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THE WEISS SYSTEM OF STREET CAR MOTORS.

It now seems to be only a question of time as to when the use of horses for drawing street cars will be abandoned, at all events in our cities. The Third Avenue line of this city for several years past has been experimenting with cable traction, and it is just announced that it proposes adopting it for the greater part of the line. In Philadelphia, cable traction is in successful operation, and electricity is being tried. Cable traction involves the expenditure of a very large additional capital beyond what is required for rails, cars, and ordinary equipment.

For this and other reasons, the processes that, on general principles, should be considered the most advanced are those dependent on electricity as the motive power. It is satisfactory to note that they are gradually obtaining a foothold. They may be divided into three types. In one, an overhead wire is needed; in another, an underground wire or third rail is used to carry the current; in the third system, storage batteries are employed. Each system has its good and bad points, to which only brief reference need be made here. Occupants of streets through which the cars pass object very strongly to the appearance of the line of poles. This point was so strongly urged in one recent instance as to cause the abandonment of electricity by a car company in a city near New York. In favor of the storage battery system, as opposed to both of the other ones, is to be cited the feature that each car carries its own power. In case of an accumulation of cars upon a heavy grade, this might be of importance. It is quite conceivable that by this occurrence so great a demand for power might be made upon the station, where electricity was supplied by a transit wire or rail, that all the cars could not ascend the grade together. Against storage battery systems the objection is made that the very heavy batteries have to be carried with the cars, and so increase the dead weight.

The system we illustrate in this issue is one whose distinguishing peculiarity is adapted to any of the three typical methods of supplying electricity. It is here shown as applied to a car of the Jersey City and Bergen line, which is driven by accumulators. In applying it a special study has naturally been made of the battery system, and in all its features the car represents the results of much thought, which results are to be still the subjects of modification, if on trial any change seems desirable.

Under the seats on the sides of the car the battery is kept. It consists of sixty cells of the Julien battery,

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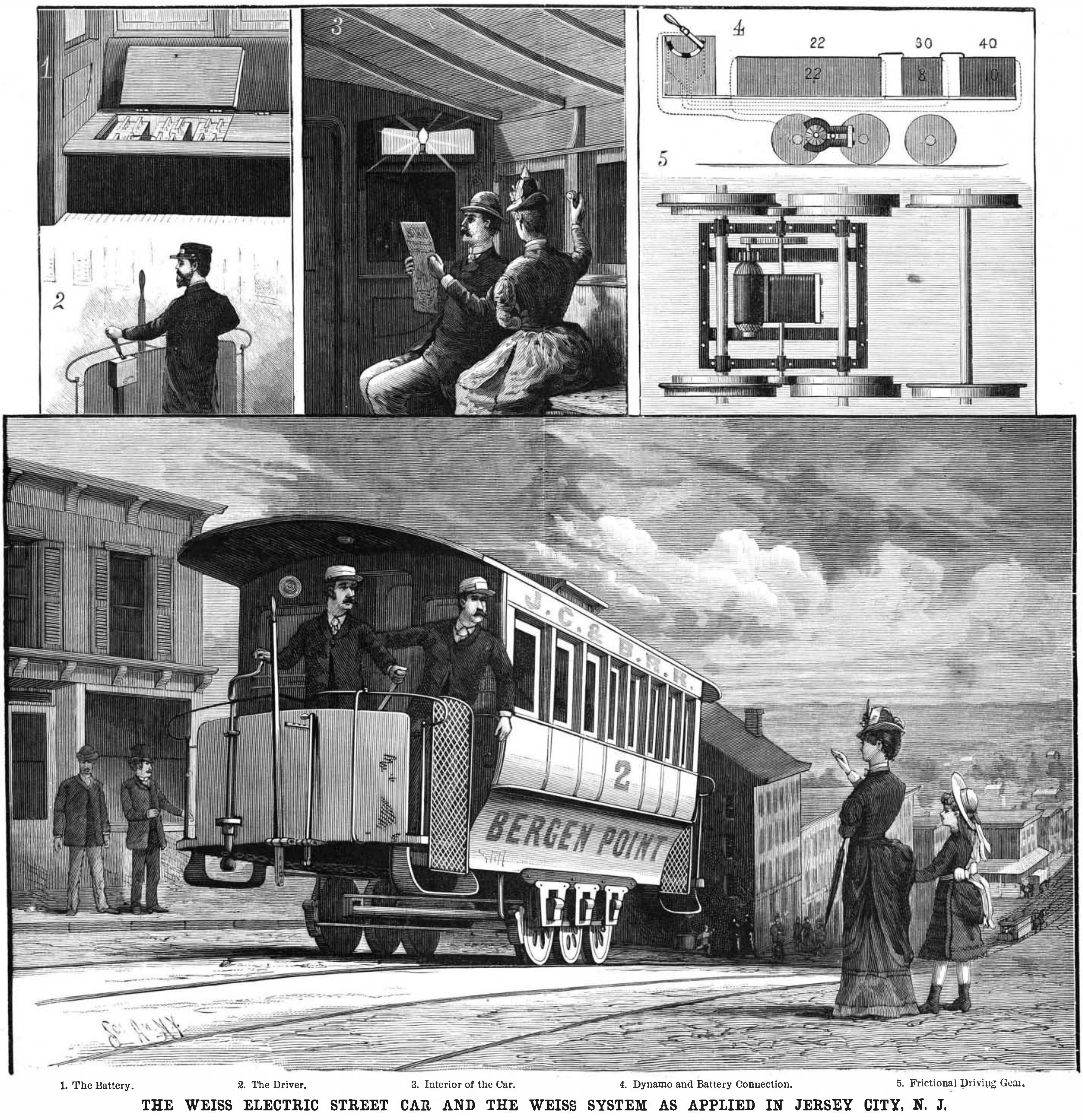


1. The Battery. 2. The Driver. 3. Interior of the Car. 4. Dynamo and Battery Connection. 5. Frictional Driving Gear.

THE WEISS ELECTRIC STREET CAR AND THE WEISS SYSTEM AS APPLIED IN JERSEY CITY, N. J.

THE WEISS SYSTEM OF STREET CAR MOTORS.

(*Continued from first page.*)

each possessing a capacity of 125 ampere hours and two volts electromotive force. The plates are contained in hard rubber cells. The cells are at present arranged in series, so that twenty-two, thirty, or forty, according to requirements, can be thrown into action at the same time. This leaves an excess of 20 cells, which may be regarded as a provision for emergencies. With this arrangement, it will be seen that the first twenty-two cells have the most constant work to do, and become most quickly exhausted. It is proposed now to adopt a different style of connection and switchboard, so as to use the batteries in series or in parallel, and thus by varying the electromotive force to vary the power applied to the car.

The switchboards for regulating the battery in any case are carried upon the dashboards of the cars. The driver can turn on more or less current and can shut it off entirely by manipulating the switch handle.

The current drives a five horse power shunt-wound Griscom motor, which is placed under the floor of the car. It has four sets of brushes. By handles worked from the platforms, these can be thrown on and off the commutator drum in pairs, so as to give at will either direction of rotation to the motor shaft. To reverse the motion, the driver has to go to the other platform, as from one platform only one direction of motion can be given.

On the shaft of the motor, which in ordinary running, at eight miles an hour, makes 1,250 rotations per minute, is a pinion. This gears with a larger cog wheel. The latter is mounted on a shaft which extends across the car. The height of this shaft corresponds, as nearly as possible, with that of the axles of the wheels.

As seen in the illustration, an extra pair of wheels is used. These come between the regular ones, and are flangeless. They and one adjacent pair constitute the driving wheels. The shaft turned by the motor carries at each end a friction wheel. A circular friction surface, a few inches less in diameter than the wheels, is provided on the inner side of both driving wheels. The friction wheels, when driving the car, bear against these surfaces. The shaft carrying the friction wheels is fixed in position, and constantly rotates when the motor is in action. To cause it to drive the car, the two pairs of driving wheels are drawn together. To do this, powerful levers are arranged at both ends of the cars, to be operated by the driver. When these are drawn back, the two pairs of wheels are made to pinch the friction roller between their friction surfaces, and consequently rotate with it, thus moving the car. To allow the wheels to be drawn together, a small amount of play between the pedestals is allowed for. When the lever is released, the wheels spring apart and away from the friction wheel. The amount of this motion is very slight. It need not exceed an eighth of an inch for each pair.

One feature in the history of electric cars has been the trouble incurred in reducing the high speed of the dynamo, whether by belts, plain gear wheels, or worm and pinion. In the present construction it will be noticed that the gearing is not on a wheel axle, and that it is not connected therewith except by the frictional surfaces. This feature, it is claimed, will obviate the wearing strains upon the teeth of the wheels, and avoid the trouble hitherto experienced. Mr. Reckenzaun's recent paper on the subject of gearing for electric street cars very fully portrayed the engineering difficulties of the problem, and gave the different ways in which its solution had been attempted. In the Weiss system a new method of solving the problem is attempted.

The general factors of the car motor and other parts may be thus summarized: The motor is of nominal five horse power, and can absorb from one to 125 amperes at seventy volts electromotive force. Each cell of the storage battery is good for 125 ampere hours in ten hours, at a potential of two volts. Thus twenty-two cells at the normal rate will give 550 watts. But on this car they are used more rapidly, so as to develop from one to three electrical horse power. With thirty cells from two to five electrical horse power, and with forty cells from four to eight electrical horse power are obtained. On average tracks 2,000 watts or 2·68 electrical horse power will drive the car at ten miles an hour. It can turn any curve, the absence of flanges from the center pair of wheels facilitating this operation. It has gone around a curve of 30 feet radius at the rate of twelve miles an hour. It has ascended with a load a grade of between six and seven feet per hundred.

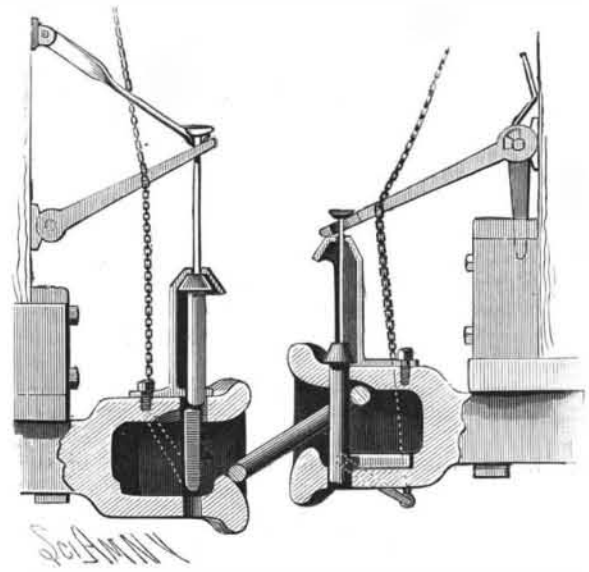
On average running at eight miles an hour it can be used for ten hours without charging the battery. This is based on 5 1/10 hours actual running time at an average of 2½ horse power.

The car with two pairs of wheels weighs 5,200 lb. The additional weight incident to the electrical part is thus divided: The extra pair of wheels with their axle weigh 500 lb., the motor 400 lb., the framing, levers, connecting rods, and other minors parts 250 lb., and the battery 2,100 lb. This gives a total for the extra parts of 3,250 lb.

The bell for stopping and starting the car, the alarm bell for giving warning of the car's approach, and the lamps for lighting the car are worked by the current also. The installation is very complete in these respects. It will be seen that the storage battery is no necessary part of the system, as it is equally well adapted for receiving its supply from overhead or underground leads.

AN IMPROVED CAR COUPLING.

A car coupler which provides a means for retaining the link in suspension outside the drawbar when the cars are in an uncoupled position is shown herewith, and has been patented by Mr. John B. Butts, of Kansas City, Mo. In the bottom of the link opening of the drawhead is pivoted a dog, adapted to rest horizontally when a coupling is made, and to maintain a vertical position beneath the suspended pin when the car is uncoupled, the dog being operated from either the top or the sides of the car by a rod journaled transversely on the car end, and having crank arms at its extremities and a chain connection with the roof, the transverse rod carrying a lever which is in communication with the dog through a chain and arm, as shown in dotted lines. A casing with cone-shaped cap is on the upper side of the drawhead, in vertical alignment with its pin aperture, a vertical rod attached to the pin passing upward through the casing and through a slot in the lever extending from the transverse rod on the end of the car. When the pin is in position in the



BUTT'S CAR COUPLING.

drawhead, as shown to the right, the lever rests substantially on the cap of the casing, and the head of the pin rod on the upper side of the free end of the lever. Above the transverse rod on the end of the car, a twisted arm is pivoted in a bracket, such arm having a recess in one edge and a downward cam-like projection opposite the recess on the other edge. When it is desired to uncouple, and leave the car so that it will not couple with an opposing drawhead, the pin rod, as the pin is raised, comes into engagement with the recess of the twisted arm, the head of the rod resting upon the upper face of the arm, and holding the pin up as shown to the left in the illustration, when the lever by which it was raised may be dropped, carrying the dog in the bottom of the link opening to a horizontal position, and the car will not be coupled by the contact of an opposing drawhead. As the lever is again raised, it comes in contact with the cam-like projection of the twisted arm, and thereby frees the pin rod, allowing the pin to drop into its aperture simultaneously with the drop of the lever.

Running Railway Trains in England.

Among the thousands who travel by rail, there are probably very few who are cognizant of the precautions taken to prevent accidents; nor are the majority of railway travelers aware that under the present system of "running a train," it is almost impossible for a collision to occur except through the negligence of some of the company's servants. In an interesting article on signalmen lately published in a contemporary, the writer explained how the signals were worked; but, according to a railway employe's statement in *Chambers's Journal*, he gives one a very inadequate idea of the care exercised by railway companies to prevent accidents and loss of life to travelers. For instance, we will take an ordinary train at its start in the morning. In the first place, at the commencement of the journey, the engine driver and the fireman belonging to the train, after having "signed on duty"—that is, signed the train book in the shed foreman's office—and being passed by the foreman as fit for work, are required to be with the engine about an hour before the time of starting the train, in order that the driver may satisfy himself that the engine is in proper working order.

His first care is to see that the engine has been thoroughly cleaned, that all working parts are free from grit, and that his previous night's statement as regards repairs, etc., to the engine, has been acted upon; and gets coal and water. He then oils all working parts himself, and proceeds to the station to "pick up" the carriages forming the train. Each carriage has been overhauled by the carriage examiner, whose duty it is to see that the train is all right and fit to proceed on the journey; and where any defect is noticed, the carriage is taken off and sent to the "shops" to be repaired. The train is now within the jurisdiction of the station master, who, having previously seen that the signals and signalmen in his district are in proper condition, at once proceeds to satisfy himself that the carriage examiner has done his duty properly, and notices that the carriages are properly "coupled."

It will be at once easily understood that to prevent oscillation and to secure the easy and smooth running of the train, it is necessary that all the vehicles composing the train should be so tightly coupled as to insure the buffers being brought so firmly together as not to be separated by any change of gradient or by the starting of the train. It is the station master's duty to observe the state of all couplings—including continuous brake couplings and cord communications—and cause any that require it to be adjusted. These couplings are also examined by the guard, who, while in the station, is under the orders of the station master. After the guard has seen that the doors of the carriages are properly closed, the train is ready to start.

The signal to the engine driver to proceed must be given by the guard upon receiving intimation from the station master that all is right. When there are two or more guards with a train, the signal to the driver must only be given by the guard nearest the engine, and then not until he has exchanged signals with the guard or guards in the rear. On the guard rests the chief responsibility for the safe running of the train. How onerous are his duties may be seen from the following. In the first place, he must regulate the working of the train in accordance with the time tables of the line over which he has to run. He must also see that the train does not travel on the line after sunset or in foggy weather without a red tail lamp and two side lamps, which he must keep properly burning throughout the journey.

Every guard when traveling must keep a good lookout, and, should he apprehend danger, he must at once attract the attention of the engine driver. This he does by using the "communication," and also by applying his hand brake, if he has one, sharply and releasing it suddenly. This operation—from the check it occasions—if repeated several times, is almost certain to attract the notice of the driver, to whom the necessary caution or danger signal must be exhibited; and should the train be fitted with a continuous brake with which the guard has a connection, he must apply it until he is certain the driver is alive to the danger. Should danger be first apprehended by the driver, he immediately gives three or more short, sharp whistles, which is a signal for the guard to apply the brake.

If, from any cause, it is found that the train cannot proceed at a greater speed than four miles an hour, the guard must immediately go back one thousand yards, or to the nearest signal box, if there be one within that distance; in which case the signalman must be advised of the circumstance. Otherwise, the guard who goes back must follow the train at that distance and use the proper danger signals, so as to stop any following train until assistance arrives or the obstruction is removed.

When the train is stopped by accident or from any other cause, the guard must go back as before mentioned, and place detonators on the rails at fixed distances, and must not return to the train until recalled by the engine driver sounding the whistle. Should the absence of a signal at a place where a signal is ordinarily shown, or a signal imperfectly lighted, be noticed by the guard, he must treat it as a danger signal, and report the circumstance to the next signalman or station master. These rules, properly carried out, and signalmen and others doing their duty, it will be plainly evident that, although accidents will sometimes occur, the railway companies do their best to secure the safe working of the line.

Substitute for Gum Arabic.

A substitute for gum arabic, which has been patented in Germany, and is likely to be largely used for technical purposes now that good gum arabic is so scarce, is made as follows, according to the *American Druggist:* Twenty parts of powdered sugar are boiled with 7 parts of fresh milk, and this is then mixed with 50 parts of a 36 per cent solution of silicate of sodium, the mixture being then cooled to 122° F. and poured into tin boxes, where granular masses will gradually separate out, which look very much like pieces of gum arabic. This artificial gum copiously and instantly reduces Fehling's solution, so that if mixed with powered gum arabic as an adulterant, its presence could be easily detected. The presence of silicate of sodium in the ash would also confirm the presence of adulteration.