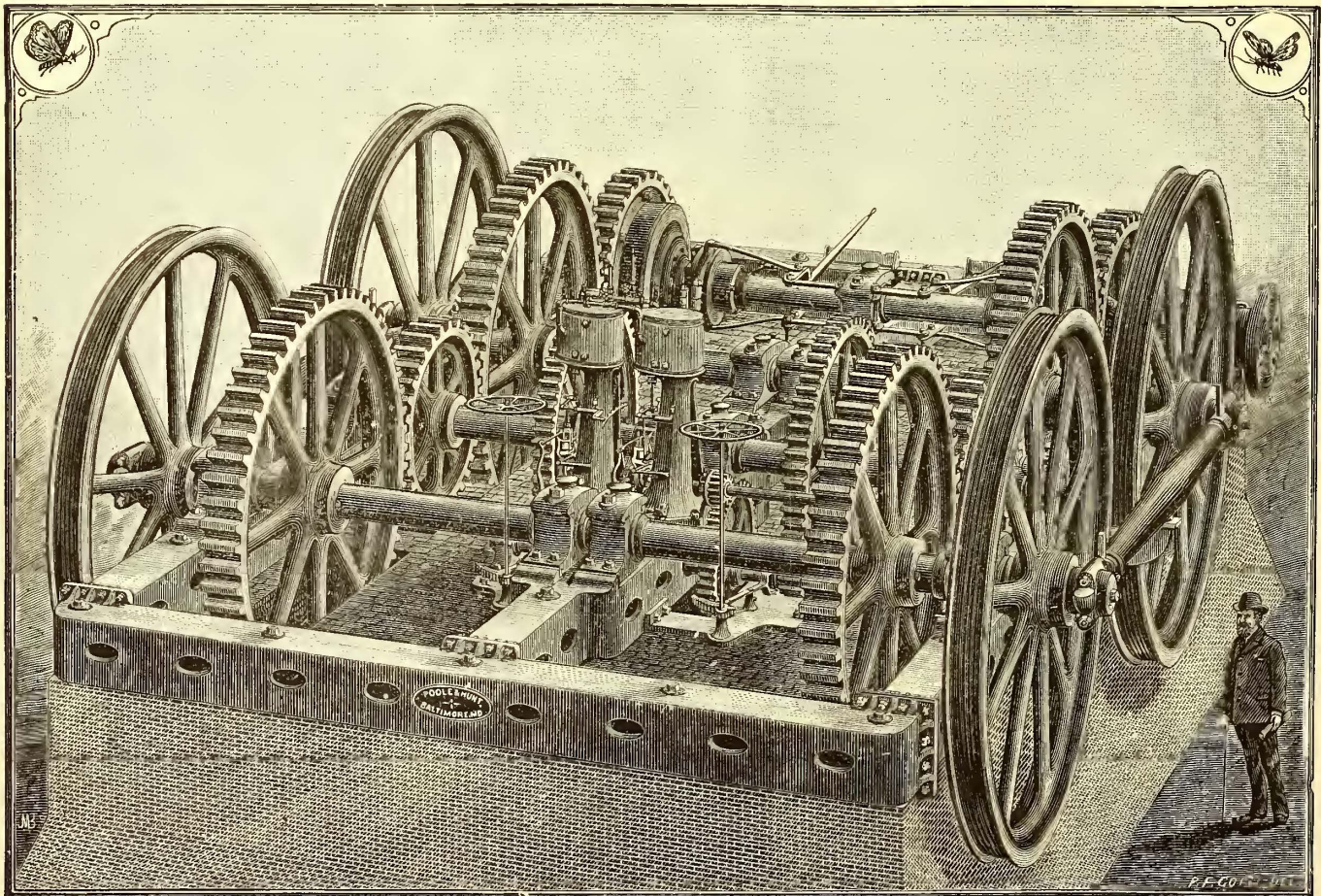


Light Draft, Easy Riding, Durable, Economical. Brasses are warranted for 10 years, and Journal for 20 years. Requires oiling or inspecting but once in 12 months. Boxes are positively dust proof.

227 Main St., Springfield, Mass.
Opp. Depot,

THE STREET RAILWAY JOURNAL, ONLY \$1.00 PER YEAR.

POOLE AND HUNT
Baltimore, Md.



Manufacturers of Cable Railway Plant
Machine Moulded Gearing for Mills and Factories.

CORRESPONDENCE SOLICITED.

JOHN A. ROEBLING'S SONS CO.,

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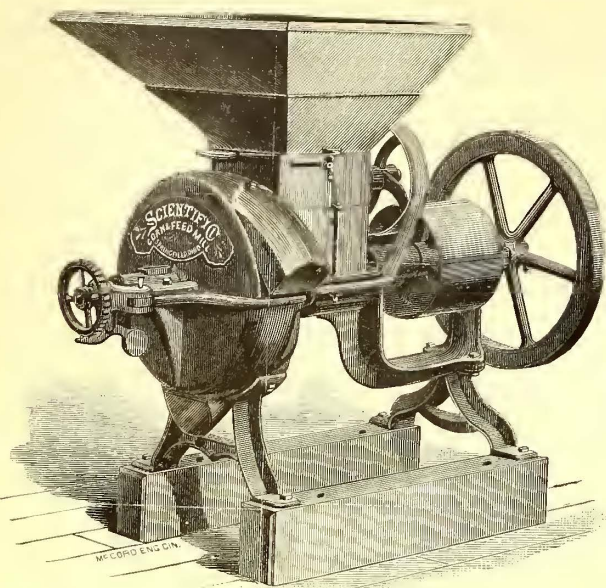
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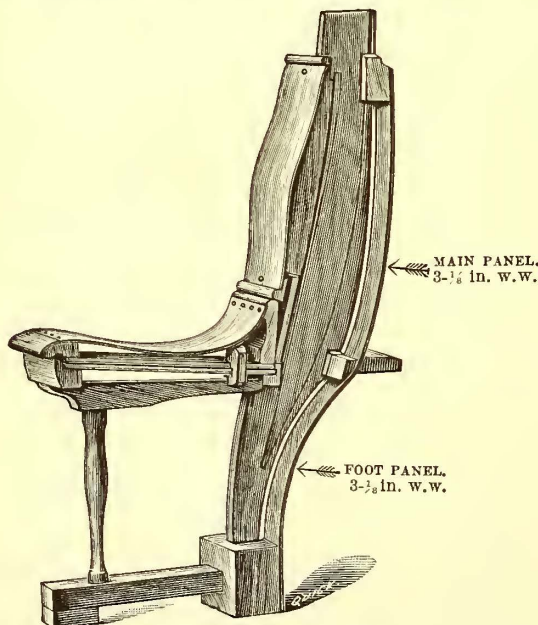
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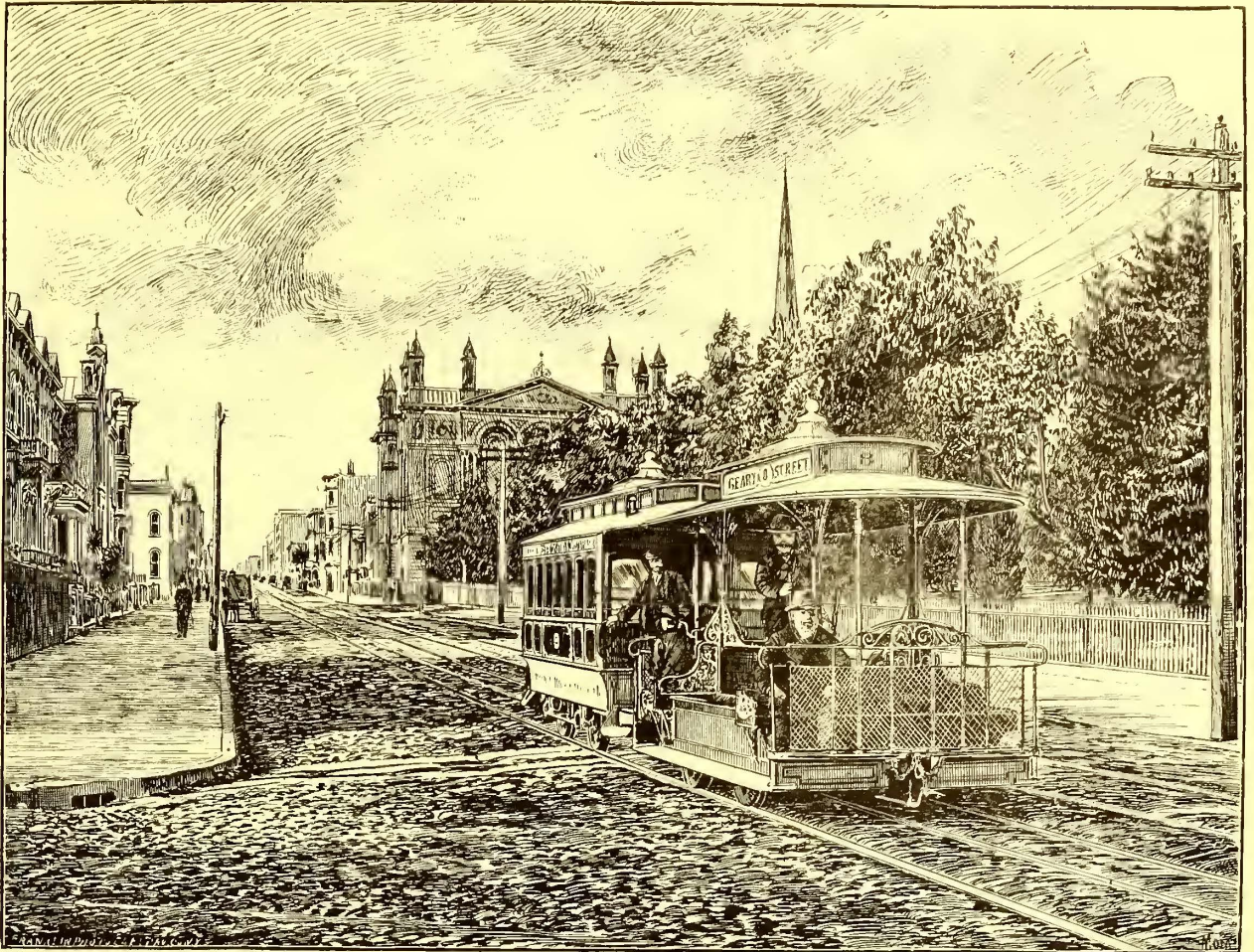
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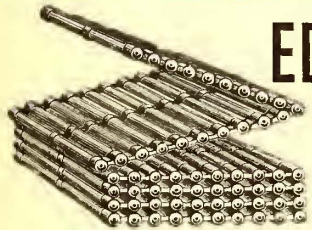
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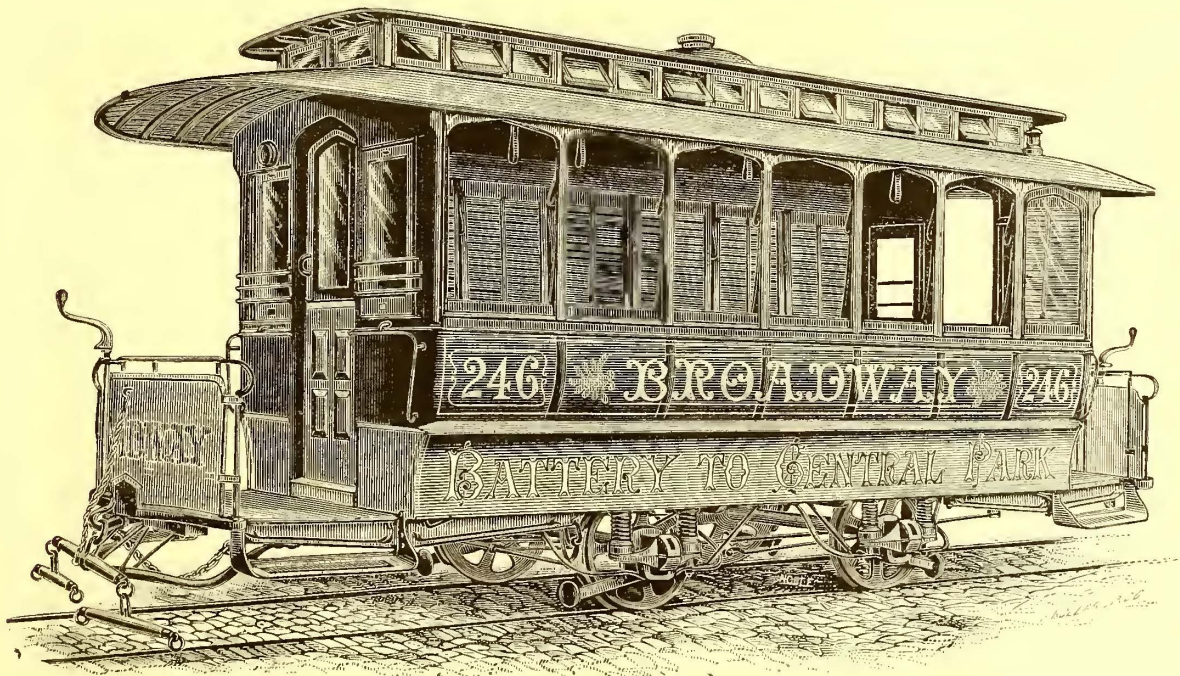
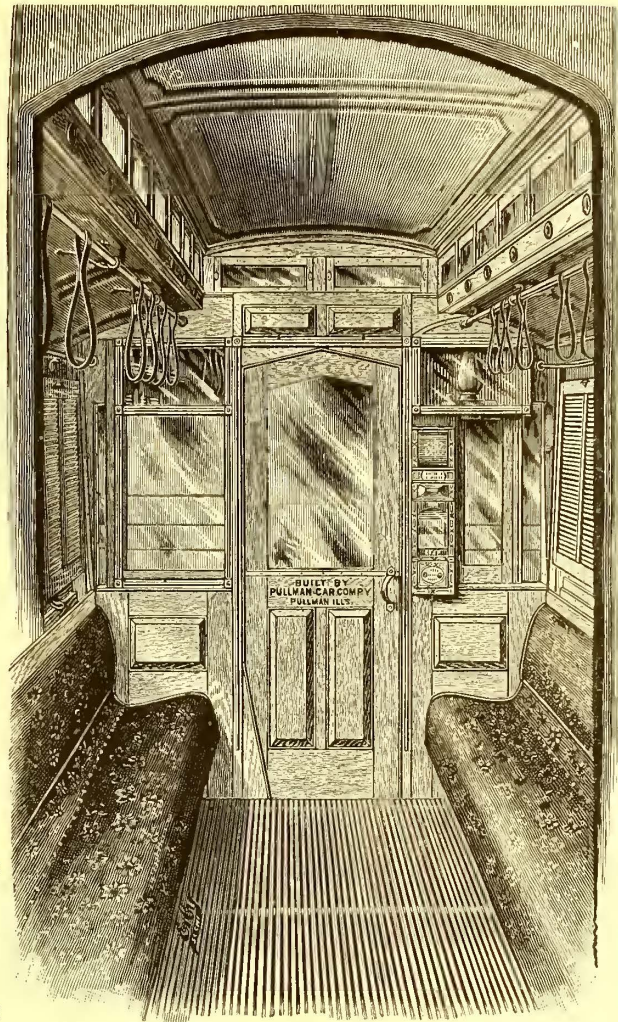
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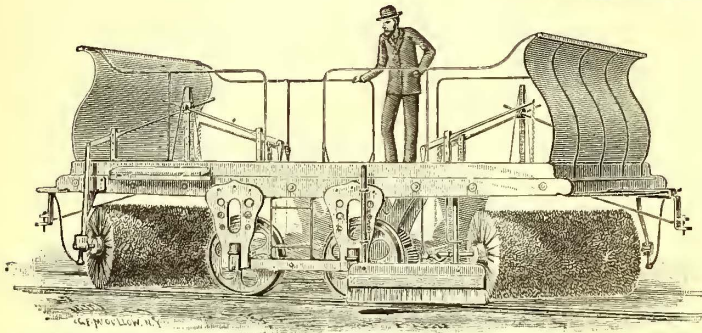
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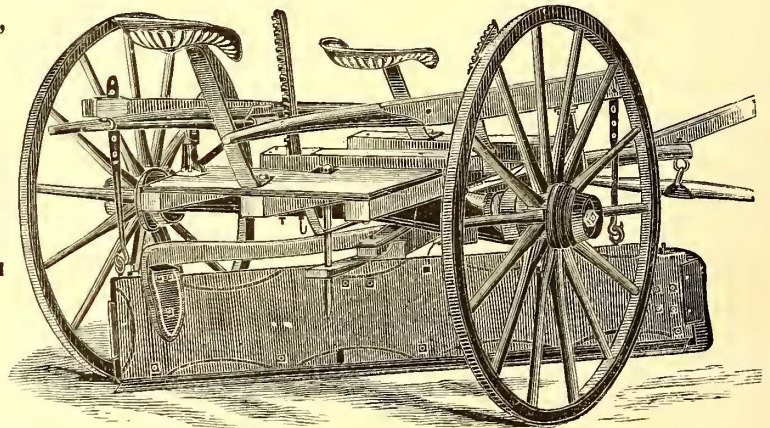
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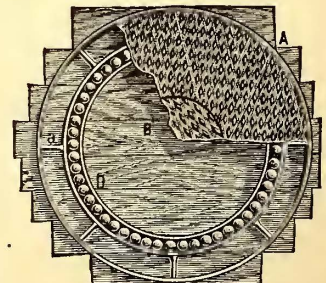
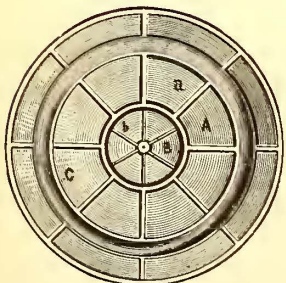
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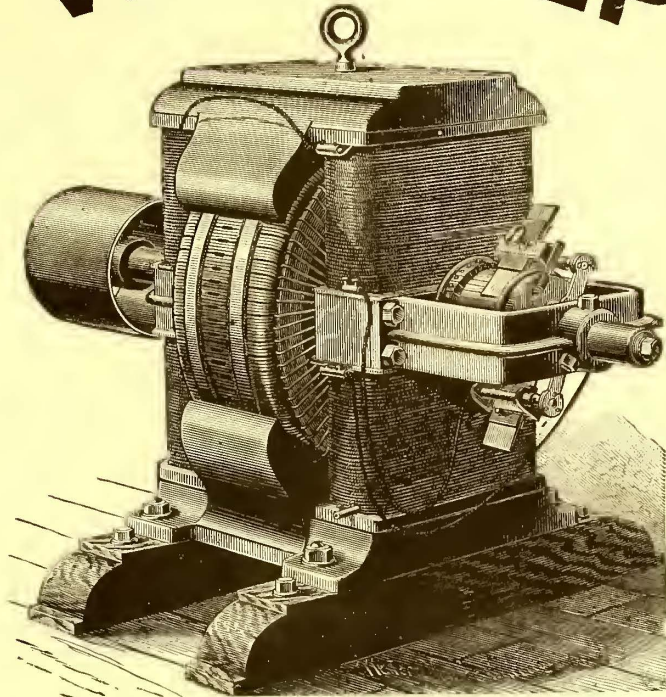
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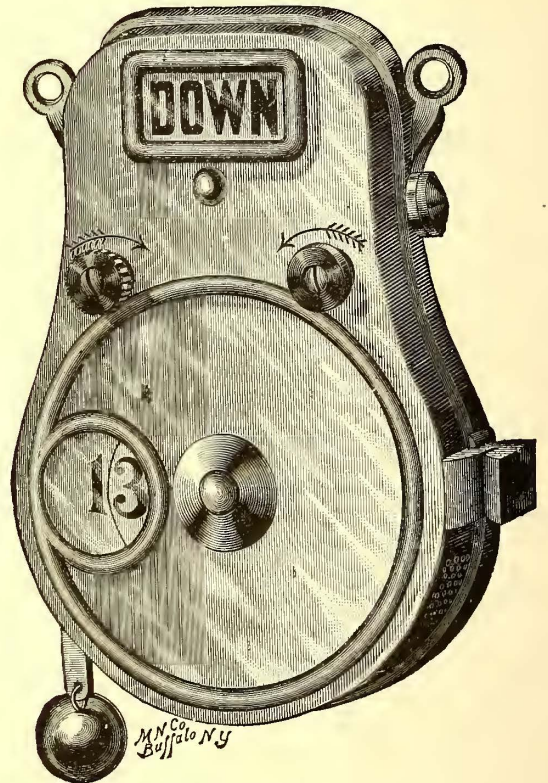


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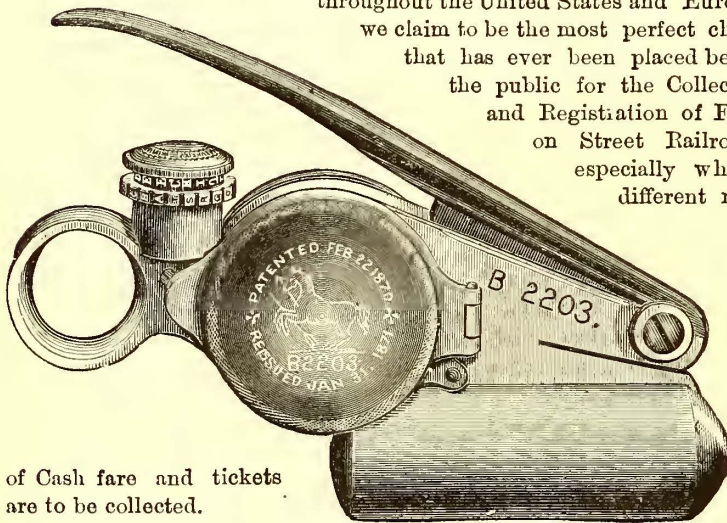
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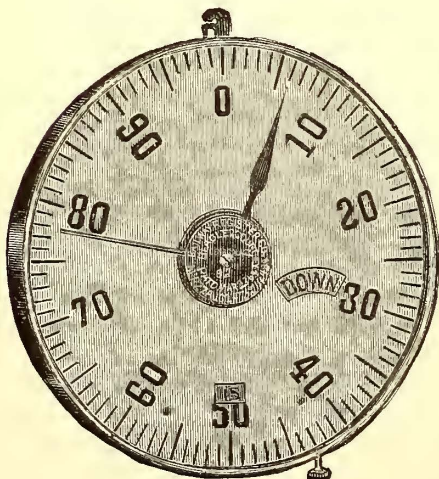
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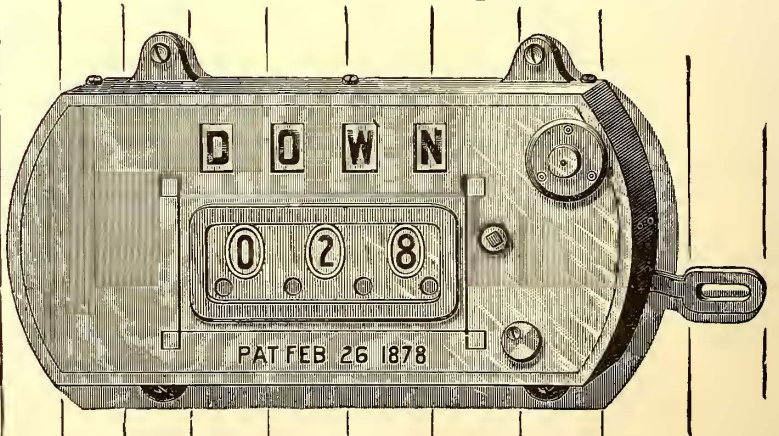
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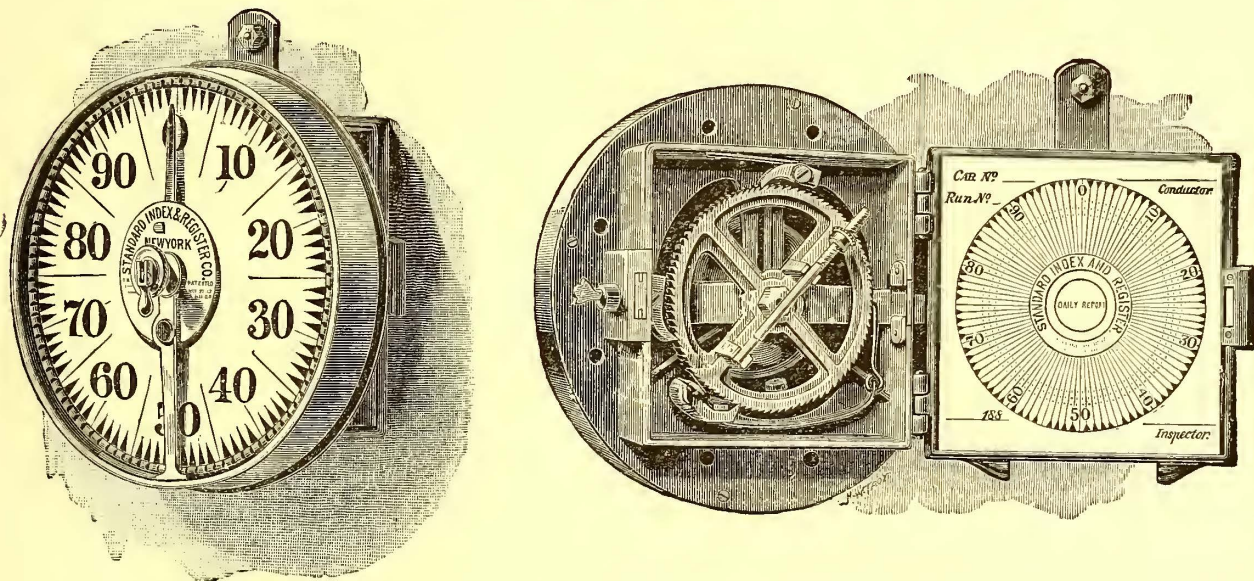
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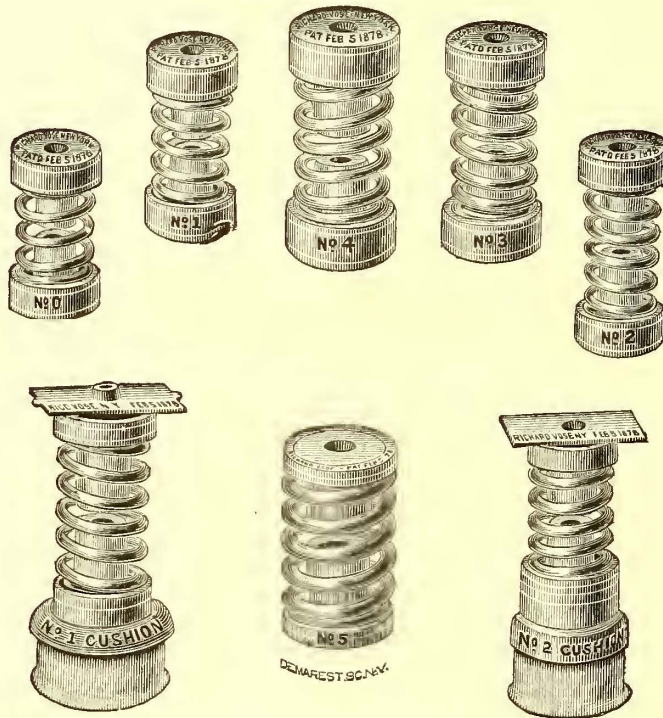
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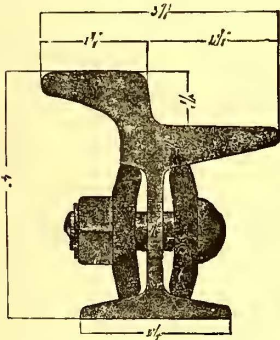
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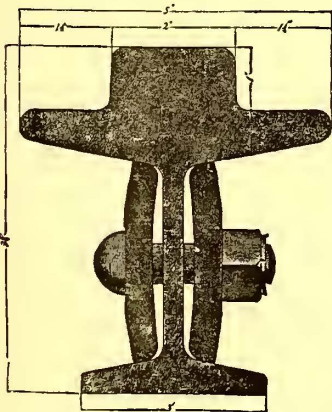
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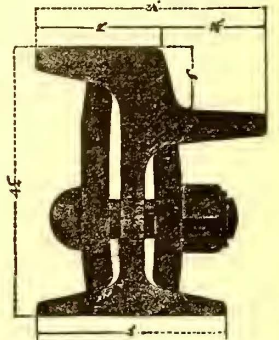
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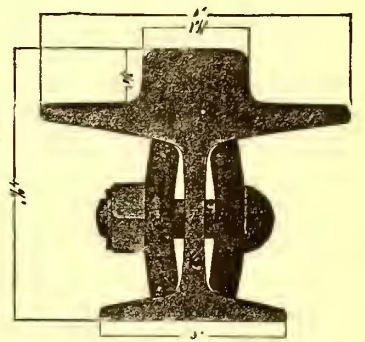
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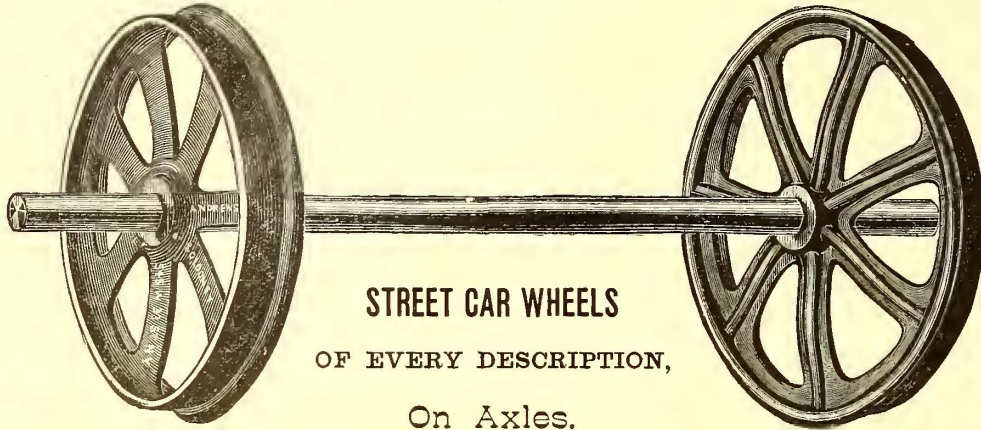
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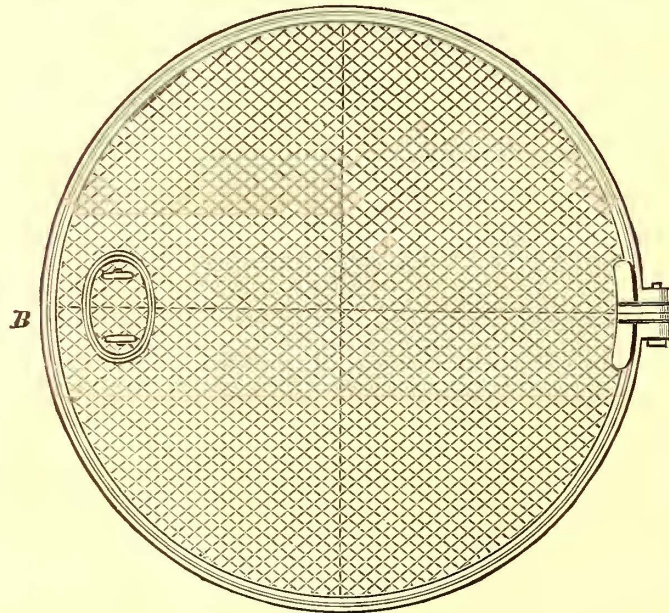
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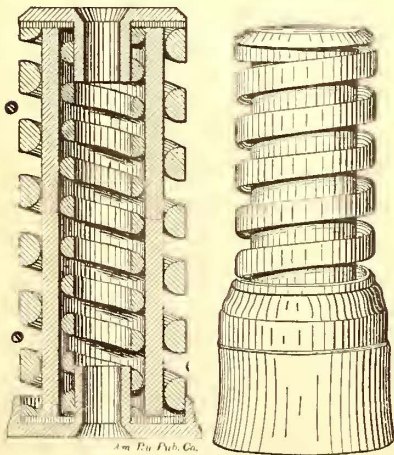
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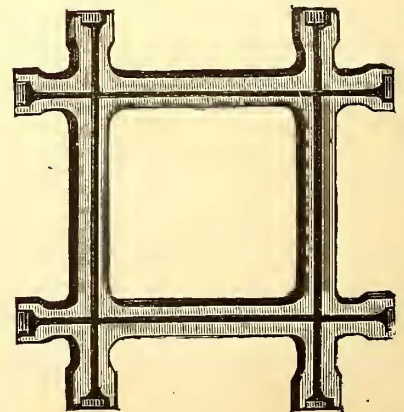
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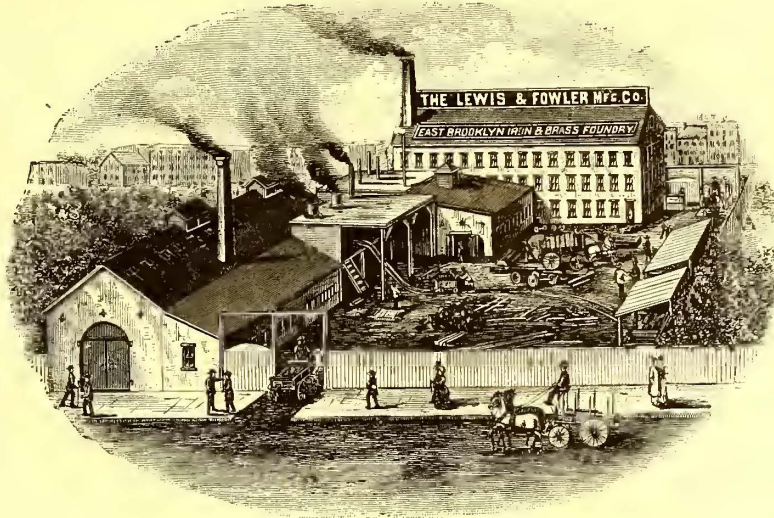
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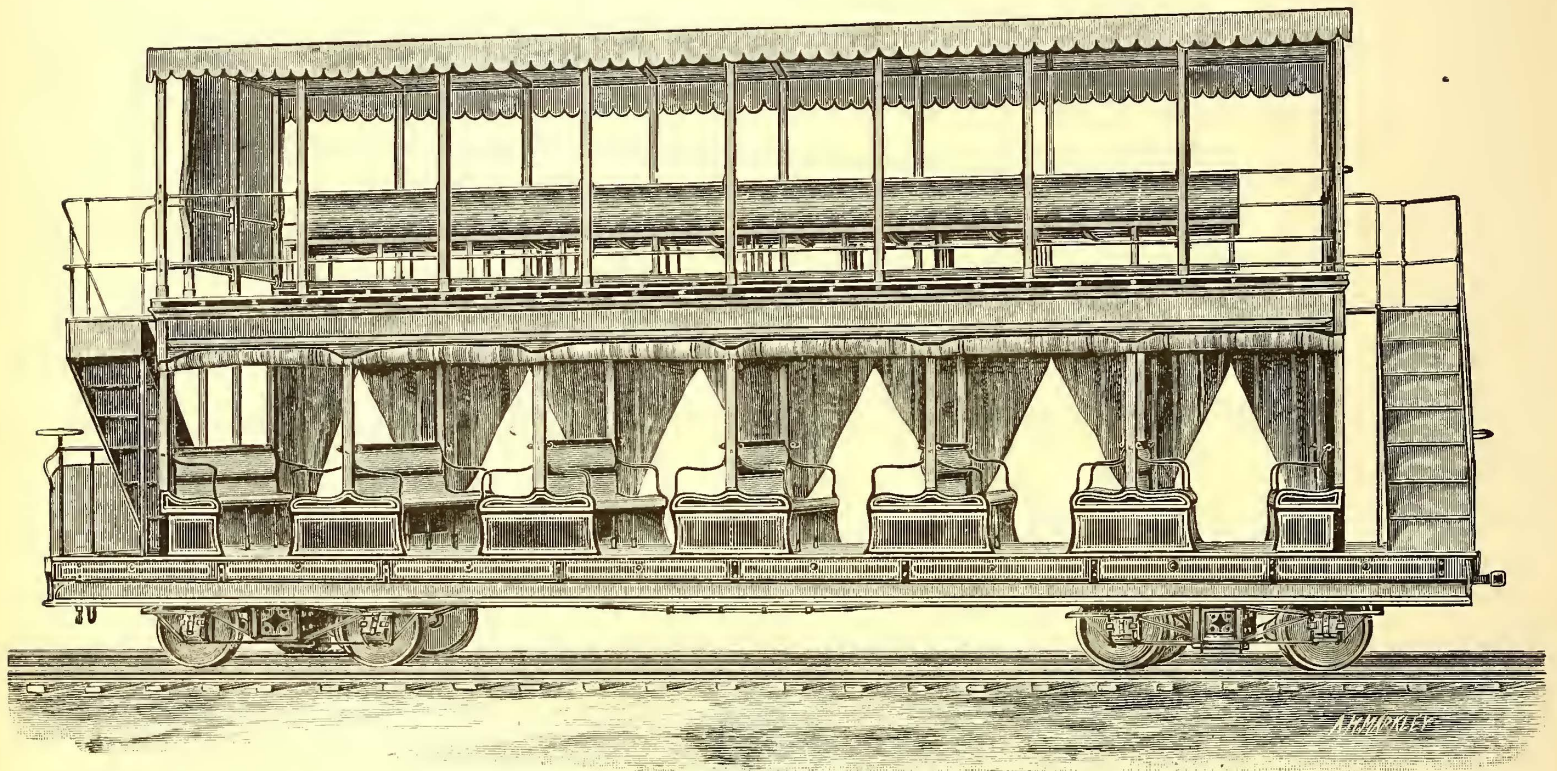
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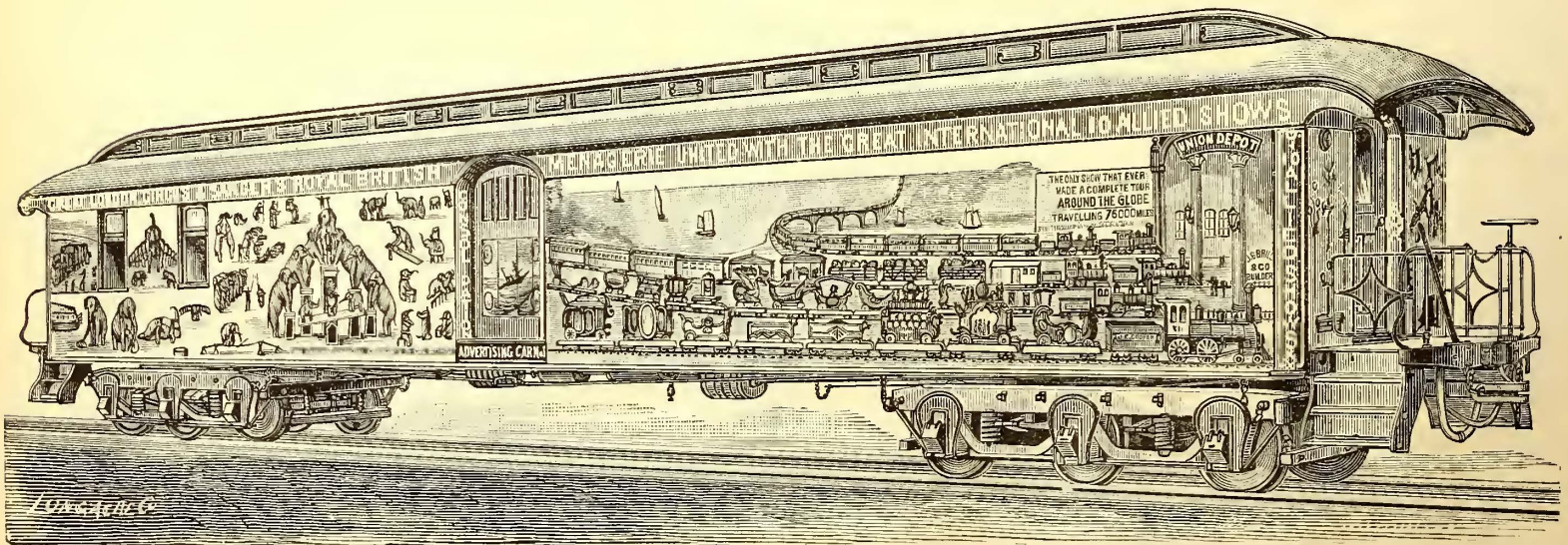
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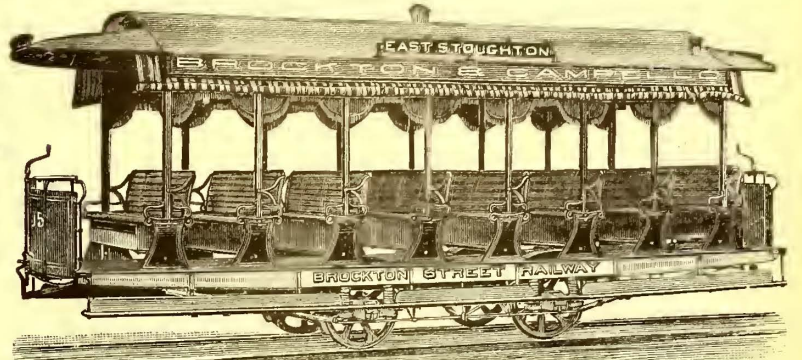
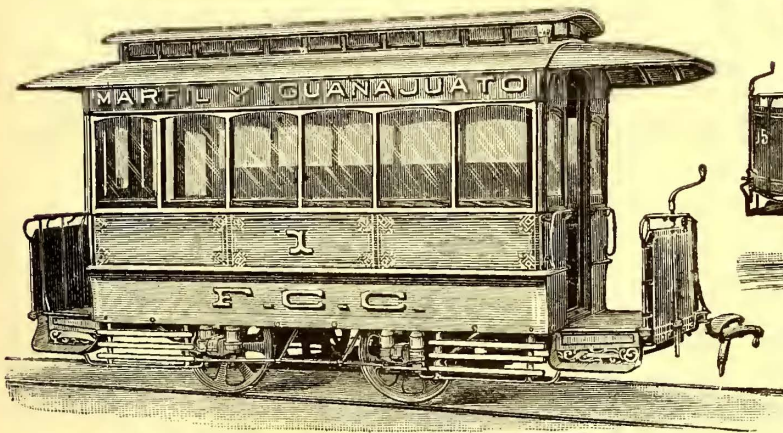
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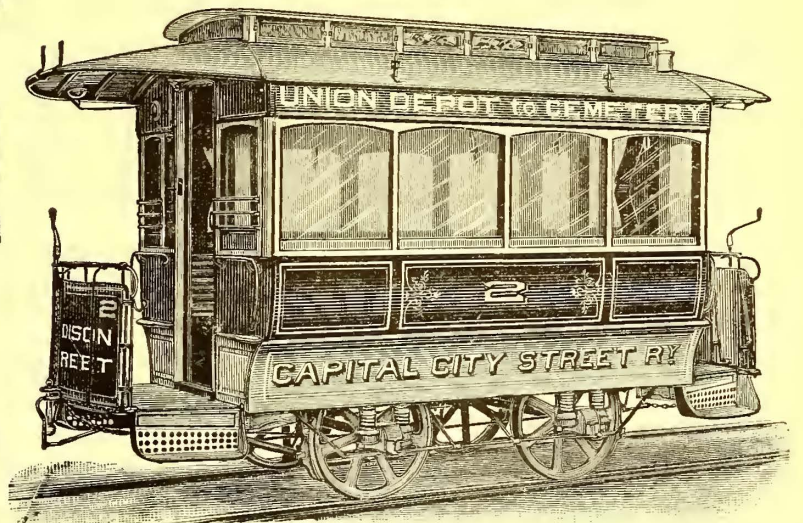
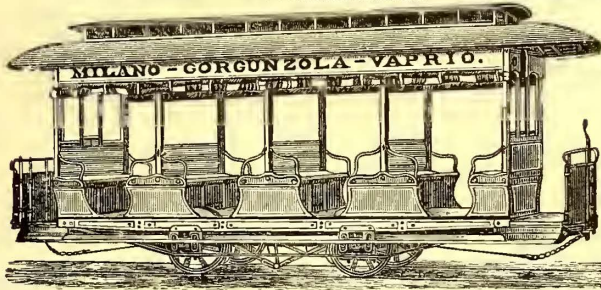
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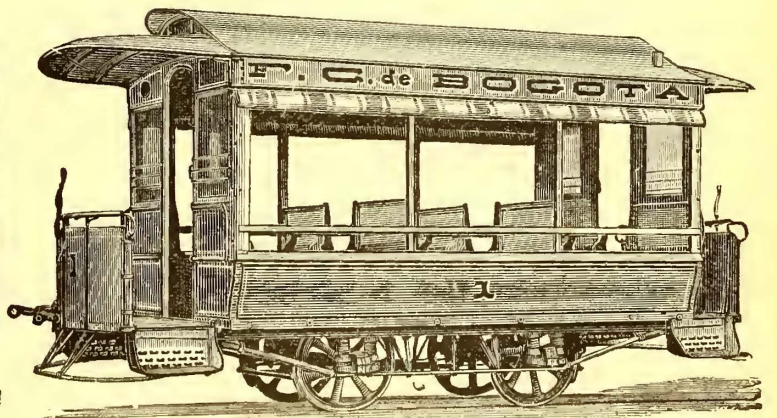
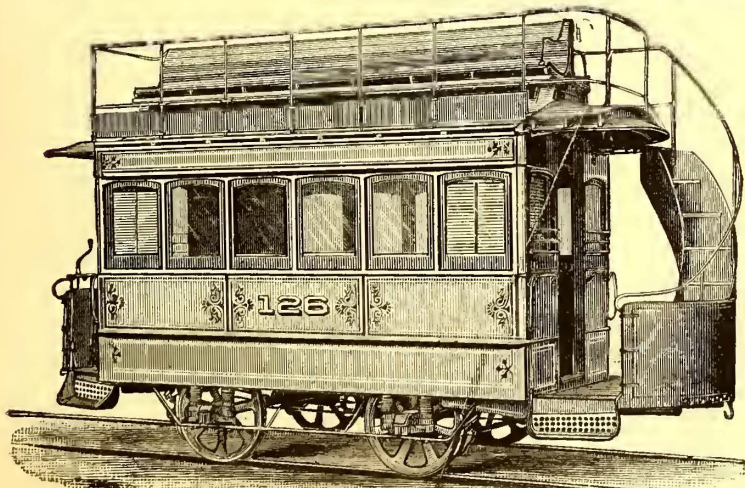
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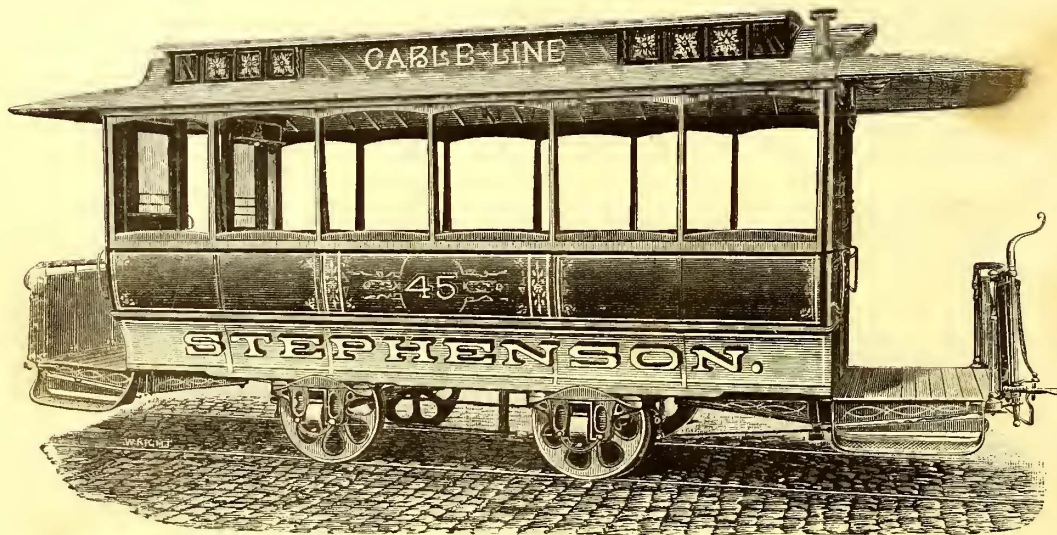
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