above the tops of boilers and cylinders of the main engines, with at each end of the machinery space an athwartship 1-inch steel bulkhead. For the steering gear, nickel-steel protection 2 inches thick and 1 inch on the flat was recommended. In working up the details of the design, it developed that the inclined deck would interfere to a very great extent with proper coal-bunker arrangement and means for rapidly stowing and emptying bunkers; so that the nickel-steel protection in wake of machinery may be placed either at the ship's side, or on the fore-and-aft inclined bulkhead between bunkers and firerooms. This change will give to these vessels an efficient arrangement of coal bunkers, which will add very materially to their steaming efficiency and endurance.

The Board recommended that a design be prepared by the Department, to include twin-screw reciprocating engines, with the necessary auxiliaries, of about 16,000 maximum I.H.P.; twelve water-tube boilers; an evaporating plant of 1,600 gallons capacity per day; a refrigerating plant of two tons capacity; a general workshop; the total weight of machinery including spare parts to be 794 tons. The Board recommended that the Department ask for bids under two classes; the first to be on the Department's design without changes in hull or machinery, and the second to be with the general characteristics of hull as set forth above, but on the bidder's design of machinery, preference being given to a turbine installation.

The 3-inch guns are to be supplied by chain ammunition hoists, two forward and two aft. The vessels are to be lighted by electricity. An electric generating plant of three 32-kilowatt machines is to be installed in separate dynamo room. The ventilating blowers, deck winches, and workshop motors are also to be electrically driven. Two large searchlights are to be installed. A wireless telegraph outfit is to be supplied. This, as well as other signal apparatus, is of special importance for the particular work the scouts will be required to perform. The vessels will carry two pole masts for signaling. There will be four smokestacks, 78 feet above base line. The forecastle deck will be raised, and will extend aft as far as the forward smokestack. The freeboard will be about 34 feet forward and about 22 feet aft. The total coal capacity will be between 1,000 and 1,200 tons; coal on trial, 500 tons. Sixteen officers and a crew of 368 men are to be carried.

The development of the design of machinery installation has in contemplation the following: Twelve boilers, modified Normand type, placed in three watertight compartments, with a total grate surface of 690 square feet, and a total heating surface 38,000 square feet. At full speed the coal consumption will be about 300 tons per day. Each boiler room is to have an auxiliary feed pump piped to feed the boilers in its own compartment, to have fresh-water connections only; a fire and bilge pump piped to supply fire main and ash ejectors and for pumping bilges; an ash ejector for removing ashes while firerooms are under air pressure.

There will be twelve blower engines driven by reciprocating engines or steam turbines and located in the deck space above the boiler rooms. The blowers are to be of sufficient capacity to give an air pressure of 5 inches in firerooms. The engines are to be of the four-cylinder, four-crank, triple-expansion type, with a low-pressure cylinder at each end. The cylinders are high-pressure 28½ inches, intermediate-pressure 45 inches, low-pressure two 62 inches diameter. The stroke is 36 inches; revolutions 200 per minute, with corresponding piston speed of 1,200 feet per minute. It will be noted that the low-pressure cylinder for the corresponding power is of considerably larger proportions than has heretofore been the practice with naval engines. The larger low-pressure cylinder will allow a greater range of expansion to be used, and hence will conduce to greater economy.

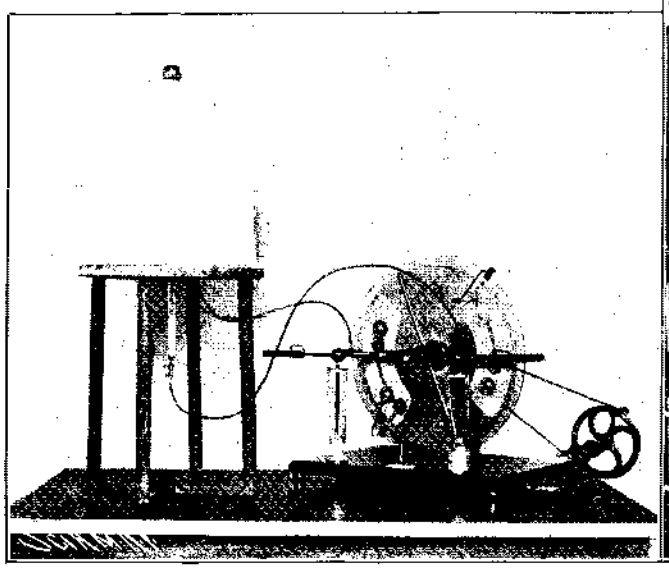

Fig. 1.—The Old Laboratory Experiment of 1884 with a Bell Jar Full of Fog Ready to be Dispersed by the Electricity Supplied by the Voss Machine, the Terminals of Which Are Connected Respectively with the Floor of the Jar and with an Insulated Point Inside.

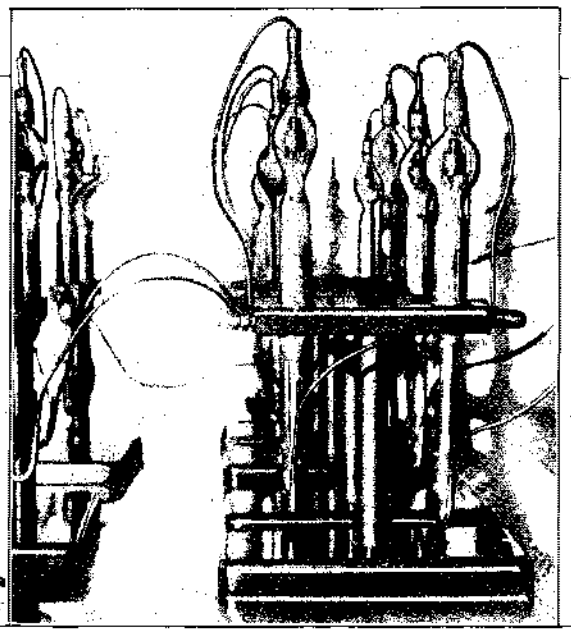

Fig. 4.—A Battery of Rectifiers Able to Stand Excessively High Potentials Without Conveying a Current in One Direction, while in the Other Direction they Transmit a Current Quite Easily.

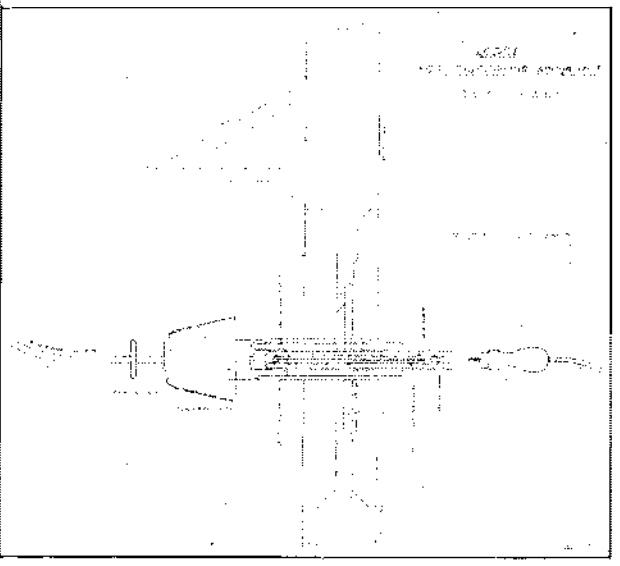

Fig. 6.—A Wall Insulator, Being the Arrangement Found Necessary for Carrying the High-Tension Leads Through a Partition and at the Same Time Enabling them to Maintain Something Like a Million Volts, even During the Damp Atmosphere of a Fog.

FOG DISPERSION BY ELECTRICITY.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A few months ago we briefly described in the SCIENTIFIC AMERICAN the latest experiments that had been carried out by Sir Oliver Lodge in dispelling fogs by the discharge of electricity into the laden atmosphere, and the highly satisfactory results that attended the tests. Through the courtesy of the inventor, we are now enabled to describe his process, and to illustrate the apparatus employed for the purpose.

The possibility of dispersing fogs which consist of one, or both, of two things—particles of dust in various forms, or minute drops of water vapor—has occupied the attention of this scientist for the past twenty years. In 1884 Sir Oliver Lodge, acting on the observations that had been made by the late Prof. Tyndall as far back as 1870, who discovered that when a hot body is held in strongly-illuminated dusty air, a dark or dust-free space is immediately formed above it, carried out a series of electrical experiments to substantiate Tyndall's theories, and also to discover the cause of the dust-free space. At first it was suggested that the solution was that the dust was burned and destroyed, but this explanation was soon disproved by using a moderately-heated body, which was not sufficiently hot to consume the particles. The same phenomenon was observed. Dr. Tyndall, unable to ascertain any other answer to the problem, advanced the suggestion that the air was dragged up in convection currents faster than its supported dust, which was consequently left behind. And so the question rested until Lord Rayleigh took up the subject in 1881, and shortly afterward by Sir Oliver Lodge, who carried out his investigations in conjunction with the late Mr. J. W. Clark. All the known experiments were repeated with minute care, and the results were highly satisfactory. In these preliminary trials hot bodies of varying descriptions were employed, but in the course of the researches the scientist accidentally conceived the idea of testing one hypothesis that had occurred

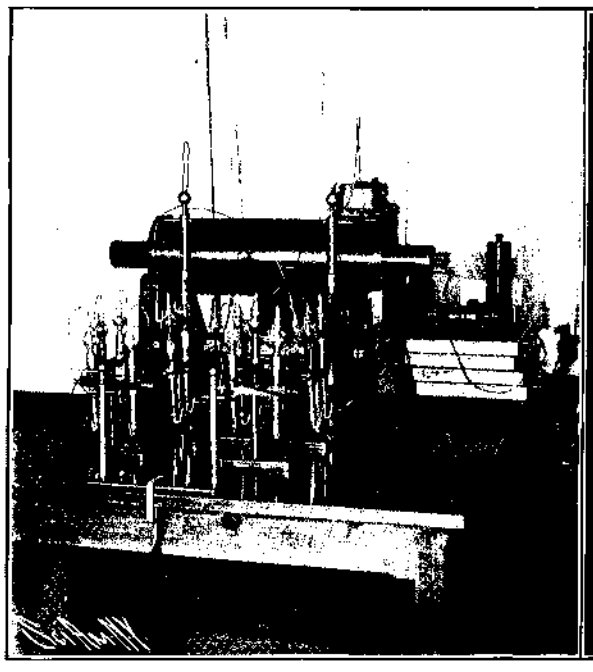

Fig. 5.—Rectifiers Connected up to a Coil Excited by an Alternating Dynamo with Condensers in Series with the Primary and Alternators so as to Get a Maximum Effect by "Tuning."

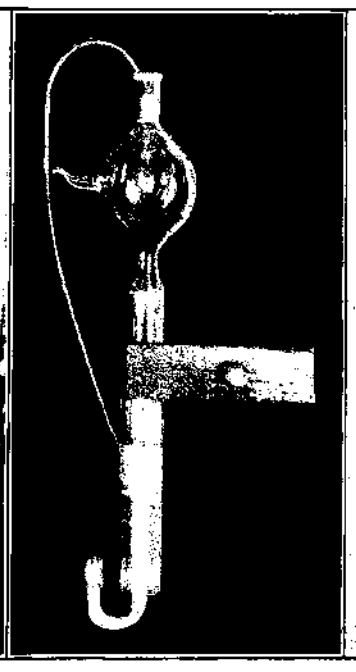

Fig. 3.—A Mercury Rectifier in a Rather Convenient Form for the Fog-Dispelling Experiments of Sir Oliver Lodge.

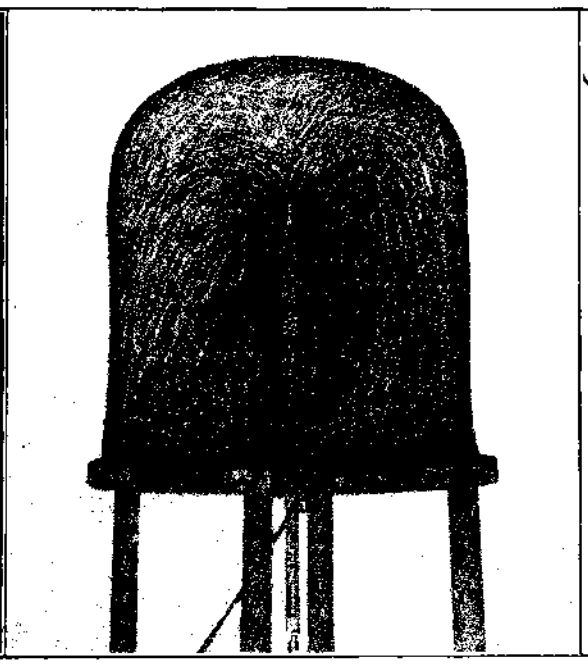

Fig. 2.—If the Supply of Electricity is Stopped the Flakes Fall; if it is Continued they are Rapidly Deposited on the Sides and Floor of the Jar.

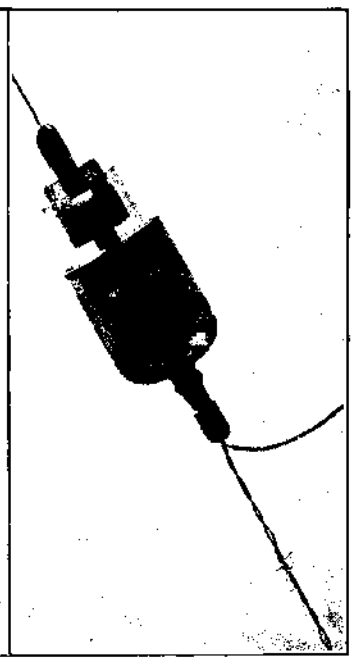

Fig. 7.—An Aerial Insulator that Fixes the End of an Insulated Barbed Discharging Wire, under Tension, by Means of a Wire Rope Tie.

to him during the early stages of the tests. It was considered possible that air in streaming over the surface of the solid immersed in the smoke, fog, or dust-laden atmosphere, might become electrified, and that from air so electrified dust might by some means or other be expelled.

To prove this hypothesis, the solid, which consisted of a rod, was electrified both positively and negatively to see what ensued. A current of 100 volts potential, increasing to 200 volts, was produced without scarcely noticeable effect. The positive electrification caused a slight widening, and the negative electrification a slight narrowing of the dust-free space. When, however, the potential was increased to a few thousand volts and brush discharge began to be possible, then a very violent and remarkable effect was noticeable. The dark space was widened enormously and tumultuously, and the whole box in which the experiment was carried out was rapidly cleared of smoke.

This experiment was carried out in the manner shown in our first illustration. A bell jar was filled with smoke—any kind will do, such as that produced from tobacco, camphor, turpentine, magnesia, brown paper, steam, wet straw, phosphoric acid, lead or zinc fumes—and the terminals of a Voss machine were connected respectively to the earth or its equivalent, and the second pole to an insulated point inside the bell jar. The Voss machine was then turned, and the small current produced caused the small particles of smoke or fog within the bell jar at once to form into flakes, which deposited themselves on the discharging rod and the sides of the jar, while the air within was rendered absolutely pure.

Exactly what occurs is to be followed in the second illustration, which shows the appearance of the jar during the discharge of electricity, being a temporary stage in the clearing. It was found impossible to obtain a photograph while the actual operation was in progress, owing to the short time occupied in the coalescing of the flakes—only a second or two. When the electric current is cut off, the flakes fall like snow; but when it is continued, they are quickly deposited. Whether positive or negative electricity is used, does not seem to make much difference.

But the dispersion of fogs, though easily accomplished in the limited scope of a laboratory experiment, yet this system offered no practical application under natural conditions in the open atmosphere. At that time the difficulties of producing a current of a sufficiently high potential, which would readily fly from the discharging points into the air, were such that further extension of the experiments had to be abandoned. In order to generate the requisite current required, a dynamo was imperative, but at that time, however, there was no type of direct continuous-current dynamo which could work at the essential high potential.

But the perfection of the dynamo enabled Dr. Lodge to continue his investigations, and some highly gratifying results were obtained. The inventor carried out a number of interesting and severe tests during some particularly dense fogs. The effect of the discharge of the current around the points of discharge was that the density of the fog was gradually reduced, and in a few minutes the air for some distance around was quite cleared, and the fog could be seen rolling toward this vortex, as it were, in fleecy clouds, which gradually melted away. This fact testified that the impulses were successfully dispelling the fog around the discharging points.

Prof. Lodge's experiments were shortly afterward, however, facilitated by the perfection of Mr. Cooper Hewitt's mercury-vapor rectifier. This device is especially useful, since it has the curious property of allowing the electric current to pass only in one direction through it. It can be also operated at very high potential, and enables alternating dynamos and transformers to be employed, the current being rectified so as to maintain a continuous discharge in one direction.

Following the introduction of this vapor lamp, Sir Oliver Lodge immediately applied it to his device. To comply with the special conditions and requirements of his operations, he devised a special type of rectifier upon this self-same principle, which is illustrated herewith. One way of using this rectifier is to employ it to redress the reverse pulses of an alternating current, thereby forming the positive and negative discharging streams. The special design of these rectifiers enables them to withstand abnormal pressure. During his present experiments, the inventor has been employing a battery of twelve rectifiers connected in series, and they will rectify at a pressure comparable to one million volts, which is the requisite potential. The dynamo current may be either a direct intermittent or an alternating one. It is first transformed up to the requisite potential, is then passed through the rectifiers, from where the positive and negative wires are taken to the discharging points. This battery of rectifiers will withstand excessively high potentials. They will not convey a current in one direction, though in the other direction they will transmit the current quite easily. If higher pressures are required, it is only necessary to increase the number of rectifiers.

To render this dispelling system most successful, it is imperative that the discharge should take place in the freest possible manner, without placing any unnecessary strains upon either the rectifiers or the insulation. This end may be assured by arranging the discharging wires in such a manner that one pole is earthed and the second erected on a mast or building or other high point, with a suitable means for discharging electricity, such as for instance a flame or a number of points. In some circumstances it is more convenient and satisfactory to employ two aerial wires, utilizing one for discharging the positive current, and the other for the negative streams, with a number of suitable points on each. For such cases Prof. Lodge has devised a special apparatus. Owing to the fact that there must be no leakage, the insulation must be as perfect as possible. The wires are incased in a thick envelope of gutta-percha, and every care is observed that there are no kinks, since the electricity might possibly spit from such points.

Owing to the tremendous potential of the current being transmitted through the wires, wherever the latter pass through any obstacles, such as for instance the wall of a building, the insulation has to be of the most elaborate nature to obviate any leakage of the current, since all surfaces near the wires are electrified to a certain extent. The result is that unless precautions are observed at these points, the current causes the small particles of moisture and smoke to adhere thereto, and in themselves constituting a gradually accumulating and excellent conducting surface for the electricity. For use at such points Sir Oliver Lodge has designed the insulator which we illustrate in the accompanying diagram. At the point where the wires pass through the obstacle there is a wooden frame with a vulcanite base. The insulator has a large glass rain guard, while the wire is carried through the wall in a glass tube inclosed in a gutta-percha-covered wire envelope, which is inserted in a vulcanite tube. The aerial tube insulator is somewhat similar, as will be seen in our illustration. This represents one of the aerial insulators employed to fix the end of an insulated barbed wire discharging under tension by means of a wire-rope tie. The electricity is brought in with a gutta-percha-covered wire. At the upper end of the wire there is a similar insulator supported from some elevated fixture, such as for instance a mast.

Sir Oliver Lodge has erected one of these fog-dispelling apparatus upon a small scale at the Birmingham University. The wires are carried from the inventor's laboratory within the building to high points upon the roofs. Although particularly dense fogs at this place are somewhat rare, yet Sir Oliver Lodge has carried out some interesting demonstrations, which have conclusively shown the utility and capabilities of the invention.

The system is not only applicable and valuable for the dispersion of atmospheric fogs, but is of great commercial utility. There are many industries where the atmosphere within the manufactories is constantly laden with fine dust or fumes, such as in flour mills, lead, copper, and arsenic works. In some instances these fumes are highly explosive, in others poisonous, and in many cases valuable, and are wasted, owing to there being no means of arresting their escape. Sir Oliver Lodge has devised an arrangement by which these fumes may be condensed by means of this device, placed in the flues or a settling chamber. The same device when applied to chimneys also constitutes an admirable method of abolishing smoke from chimneys, the particles of carbon being arrested during their passage up the chimney and deposited, so that nothing escapes into the outer air but the waste heat.

At Liverpool the inventor practically demonstrated its efficacy for the dispersion of river fogs. The apparatus was erected on one of the banks of the Mersey, and although the potential of the current employed was not abnormally high, yet a clear space of about 180 feet in radius around the discharging points was completely cleared of fog, the moisture of which it was formed being deposited. For the dispersion of such natural river fogs, the inventor suggests the suspension of barbed wires on either bank parallel to the river, and carried at a sufficient height from the ground as not to affect the traffic below. Positive electricity would be discharged from the wire points on one bank, and negative current from the corresponding wire points on the opposite bank. In this manner the waterway could be maintained absolutely clear to a sufficient height for the shipping.

In the quarterly statement issued by the committee of the Palestine Exploration Fund brief mention is made of a report received from Dr. Gurney Masterman on the changes of level in the Dead Sea during the second half of the year. It is stated that a continual fall has been observed. The level taken on October 26 was 10 inches lower than in August and 23½ inches lower than in April, 1904, the lowest level of 1904 being 15½ inches lower than the lowest of 1903.

Correspondence.

Tidal Power on Rivers of Bay of Fundy.

To the Editor of the Scientific American:

Recently an article appeared in your valuable journal from a Mr. Cleaveland, relative to the great opportunity for getting power from the tidal rivers at head of Bay of Fundy, notably the Petitcodiac River, flowing past Moncton, New Brunswick.

Mr. Cleaveland's contention is good so far as it goes, and undoubtedly much power could be had, at certain times, but he forgot to mention that for five months of the year, practically, these rivers are one solid mass of snow and ice, hence there would be only seven months of the year the power could be utilized properly.

It may be, however, Mr. Cleaveland has some plan or theory, whereby this tidal power could be still used during the five winter months. If so, I am sure all your readers and the public generally would be pleased to know his views on same, as if this difficulty could be met, there undoubtedly could be a wonderful amount of power derived from the many large tidal rivers at the head of the Bay of Fundy, such as the Petitcodiac, Tantramar, Shubenacadie, Avon, St. Croix, and many others of smaller size. I should like to hear more upon the subject. Inquirer.

New Brunswick, January 23, 1905.

The Automatic Train Stop.

To the Editor of the Scientific American:

Your admirable editorial entitled "Schedule vs. Safety" has been called to my attention. As I am the inventor of the automatic train stop used on the Interborough tunnel to which you refer, I feel entitled to express my opinion of the manner in which you have handled the subject. The eminently successful action of the device on the express tracks in the tunnel certainly warrants the belief that it could be made to work equally as well on the local tracks, were it not for the impression now prevailing that it is necessary to keep each train in a separate section or block. Theoretically this is right, and is just what it does. In practice, the presence of a train in one section need not require that a train about to enter a section behind it should come to a full stop, and stay there until the first mentioned train has proceeded into the next block; for that would most certainly congest a very busy line.

The proper function of the automatic train control is not to assume the prerogatives of the healthy human intelligence, but it is rather the substitution of mechanical precision for the occasional lapses or misconceptions of the human element, thereby preventing an impending catastrophe until the man at the controller can intelligently and comprehensively reassert his control and proceed under (if you please) the united judgment of himself and the train conductor, who might otherwise ordinarily remain in ignorance of the existence of the danger conditions confronting his train.

At least one chief engineer of signals says, in effect, that "an excessive amount of traffic justifies the taking of increased risks in order to get the company's business over the road on time." The public, however, are beginning to think that increased business calls for extraordinary precaution; in fact, records show that the most and the worst railroad wrecks have occurred in years and on those roads put down as the busiest and most prosperous. On a road operating but two or three trains a day, it is much safer to depend upon the judgment of the engineer than it is upon roads where trains are counted by the hundreds. The latter should be required by law to use only the absolute system, which means a full stop at a danger signal.

The statement of the signal engineer above referred to shows that permissive signaling is the rule on his road rather than the exception. The difference between the application of the absolute system with visual signals and the same system with visual signals and the automatic control as an auxiliary is the same, except when a misunderstanding of the visual or written orders is offset by the mechanical precision of the automatic control, which never sleeps nor becomes confused. He who says it is impractical, is practically claiming that human ingenuity has reached its fullest limits in the present perfection of visual and audible signals, which in turn means that as traffic and speed increase, we are to be treated to increasing numbers of casualties. Where trains are run under close headway, my resetting device is essential, and may or may not be so operated as to require the intelligent action of two individuals to restore normal power and brake system conditions. The time for its operation can be reduced to two or three seconds, where the rules of a road permit a train to go on "under control." This would be of slight consequence compared to the risk run by not using an automatic control. T. E. Kinsman.

91 Liberty Street, New York.