formula $Cr_2O_3, 3CrO_3$. Of basic chromates there are quite a number. One which seems to be well defined is Cr_2O_3, CrO_3, which is sometimes written with the simplified formula, CrO_2.

In actual practice, potassium or ammonium bichromate is used indifferently. Sometimes the formulæ given provide for the addition of ammonia, and sometimes they do not. This would hardly seem to be a satisfactory state of things, and I took advantage therefore of an opportunity recently to go into the question, both from the theoretical and from the practical point of view.

It is impossible to help noticing that, while the relative quantities of the two salts of potassium and ammonium bichromate, which are chemically correspondent, are 116 of the first to 100 of the second, if one employs the two bichromates in these proportions it is found at once that the ammonium bichromate has a quicker and more powerful action.

This is easily explained when it is borne in mind that in the case of ammonium bichromate all the chromium present is effective, while in the case of potassium bichromate only that is active which is in the condition of chromic anhydride. Now, I would remind my readers that the bichromates can be considered as a combination of neutral chromate with chromic anhydride. Thus, one can write the formulæ of the two bichromates in the following:

K_2CrO_4, CrO_3.	$(NH_4)_2CrO_4, CrO_3$
Potassium bichromate.	Ammonium bichromate.

Now, the neutral potassium chromate in the presence of a colloid is almost unaffected by light, for the tendency to decompose into potassium oxide and chromic anhydride is at a minimum. This is because the potassium oxide which forms—which remains present—tends to prevent by its presence the continuation of the decomposition of the chromate itself. In the case of neutral ammonium chromate, on the contrary, the alkali, being volatile, easily and quickly disappears, and so the process of decomposition goes on right up to the end.

This is shown in the following equation, the chromic anhydride which is set at liberty acting by oxidizing organic matter which is present:

$(NH_4)_2CrO_4$ Neutral ammonium chromate.	$= H_2O + 2NH_3 +$	CrO_3.
	= water + ammonia +	chromic anhydride.

This may be put in other words by saying that in the case of the decomposition of a body by light, the sensitiveness of the compound is governed not merely by the quality inherent in the compound itself, but also by the greater or less facilities which are afforded for the gettting rid of one of the products of the decomposition. It follows that ammonium bichromate can undergo reduction to a much greater extent than potassium bichromate, and it is therefore necessary to employ a much greater quantity of the latter to obtain the same effect in an equal or even in a longer time.

The addition of ammonia to the bichromate solution is useful in certain cases, but not in all. It has the effect of changing the bichromate to the neutral chromate. When added to a solution of potassium bichromate, the addition of ammonia acts by transforming it into a mixture of the two neutral chromates of potassium and of ammonium, of which the latter alone, as I have already said, is effective. With ammonium bichromate, the addition of ammonia gives only neutral ammonium chromate, which is very active. Neutral ammonium chromate acts in a less active manner than the bichromates. It will therefore generally be found convenient, when it is proposed to neutralize the bichromate, to employ ammonium and not potassium bichromate, in order not to diminish the action too much.

The addition of ammonia to a bichromate solution ought to be made in such a manner as to change the orange yellow color of the liquid to a citron yellow, and it is a good thing to make it until the mixture smells of ammonia. The excess of ammonia has no injurious influence, for as the film dries the ammonia volatilizes.

But if it is proposed only to transform a part of the bichromate into neutral chromate, it is not advisable to follow the method so often recommended in formulæ, of adding a stated volume of liquor ammonia thereto. Ammonia solution is so variable in strength that such a method can only be adopted with the hope of obtaining uniform results by making an elaborate calculation, taking for its basis the actual weight of ammonia gas contained in the particular solution which is being used at the moment. It is a much more simple plan to divide the bichromate solution into two equal or unequal parts, as the case may be, into one of which sufficient ammonia solution is poured just to change the orange color completely to yellow without exceeding this point but very slightly, and then to mix the two solutions. In this way we can obtain bichromate solutions which, in contact with colloids in the presence of light, display an energy which is intermediary between that of the pure solutions of bichromate and that of neutral ammonium chromate.

It may be noted that the partial or total neutralization of bichromate with ammonia is particularly useful in the case of those colloid bodies which tend to become insoluble by the action of acids, as for example, with albumen.

In making up solutions or preparations of albumen with bichromate, it is always useful to add an excess of ammonia. Solutions are obtained in that way which keep well for several months, whereas without the addition of ammonia the solution keeps very badly or for a very short time, and even when employed at once it often produces in the dried film a partial insolubility before exposure. But in the enamel process, the addition of ammonia to the mixture of bichromate and fish glue is not beneficial, since it makes a film that is less resistant, and one which tends more easily to become detached from its support. Therefore, when a mixture of fish glue with a little albumen is employed, it is well not to add ammonia to neutralize the bichromate. By so doing, I have found that when the sensitive mixture is to be used after it has been made for two or three days, there need be no fear of the trouble that would be likely to occur if albumen by itself were being used.

The employment of neutralized bichromate, on the other hand, is an advantage in sensitizing carbon tissue, when it is to be kept for as long as possible, because the ammonium chromate acts in a slower manner, not only when exposed to light, but in the reaction which goes on in the tissue when it is kept from the light. Preparations of gum arabic also keep much longer if they are sensitized with a bichromate solution to which ammonia has been added.

Bichromates which have been transformed into chromates by the addition of ammonia have still another advantage, which renders them preferable in certain cases. They are much more soluble. For example, one can prepare solutions having a concentration of as much as 25 per cent, while with potassium bichromate according to the season, one can only obtain from 8 to 10 per cent solutions, and with ammonium bichromate 12 to 15 per cent. The great solubility of neutral chromates does away entirely with the fear of invisible crystallizations taking place in the film of gelatine, gum, or albumen, as can easily be shown with ammonium bichromate, and still more easily with potassium bichromate.

One colloid body which, so far as I know, has not yet been experimented with to any extent, is a mixture of chromate and casein. A solution of casein in ammonia or in borax may be made, and a solution of ammonium bichromate, neutralized with ammonia, added to it. In this way, a solution is obtained which, after filtering, may be spread upon paper or glass, and gives a film insoluble in water, but soluble in alkaline solutions. After exposure to light, the film becomes insoluble in alkaline solutions also.

Before leaving this subject, I would like to point out an experiment which I have made recently, which may help to show how complex is the action which the bichromates produce on colloid bodies in the presence of light. I took a 10 per cent solution of ammonium bichromate, added to it a little glucose, and heated it for a long time in a covered vessel. The yellow liquid became a very marked brown, on account of reduction of the glucose, brought about by the heat. One may take it that, under these conditions, a product is obtained resembling to some extent that which forms under the action of light upon bichromate in the presence of organic matter. On the other hand, it may be pointed out that the resulting solution only has a very slight action in rendering gelatine insoluble. I have further experiments in hand on the action of chromate and the salts of chromium in gelatine to which I may recur later on.—Photography.

THE HISTORY OF ALCOHOL.*

By DR. B. NEWMANN, Privatdocent, Darmstadt.

WHILE the history of several of the chemical-technical industries has been excellently written up—for example, the history of Sugar, by E. O. von Lippman; that of Explosives, by Romocki, etc.—as yet we possess no similar detailed story of the origin and development of quite a number of substances belonging to the same class of products, among them one of the most important of all—Alcohol In all the existing special works on alcohol, chapters or sections devoted to the history of the substance, are conspicuous by their absence. Now, some seven or eight hundred years after the discovery of alcohol, a special literature has arisen with it as the topic, embracing works on the methods of its preparation, works on its uses; on the materials from which it is derived, etc., and it seems that it is worth while to take at least a short glance into its history.

From the writings of the ancients we learn that long before the beginning of our method of reckoning time, liquids containing alcohol were well known, and especially well known, in even the remotest ages, was wine-making from the juice of the grape. It is also well known that the Egyptians and the ancestors of the Germans prepared liquors similar to beer, and further, that the juices of the palm tree, of fruit, and of honey, etc., were made to undergo alcoholic fermentation, and yield intoxicating liquors. All of the peoples, however, who had learned and practised these methods, were ignorant of pure alcohol. They had no distilling apparatus, fit at least to drive off and preserve the involatile constituent of their wines or beers. In Pliny alone do we find a statement which has reference to the alcoholic content of wines—that wherein he says that the Falernian is distinguishable from all other wines by its inflammability.[1] Only after the discovery, by the Alexandrians, of improved distilling apparatus, do we find evidences that wine was submitted to distillation, and the inflammable material separated therefrom.

Marcus Græcus, who lived in the eighth century, in a work by him entitled "Liber ignium ad comburendos hostes" (The book of fires for the destruction of enemies), says:

"Ardent-water (Aquam ardentem) you can make in the following manner: Take black wine, thick and old, and in one quarta[2] of it, rub up 2 ounces of live sulphur, most finely powdered; 2 pounds of tartar derived from good, white wine, and 2 ounces of common salt. Place the ingredients in curcurbit[3], well leaded, put on the alembic, and distill off the burning or ardent-water, which should be preserved in a closed glass vessel[4]."

The term aqua vitæ as the name for alcohol came later into use, and is first found in the Latin translation of Gheber's writings (VIII. century). Here, for the first time, also (in the Testamentum), do we find alcohol recommended as an agent for the solution of various substances. Says he: "A salt is better extracted from calcined bodies by means of aqua vitæ, derived from white wine for white calcinations, while for red ones distilled vinegar is best." Neither in the "Testamentum" of Gheber, or in the "Liber Perfecti Magisterii" of Rhases (about 900 A. D.), however, is anything said of the inflammability of alcohol.

Rhases writes: The preparation of aqua vitæ is simple. Take of the occult any desired quantity, and stir strongly until it becomes like marrow, set it away to ferment, day and night, after which put it into a still and distill off. The surgeon, Albucassis of Zahara (who died in 1122 A. D.), by contemporary writers also called Abul Cassis, Alzaharavius, Buchalsis Ben Aferazeris, in his work, entitled "Servitor" (published in Latin first at Venice, in 1471), describes minutely a distilling apparatus made of glass and burnt clay. In the same work he describes the distillation of rose-water, and the subjection of wines to distillation. The alcoholic liquid thus obtained he called vinum ustum, burnt wine, using the words "burn" or "burnt," and "distill" or "distilled" as synonymous, just as they are used in Germany to-day. In this way we (the Germans) get our uncouth word "Branntwein."

The Arabian physicians of the beginning of the twelfth century, Merwan Ebn Zahar (Avenzoar), earlier the body-surgeon to the Sultan of Morocco; Ackmed Ebn Roshed (Averrhoës) and others, used spirit of wine as a stimulant in medicine. Cardinal Vitalis de Furno, of Basle, Switzerland, in a book published in the thirteenth century, and entitled "Selectiorum remediorum pro conservanda sanitate ad totius corporis humani morbos," extolled alcohol as the Universal Panacea. Thaddeus of Florence, who taught the art of medicine at Bologna, in the second half of the thirteenth century, did the same. At the beginning of the fourteenth century, the distillation of alcohol was still considered a very difficult and ceremonious operation. Indeed, distillation was even then regarded as a secret art, and in alcohol the alchemists discovered the foundation or beginning of their "vegetable philosophers' stone," as we learn in the writings of Raymundus Lullius (1235-1315), and Arnoldus of Villanova ("Villanovanus"), who flourished in the last half of the thirteenth and first quarter of the fourteenth, and who is frequently but incorrectly referred to by modern writers as the discoverer of the art of distilling alcohol. As we have seen, the Arabians anticipated him by several hundred years, and we can at most merely assume that he laid the foundation of his more exact and intimate acquaintance with the substance (alcohol) somewhere in Central Europe.

According to Alexander Tassoni, as early as the fifteenth century (by others relegated to a century earlier), great quantities of brandy were exported from Italy, over the Alps. The Modenese, on the occasion of an extraordinarily immense vintage, we are told, converted a part of the wine into brandy, and drove a lively trade in the "water of life" (aqua vitæ) with the Germans. The Viennese, jealous of the profits those of Modena were raking in, at once also entered into the distillation and export. It is scarcely probable that these great quantities of liquor should have been used in medicine only, but at just what period brandy became a popular drink in Germany, we cannot determine with any degree of accuracy. At any rate, that we were forestalled therein by the populations of the more southern wine-producing countries, and especially Italy, seems certain. It was in Italy, too, that the soldiers, drawn thither by the numerous wars, of which her soil was the amphitheater, first made the acquaintance of brandy, and learned to love the tipple. It may be, too, that in the outset, the liquor was taken as a prophylactic, merely, against the constantly returning epidemics of the plague (the Black Death), and thus the soldiers became addicted to its use. This much is certain, however, that at the end of the fifteenth century "brandy" was on tap (Branntwein schänkte), and was drunk in such quantities that laws became necessary for the control of its use. At the same time alcohol, in one shape or another, was being used more and more in medicine.

The author has in his possession two German prints dating from this period, one of which is devoted to "Geprannten Wasser" (distilled water, but meaning brandy), and the other to "Gepranntwein" (brandy), and both of which place before us in a remarkable manner the relations which brandy had to the existing times. Michael Schrick, doctor of medicine (Doctor der Erczнei) is the author of the first named publication—"Verzeichnuss der Ausgeprannten Wasser"—which appeared at Auburg in 1494. An earlier exemplar, which may be seen in Kloster Buxheim, of 1483, consisted of twelve leaves, without title, and began with the words: "Herein stands depicted distilled water (i. e., brandy), in what measure one must apply it to suffering, and make use of it. All of which Master Michael Schrick, doctor of medicine, hath described, and is good and useful to know[5]. After which follows a useful discussion of several distilled waters, how one shall use them and employ them to the bettering of the health of man. And this booklet has Meister Schrick, doctor of medicine, collated out of books, and writ through love and at the especial prayer of honorable persons[6]."

Following this were receipts for a number of aromatic waters—rose-water, white-lily-water, snow-drop-water, field-lily-water, etc. The latter part deals entirely with "Geprannt Wein," and the diseases and conditions in which it is recommended as a remedy. These latter are as follows:

"Brandy is good for the gout, rubbed on the same."

"Whoever is hoarse, let him rub brandy around his throat, and drink of the same, three mornings in succession, fasting."

"Anybody that will drink a half tablespoonful of brandy every morning, will never be sick."

"Item: When a man be dying, let one pour a little

*In the Pharmaceutische Centralhalle.—Translated for the National Druggist.

[1] Nec ulli in vino major auctoritas solum vinorum flamma ascenditur.

[2] Quarta. The Translator is at a loss to know whether the author here means a fourth of an amphora (which would be 2¼ gallons), or the fourth of a congius (about a quart).

[3] Cucurbit, i. e., a matrass, or gourd-shaped vessel, originally forming the lower part of an alembic. F. L. J.

[4] Aquam ardentem sic facies: Recipe vinum nigrum, spissum et vetus, et in una quarta ipsius distemperabuntur unciæ II. sulphuris vivi subtilissime pulverizati; iib. II. tartari extracti a bono vino albo; unciæ II. salis communis; et subdita ponas in curcurbita bene plumbata et alembico supposito distillabis aquem ardentem, quam servare debes in vase clauso vitreo.

[5] Hiernach stehen verzeichnet die ausgeprannten Wasser. In welcher maas die zu den gelydern nützen und prauchen sol. Alsdann Meister Michel Schrick doctor der ercznei beschrieben hat und ist gut und nützlich zu wissen. Hienach volget eine nützliche mater; von manigerlei ausgeprannten Wasser wie man die nüzen und prauchen sol zu Gesuntheit der Menschen. Und daz buchlein hat Meister Schrick doctor der ercznei durch liebe und besunder gebet willen erber personen als aus den büchern zusammen colligieret und geschrieben.

[6] Apothek für den gemainen man, der die Ertzte zu ersuchen, am gut nicht vermügens, oder sonst in der not, allwege nicht erraichen kan.

brandy into his (the decedent's) mouth, then will he speak before he dies."

"If brandy be poured into (the body of) the dead, the corpse will not putrefy, nor stink ever, whether on top of, or under the earth."

"Item: Whatever meat be rubbed with brandy, whether it be raw or cooked, that flesh will neither rot nor stink."

"Whatever person hath stone in the bladder, let him drink a little brandy of mornings, for that breaketh the stone which speedily cometh away and leaveth the man sound again."

"Whosoever drinketh brandy, though but one time in the month, regularly, the worm dyeth which grows in the heart, or lungs, or liver of mortals."

"Brandy be good, too, for that man whose head acheth him, and he who batheth his head therewith remaineth handsome and long young, for it maketh a good memory and inciteth the spirit and wit."

"Item: He who hath a cold, let him drink brandy mixed with wine (gepranntwein mit anderm wein), and he will anon be well."

"Item: He who hath troubled and red eyes, let him rub a little brandy on the brows, and when he goeth to bed, put a droplet in the eyes, and anon he will be sound and well."

"Item: He who is hard of hearing hath but to drop a little brandy into the ears to recover his hearing."

"He who is dropsied hath only to drink brandy, and rub some of it over and around his belly when he cometh out of the bath, and goeth and standeth by the fire, he will soon be better."

Some time afterward (in 1529) Schrick's pamphlet, bound up with a lot of recipes accredited to the highly renowned and well-learned (hoch berumbten wolerfarnen) Hieronymus Brunsweick, was published at Nuremberg, under the title "Apothek for the laity who cannot, on account of lack of property or otherwise, in cases of necessity, reach the doctors."

Still more original is a poem in praise of alcohol, which appeared in 1493, of unknown authorship. It is entitled: Those to whom brandy be of use or of harm, and how it (geprannt wein) may be correctly or falsely prepared. The title is cut in wood, and is illustrated with pictures of the uses of brandy. The text is printed in movable letters, and at the close (where "Finis" usually is placed nowadays) stand these words, "Gedruckt zu Bambergk Von marxem Ayrer. Unnd Hannsen Pernecker in dem Zincken werd Im LXXXXIII. Jar." (Printed in Bamberg by Marc Ayrer and Hans Pernecke. Put into the zincs (i. e., type) in the year '93).[1]

In the poem we are not only told the diseases and conditions for which brandy is useful as a remedy, but it describes the properties, tests for pureness, etc., of spirit of wine, its antiseptic qualities, and finally the phenomena superinduced by too great indulgence therein. We reproduce a few stanzas of the therapeutical properties ascribed to brandy (or "spirit of wine," as throughout, in all the prints referred to, the terms are used as identical) It commences by naming a lot of herbs to be put in the liquid to make a vulnerary wash, and proceeds thus (no attempt being made to preserve the meter):

"First lay these herbs in burned wine,
And make the brew both strong and fine,
Then wash the wounds therewith, and know
That sooner than common they will better grow."

"If he, that fearful of the stroke (i. e., apoplexy),
But drink the wine, his health will ne'er be broke."

"Whoso drinks it, whether or no he liveth long,
While he *doth* live, liveth ever young and strong."

"If one but rubbeth brandy on the head,
Lice and their nits will all be dead."

And so the "poem" continues—recommending "geprannten wein" as a panacea for sore eyes, toothache, headache, backache, and almost every other conceivable ill, as well as a prophylactic against them, provided it be but regularly and industriously "nipped." (We need not, however, pursue the translation further.—Translator.)

The poem is noteworthy in more respects than one. By word and picture, it shows us that as early as 1494 brandy had become a common drink among the masses, and that great scandals were publicly caused by its abuse. Even at this early date there were public houses devoted to the sale of spirits, and that these had an enormous and open patronage, to such an extent, in fact, that ordinances and laws became necessary to regulate the sale and use of the liquor. Our poet's description of the effects of too much brandy on the human system is quite comical, as are also his word sketches of topers whom he claims to have known. As far as the manners and habits of these gentry, were it not for the quaint old German idiom, full of obsolete and long forgotten words, the sketches might have been written yesterday, so true to life are they.

As another proof that at the close of the fifteenth century the drinking of ardent spirits in public tap rooms had reached enormous proportions, we may cite a police ordinance of the city of Nuremberg, dated 1496, which commences: "Since many individuals of this city are addicted to the use of brandy, astonishing abuses have arisen in that trade, and it has been concluded to firmly and earnestly decree that from now henceforth, on Sundays and other holidays, no person shall offer for sale or sell brandy, either in their houses, groceries (Krämern), shops, on the Market Place, open streets, or elsewhere in this city."

Landgrave William II. also ordered that "Whoever had brandy for sale in his house shall not allow credit, be it on holidays or work days. We order, moreover, that on the holy days no one shall expose for sale or sell brandy near to or in front of churches—this on penalty of the confiscation of his stock of brandy."

Landgrave Philip, in 1524, prohibited the sale of brandy, either by the dram or otherwise. In the "Amtsregister" of the House of Zelle, we find in 1578, the following notice: "Hans Müller and Hans Günter have begun to distill brandy and to keep the same on tap, against the express command of our gracious sovereign." In Frankfort-on-the-Main, in 1582, brandy was entirely forbidden, the barbers (who were also surgeons) having reported that "in the present heavy mortality, the use of alcohol has very deleterious results." Again, in 1605, the order forbidding the use of alcohol was revived. In 1595, for the first time, the Magistrates of Berlin imposed a local tax on brandy, which tax was, just three-quarters of a century afterward, by the Great Churfürst, following the example of England, France and Russia, converted into a state revenue.

[1] In the rhymes which follow, as in the text of Schrick, *h* and *e*, *p* and *b*, and *t* and *d*, are used for each other indiscriminately, as though identical in sound and value.

A NEW AUTO-TROLLEY FOR ELECTRIC VEHICLES.

BESIDES the regular electric automobiles there exists a class of vehicles driven by electric energy obtained from an outside source, such as the trolley cars, some types of automobile buses, and various other road vehicles. With the trolley cars, the current returns through the rails, and a single wire only is employed, but with the omnibuses and other vehicles, a return wire is necessary.

The overhead trolley system for carriages is less in vogue at present than the storage battery automobile; nevertheless, there are some places where it is in successful use, one of them being at Fontainebleau, where it is being employed to run an omnibus line.

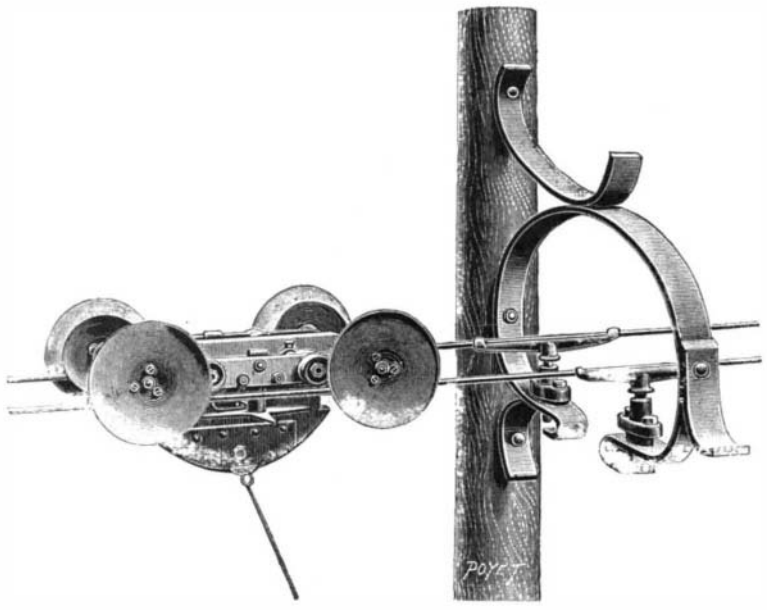
Various difficulties were met with when this system was first introduced by the Americans Cafrey and Marson and the Frenchmen Nave and Galliot. The problem is by no means the same as with street cars, which follow a fixed track. The electric vehicle must be able to move about on the road and not be obliged to remain on one side only, which, of course, necessitates an altogether flexible cable to connect it to the overhead trolley. Otherwise, the pull of the cable on the trolley might come at such an angle as to derail it, a thing that sometimes happens also if too great speeds are indulged in.

These difficulties have been overcome in some measure by the Lombard-Gerin auto-trolley, which was on exhibition at the Exposition of Vincennes, and which is the one in use at Fontainebleau. The chief fault of this auto-trolley is its weight, which necessitates a carefully constructed line with poles near together, making, on the whole, a rather costly installation.

The General Electric Construction Company has devised an auto-trolley which consists of a light frame supported on four grooved wheels patterned somewhat after the usual trolley wheel and adapted to fit on the two wires that conduct the current. Fastened on the frame is a metallic piece in the form of a star, which is constantly under the wire and keeps the wheels from jumping off. This guide piece is mounted on a vertical pivot, which allows it to turn and slip past the supports of the trolley wire, while a spring holds it in place afterward. Thus the trolley will always stay on the wires whatever the direction of the pull upon it.

A counterweight placed beneath the trolley counteracts the effect produced if there is a sudden pull on it along the wires, as when the carriage is starting. As long as the tractive pull of the carriage is less than the weight, the trolley remains stationary and the vehicle advances till the moment when the pull of gravity on the weight is exceeded by the effort of traction, in consequence of the obliquity of the line, which increases; the trolley begins to move at this moment.

The above described auto-trolley has the advantage of being simple, light, and cheap, which permits of the establishment of a line at an economical figure.—La Locomotion.

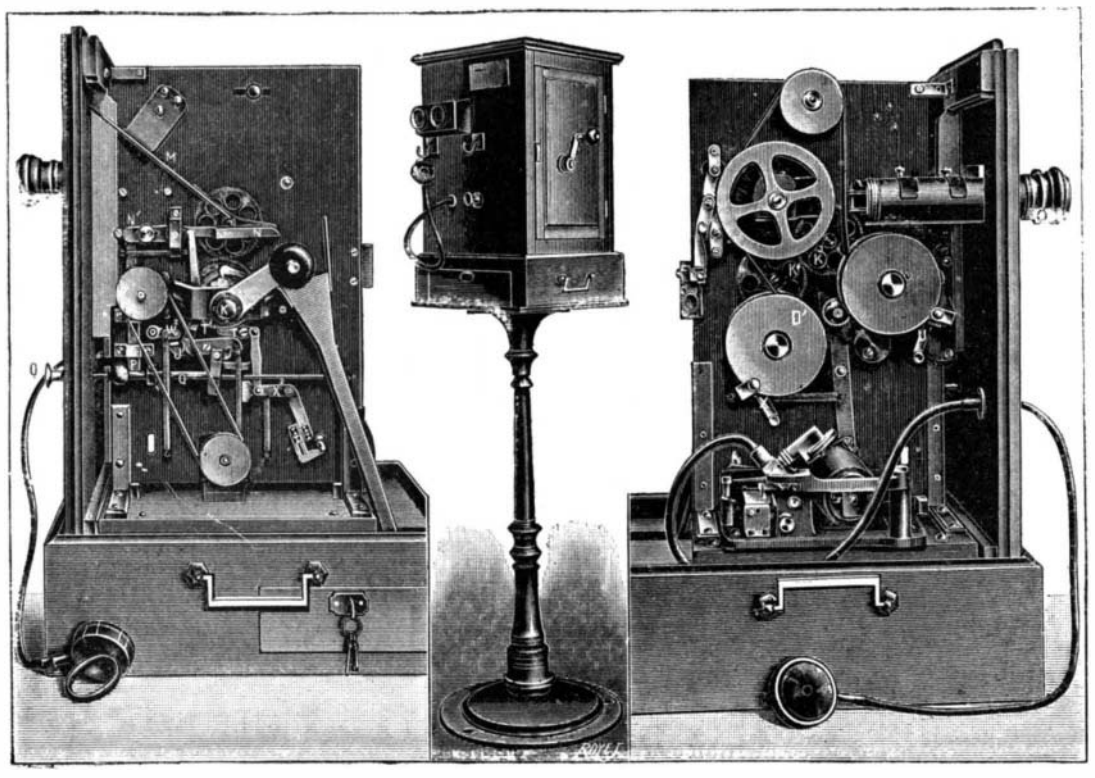


THE AUTO-TROLLEY FOR ELECTRIC VEHICLES.

THE AUDIPHONE DIOCINESCOPE.

OUR readers will doubtless remember M. Clermont Huet's "diocinescope," a curious apparatus which made its début at the Exposition of 1900, and of which we gave a detailed description at the time.

The diocinescope consists of the following essential parts: (1) A drum carrying on its periphery a number of juxtaposed divergent lenses; (2) a second drum connected with the first and on the same axis with it, which carries along the successive negatives of the band of film; (3) a reflecting system (prism with parallel faces) interposed between the two drums and designed to send the images in the direction of the corresponding lenses; (4) a convergent lens forming part of the reflecting system and correcting the aberrations of sphericity of the divergent lenses; (5) an arrangement of prisms with parallel faces and a lens, interposed between the image and the observer's eyes, so as to produce two images at a proper distance apart to fit the eyes and thus assure binocular vision; and (6) a mechanical method of controlling the drums and film spools and permitting of easily winding the film from one spool to another without changing the direction of rotation of the winding handle. This instrument, which is nothing more than a cinematoscope permitting of a direct view of the images, is capable of being so arranged as to operate automatically after the manner of the coin-in-the-slot apparatus that are now so numerous. In fact, such a transformation has recently been made by M. Huet, who has completed his apparatus by combining a graphophone therewith, so as to permit the spectator while witnessing the different phases of the scene



THE AUDIPHONE DIOCINESCOPE; GENERAL VIEW AND DETAILS OF MECHANISM.