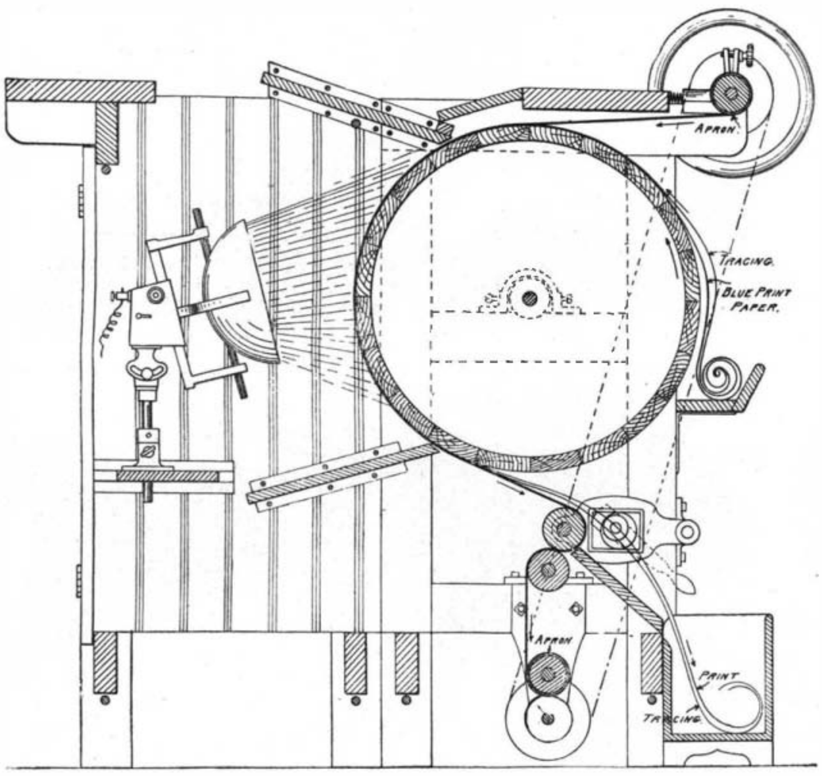
the casing consisting of two parts joined together and fastened by the set-screws, *a' a'*. These set-screws fit into slots in the outer flange of the casing, and a spring, while keeping the two portions of the casing in position, takes up much of the vibration of the tool when working, thus protecting the hand from jolts.

At its farther end the connecting rod *I* has a longitudinal slot through which passes the pin, *g*, attached to the plunger, *H*. This latter works in a cavity of the hammer, *G*. The plunger is shaped to fit the end of the rod, as shown, so that at each revolution of the crank, a blow is transmitted from the rod *I* to the hammer *G* through the plunger *H* and the spring in the cavity of the hammer. This latter is therefore a floating hammer, not being rigidly connected to the power shaft and its blow depending entirely upon its momentum.

By this construction the shaft is relieved of all jar due to the hammer striking the end of the tool, and thus the even running of the shaft without undue racking is insured.

It is evident that the instrument can be worked from any other power source instead of an electric motor. But the latter is found by far the most convenient. The hammer can be used in places which would be inaccessible to instruments of the pneumatic kind.

The shaft is driven at high speed, and the motion is kept uniform by means of a flywheel situated within the flat cylindrical portion of the casing shown at the rear of the instrument in Fig. 3, which also shows the tool. This latter, *f, F* in the diagram, has a cylindrical portion, *f*, fitting into the anterior end of the instrument, and a thicker portion, *F*, of polygonal cross-section, preventing the tool from entering beyond the shoulder formed by this polygonal portion, except in so far as the collar against which that shoulder presses is forced inward against the spring behind it by the hand holding the instrument. By this arrangement the workman is enabled to regulate the blows of his instrument.



CROSS-SECTION OF BLUE-PRINTING MACHINE.

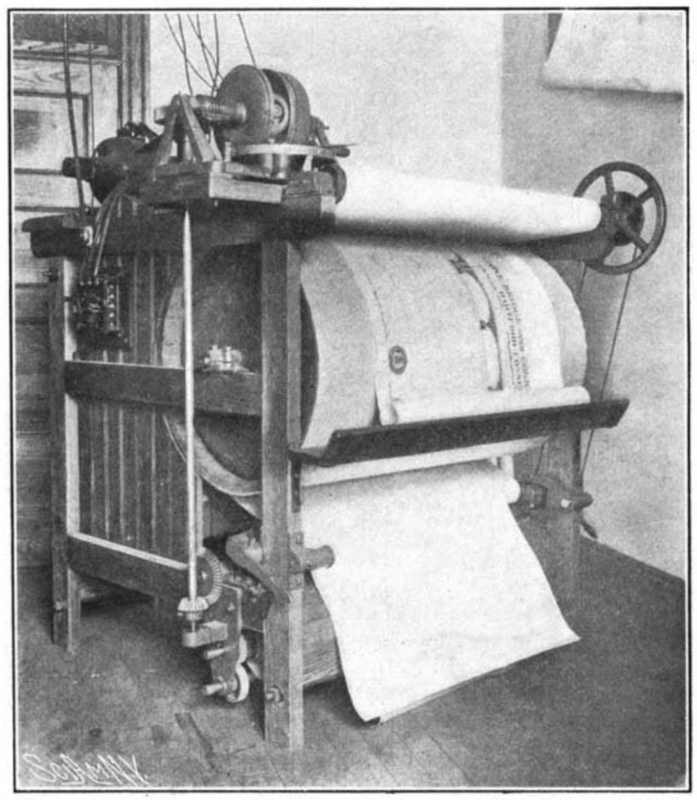
ELECTRIC BLUE-PRINT MAKING.

BY GEORGE J. JONES.

The marvelous development of the blue-print has been responsible in no small measure for the rapid manner in which great engineering and mechanical tasks are now performed in the workshops of this country. Our facility to successfully carry out stupendous engineering undertakings has within a few years carried our industrial fame to the four corners; and that the tremendous feats which have been done with such marvelous rapidity by our engineers and our industrial establishments have been made possible by the humble blue-print, is conceded by those who know.

It has been only a few years since the virtues of the blue-printing process were first recognized, and since that time there has been an almost complete revolution in workshop and building methods, and the manufacture of these blue-prints has developed into a vast industry. So formidable has the business grown, that it has been found necessary to find a substitute for the sun for the purposes of printing, not only for the reason that the sun is more or less an uncertain commodity, but because he can not be induced to work overtime, no matter how serious the emergency.

Naturally the electric light has been resorted to, and while it is somewhat slower than the sun, prints can be turned out night and day. These machines are of recent invention, and it is by their use that certain large photographic plants are enabled to hang up signs reading something like this: "Blue-prints made on short notice. Night or day. Rain or shine."

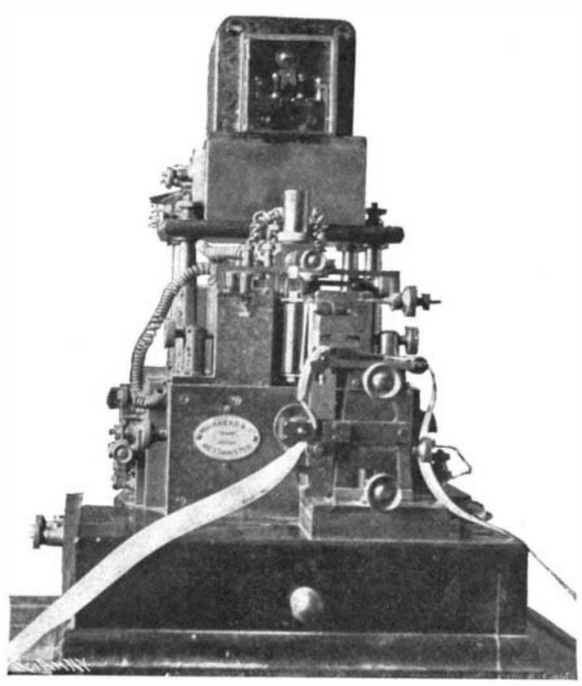


A BLUE-PRINT-MAKING MACHINE.

Probably the most complete of these machines is one which is continuous in its operation, and which is fed by the operator with great lengths of tracings and blue paper in much the same manner as the washerwoman feeds the wet clothes into the wringing machine. This is known as the Federal, and is shown in the accompanying cuts in perspective as well as section, clearly revealing its operation as well as its general appearance. The large wooded drum, around which the tracings and printing paper pass, is moved either by a connection with the shafting or by an electric motor mounted on the apparatus, the speed of the drum being regulated by a device shown on the top of the machine. A traveling apron of transparent material takes the place of the glass in the printing frame of the ordinary type, and as it is under tension at all times, it insures an even and close contact at all points. This apron is wound on a small drum at the top, and after passing along the large drum where the contact and exposure take place, it is wound up on the drum below; after the printing operation has been completed it is rewound by hand back on the upper drum. In the rear of the machine are three arc lamps with reflectors, which concentrate the light on the tracings which, with the exposed prints, drop out into the box in front. The blue paper may be kept in a roll ready for use on the upper front part of the machine, or may be fed in small sheets with the tracings where the work being done is of ordinary size.

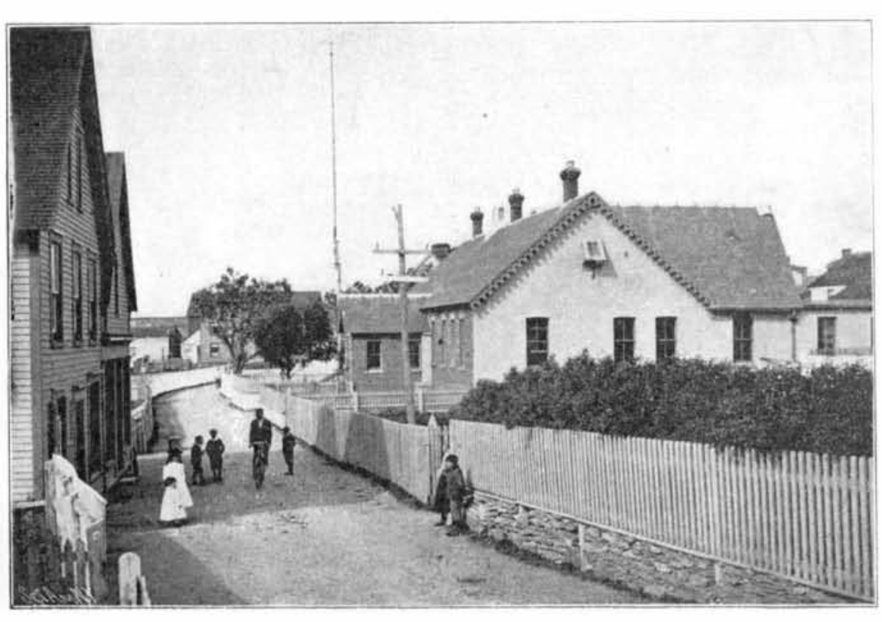
These machines are made in two widths, thirty and forty-two inches, and the apron supplied with them is seventy feet long, and prints of this size can be made as readily as smaller ones where it is desired. The ability to make prints of this size greatly enlarges the sphere of usefulness of the blue-print.

A feature of this machine quite as valuable as its capacity for making large prints is the fact that it can

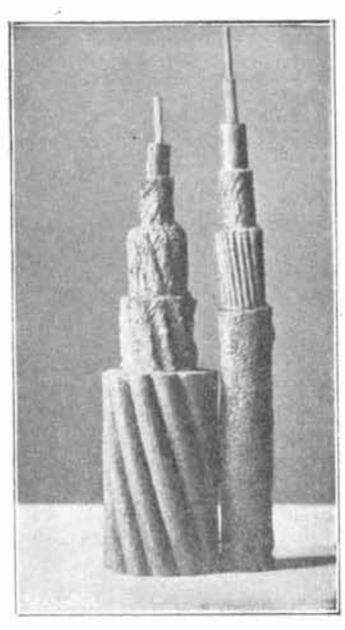


The Siphon Recorder.

A Corner of the Battery-Room at Heart's Content.



The Station at Heart's Content.



Sections of the Cable at the Shore End and Deep-Sea Portions.

THE FIRST ATLANTIC CABLE STATION IN AMERICA.—[See next page.]

be readily turned into a sun-printing machine. At such times as the sun is available this represents an economy of some considerable moment, for it not only saves the cost of the current, but also makes the prints somewhat quicker, thereby increasing the capacity of the apparatus.

So general has the use of blue-prints become, that it is now one of the features of the business of the cabinet maker and office furniture manufacturer to build cabinets designed especially as a receptacle for these sheets. For large offices they are generally designed to meet the particular requirements of the establishment, and are necessarily quite extensive. Smaller sizes are, however, carried in stock by the larger dealers in this sort of material. The cabinets consist of a series of receptacles of varying sizes, with the openings protected by means of hinged and falling doors. In the center and toward the top is a small drawer, with an index system in which a record of each print in the cabinet is kept. The top of the cabinet offers a smooth flat surface for the examination of the prints.

THE FIRST ATLANTIC CABLE STATION IN AMERICA.

It is a curious coincidence that the first signal sent from the Old World to the New by means of wireless telegraphy should have been received not far from where the first Atlantic cable message was also received. Signal Hill, which marks the entrance to the harbor of St. Johns, Newfoundland, was the site of the first Marconi station in this country. On the shore of Trinity Bay on the northeastern coast of the same island is located a little village bearing the attractive name of Heart's Content. In it reside less than a thousand souls, and it differs little in appearance from other Newfoundland settlements, with the exception that the houses are somewhat more pretentious and it does not contain as many flakes for drying codfish. This is because the town owes its existence to the fact that it is one of the terminal points for the cables which extend between the eastern and western hemispheres. Heart's Content might be called the birthplace of submarine communication, for in one of its buildings was received the first message sent under the seas—in which Queen Victoria congratulated the President of the United States upon this connection between the nations. The cablegram consisted of ninety words and required sixty-seven minutes to transmit, owing to the crudity and the imperfections of the apparatus. Shortly after being placed in operation the cable failed entirely as a means of communication. Seven years later the "Great Eastern" entered the harbor of Heart's Content, and another cable was completed, to be severed within a year. Again this famous steamship crossed the Atlantic with a third cable, and her crew finally spliced the one laid in 1865, so that the Newfoundland operators could receive messages over two separate systems, the newer one containing no less than 4,000 tons of wire and covering.

In the early days of the cable service the receipt of messages depended largely upon the operator's eyesight, as the words were indicated by electric flashes of different lengths, which appeared on the surface of a small mirror. Then came the invention of Lord Kelvin—the siphon recorder—which has been in service nearly thirty years, translating the breaks in the electric current sent under the sea into legible characters upon a roll of paper with which it is connected. So many communications are going to and fro between the two worlds that although other cables have been laid, a force of nearly thirty operators is required in this little town in the far North. They are divided into a night and day staff, and are in charge of a general superintendent—Mr. William Bellamy.

The cable office is the principal building in Heart's Content—a plain two-story structure built of brick and stone. The principal apartment is the operating room, where are placed the siphon recorders and other instruments. Considerable space, however, is required for the battery, as a large quantity of chemicals are required to fill the several hundred cells used. These are placed in racks in the battery room, and the services of one man are continually required to clean and replenish the jars. The cables are laid to the operating room through an underground conduit which is walled with masonry. The shore section and that which extends into shallow water is considerably smaller than the deep-sea cable, as it requires less protection. The one which was last laid consists of eighteen strands, each strand composed of seven iron wires forming a metallic sheath for the copper wires which convey the electric current. The copper is embedded in gutta percha incased in hemp which is saturated with a combination consisting principally of beeswax, paraffine, and oil; this casing is surrounded by the iron wire, which is also covered with a waterproof compound. Several coatings of the hemp covering are wound about the gutta percha, so that the copper wires of the deep-sea cable are really protected by five wrappings. The shore section differs from the deep-sea principally in the absence of the wiring on the outside.

The services of a repair ship are frequently needed, as the terminals of the cables are liable to be injured by the masses of ice drifting down from the Arctic regions throughout the summer, as well as by other causes, and a repair ship is stationed in Trinity Bay ready for immediate service. The "Minia" is a schooner-rigged steamship carrying three masts, so that sail as well as steam can be employed when under way. The sails, however, are principally utilized in "lying to" when the vessel is making repairs where the water is too deep to permit anchorage. She carries lengths of extra cable coiled in tanks specially built for the purpose, and is provided with a set of steam winches and drums for hoisting and lowering. Her equipment also includes modern grappling appliances, electrical testing outfits, and in addition to the regular crew she carries several expert electricians and cable repairers.

APPROACH TO THE NEW EAST RIVER BRIDGE.

If the carrying capacity of a bridge is the true measure of its size and importance, then the new East River Bridge, now known as the Williamsburg Bridge, is the largest structure of its kind in the world. The length of the river span from tower to tower is 1,600 feet. This is 110 feet less than each of the two great cantilever spans of the railroad bridge across the Firth of Forth, Scotland; but although the Forth Bridge has longer spans and is a much longer bridge from approach to approach, it does not compare in carrying capacity with the new bridge across the East River which is now nearing completion. The Forth Bridge was intended simply to form a railroad connection for a double-track road, and provision is made merely for two lines of track and two footpaths, the total width of the roadway being about 40 feet, whereas the floor system of the Williamsburg Bridge measures 118 feet between the hand rails on the outside of the roadways, and provision is made for four street railway tracks, two elevated tracks, two 18-foot roadways for vehicles, two passenger footways, and two bicycle paths, or in other words the new bridge will have more than the capacity of a great city avenue.

When the bridge was planned some seven or eight years ago, the Bridge Commissioners, profiting by the experience gained with the Brooklyn Bridge, decided not to build any terminal station at each end of the bridge, but rather to consider the bridge as a great connecting thoroughfare between New York and Brooklyn, over which the traffic, elevated, trolley, vehicular, and pedestrian, could pass to and fro without the delays incidental to bridge terminals. Of the various kinds of traffic that will seek the new bridge, only that of the elevated railways will approach it above the normal street level. Surface cars, street vehicle traffic heavy and light, automobiles, bicycles, and pedestrians will enter the bridge approach at street grade. At the center of the bridge the trolley cars and the vehicular traffic will cross the river at an elevation of 140 feet above mean high tide; and both the roadways and the car tracks will rise from street grade at the approaches to the highest point of the bridge at midstream, on the regular grades corresponding to the curvature of the floor system. The foot passengers and the bicyclists will travel on an upper deck of the bridge, built at a sufficient height to clear the roofs of the trolley cars, while the elevated railways will enter the bridge approach at their normal elevation above street grade, and will continue above the approach on a level grade until they meet the rising grade of the bridge floor system, when they will pass over the bridge at the general level of the floor. The position of the various tracks and roadways was shown by this journal very clearly, in an illustrated article published in our issue of June 15, 1901.

Now to bring these various classes of traffic into their proper relative positions on the bridge required careful thought and judicious planning. The view of the bridge shown on the front page of this issue is drawn at a point near the anchorage on the Brooklyn side, and it shows how the traffic is segregated and brought to its proper relative position and level. In the first place, the foot passengers travel over the approach on a single passenger walk located on the center line of the bridge, until near the abutment, when the walk divides and passes to either side of the elevated structure, the traffic toward New York taking the right and that from New York the left of the center. Bicycles and motor vehicles approach the anchorage on a central driveway, located beneath the elevated structure and above the passenger footpath, and at the point shown in our engraving the pathway divides, the bicyclists and motor cyclists bound for New York taking the right-hand of the structure, and the travel from New York coming in on the left-hand side. At the anchorage the footwalk rises to the same level as the bicycle path, and diverges to join the latter, the bicyclists and foot passengers being separated by an iron railing. It will be understood that although at the point chosen for illustration the floor of the elevated structure is located at a considerably higher level than the roadways and trolley tracks, necessitating the use of columns of considerable length, the steep grade of the bridge causes the elevated and trolley tracks to rapidly approach a common level, until ultimately the bicyclists and foot passengers find themselves traveling at a higher elevation than the roofs of the elevated cars.

Our drawing also shows the architectural treatment which has been given to the bridge under the direction of the Municipal Art Commission. It includes the tall finials at the tops of the towers, a softening of the hard lines of the stiffening truss portals, and the provision of the two cut stone shelters above the anchorage. The effect has been to greatly improve the bridge by softening the hard, angular effect which characterized the structure.

Three More Airships for the St. Louis Contest.

Three more airships have been invented and will be entered in the World's Fair aerial tournament to compete for the grand prize of $100,000.

W. M. Morris, a Monte Vista, Col., mining engineer, is one of the contestants. His machine will be 30 feet in diameter and 150 feet long when fully rigged. Aluminium will be the material used in its construction, but no gas bag will be used as in other flying machines.

E. A. Kindler, a Denver, Col., man, has completed a model for an airship and conducted a satisfactory test. He will enter it in the contest for the $100,000 prize at the Fair. Safety appliances are a feature of the airship. Canvas flaps three feet wide extend entirely around the balloon as on Stevens' airship. These are limp except in case of sudden descent, when they open out like umbrellas or parachutes and are large enough to check descent to a gentleness devoid of danger should the gas bags fail completely. Motive power is furnished by a storage battery. The framework, which is made of aluminium and light steel tubing, with the motor, battery and propeller, which is six feet from tip to tip and has four blades, will weigh about three hundred pounds. A test was made recently of the model. The machine is said to have described a circle about fifty feet in diameter, rising, dipping, and finally descending to its moorings without a hitch in its mechanism.

Streator, Ill., will be represented in the aerial tournament by an airship planned by Mr. Reiferscheid, of that town. Reiferscheid's machine consists of a balloon pointed at both ends and lying in a horizontal position. Around this balloon are strips of aluminium strong enough to make a substantial framework. At each end are the propellers, six in all, to be used in raising and lowering the machine and to assist in guiding it. A six horse-power gasoline motor will provide the motive power and the balloon will be filled with hydrogen gas and hermetically sealed. Large fans will provide a safety device which will permit the ship to slowly descend in case the balloon collapses.

The British Antarctic Expedition.

On June 10, Sir Clements Markham, president of the Royal Geographical Society, lectured on the work of the British Antarctic expedition. Although he did not give much information in addition to that which has already been published, he did read a number of private letters containing some valuable data.

It seems that Commander Scott, on his ninety-four-day sledge journey, reached latitude 82 degrees, 17 minutes south, and longitude 163 degrees east, from which it would follow that the eastern coast line of Victoria Land, to which he adhered, extends almost due south of Mount Erebus, his starting point, with only a very slight deflection to the east. A range of mountains extended beyond this point as far as he could see in a southeasterly direction. Scott must have traveled over 980 statute miles on this remarkable journey. His most southerly point was only one mile farther from the South Pole than the corresponding record for the North Pole made by Peary in the Arctic. The "Discovery" was frozen in latitude 77 degrees, 50 minutes, or more than 500 miles further south than any ship ever wintered before. An extensive land mass was found in longitude 152 degrees, 30 minutes west, to which the name of King Edward VII. Land was given. Mountains tower above the land to a height of 2,000 and 3,000 feet above the sea level.

In the other sledge journey, which was undertaken by Armitage, longitude 157 degrees and 25 minutes east and latitude 77 degrees and 21 minutes south was reached. Armitage penetrated Victoria Land almost due west and reached an altitude of 9,000 feet.

An old subscriber, in remitting for renewal of his subscription for the coming fiscal year, writes us humorously, as follows: "A man might get along without his shirt, and could do without the cereals, Force and Oatmeal, but I defy a man to get along without the Scientific American if he wants to fatten his brains to meet men of brains in the common walks of life. Give me the Scientific American, and I will go without my breakfast. Yours always hungry for *top knot* food."