The Industrial Development of Cleveland, Ohio.

The rapid industrial development of the West finds no more notable illustration than the recent rapid growth of Cleveland, Ohio, as a manufacturing city. Its first city directory, issued just 40 years ago, enumerated among the manufactories on the east side, 4 iron foundries and steam engine manufactories, 3 soap and candle manufactories, 2 breweries, 1 sash factory, 2 ropewalks, 1 stoneware pottery, 2 carriage manufactories, and 2 French burr millstone manufactories. These were all very small in comparison with works of the same nature at the present time. On the west side of the river, then known as Ohio City, there was the Cuyahoga Steam Furnace, a steam boiler factory, a saleratus factory, and a glue factory.

The directory of the current year shows among the iron-working establishments, 16 first-class foundries, any one of which does more business in a year than all the iron works of Cleveland combined in 1837, 23 machine shops, 8 steam engine manufactories, 7 boiler making establishments, 4 agricultural implement manufactories, 3 axle manufactories, 2 boiler plate works, 6 bolt manufactories, 2 chain works, 2 cast steel works, 9 iron fence and railing works, 2 spring factories, 2 iron pipe factories, 3 car wheel factories, 2 car journal manufactories, 1 architectural iron works, 16 iron works of general character, 1 steel screw factory, 5 bridge building works, 1 car building works. There are also 4 brass foundries, 15 planing mills, 3 white lead factories, 3 woodenware works, 1 woolen mill, 4 chemical works, 6 flouring mills, a number of oil refineries of large capacity, including the immense Standard Oil Company's establishment, and manufactories of various other descriptions, with innumerable smaller workshops.

Handsome as Cleveland is, and justly as it bears the title of the Forest City, remarks the *Graphic*, which devotes the major part of an edition to the pictorial illustration of the city, it is, nevertheless, one of the great manufacturing points of the country. It has earned for itself the title of the Pittsburg of Ohio by the number and importance of its iron works. The odors of its great oil refineries are borne upon the breeze in all directions. Dense clouds of smoke are carried from the numerous foundries and factories far out upon the lake, so that the voyager from Buffalo is apt to see the smoky sign of Cleveland's whereabouts some time before the city itself is visible. Along all the five railroad lines entering Cleveland, but especially along the two principal coal roads from Pittsburg and the Mahoning Valley, are stretched manufactories of various kinds, and the Cuyahoga Valley is a busy hive of industry, while factories, large and small, are scattered through other parts of the city.

The development of the iron mines of Lake Superior, largely by Cleveland enterprise, and the easy access to the vast coal fields of Northeastern Ohio by the Ohio Canal and branches, and the Cleveland and Pittsburg and Mahoning railroads, encouraged the development of the iron making industry, which, together with manufacturing generally, received a sudden and extraordinary stimulus from the demands growing out of the war. Cleveland enterprise, also, was largely instrumental in the development of the petroleum fields of Pennsylvania, the consequence being the transfer of the greatest share of the refining industry to Cleveland, which has remained the headquarters of the refining trade. The opening of a railroad to the Tuscarawas Valley, and the connection of the railroad from Columbus with the Hocking Valley Railroad, placed Cleveland in communication with two new coal fields of inexhaustible extent, and the completion of the Valley Railroad next year will open an independent route to still another coal field, and furnish increased advantages for manufacturing.

While Cleveland is thus favorably situated for obtaining the raw materials, it is no less so for the distribution of the manufactured articles. Its railways radiate east, west, and south, like the ribs of a fan, with innumerable branches from the main lines, reaching every part of the country. To all principal points there are two or more competing lines. In addition, the lake affords unlimited facilities for shipment to Canada on the north, and to most points west and east. Under these favoring circumstances it is no wonder that Cleveland has become, within a few years, one of the most important manufacturing cities west of the Alleghanies.

Concentrate your Effort.

When Agassiz was asked to give his opinion on a question in chemistry, he persistently declined. "I am no chemist," was his only reply. This resolute concentration of his power in a few well defined channels was one of the secrets of his eminence. In this age, when knowledge goes on adding province after province to her vast empire, one can hope to explore but a little space. There are no longer any universal conquerors. Goethe and Humboldt have left no successors, and if they themselves were to return, they could not possibly take the positions they once held. Half the intellectual failures come from a lack of definite aim and an unflinching devotion to some special pursuit. When so many interesting fields of inquiry are open, it requires a Roman fortitude of mind to purposely give up all save one or two. But this is precisely what you must do if you mean to make your power tell in the world. To concentrate is to master something eventually, while to diffuse your time and energy is to acquire a great mass of imperfect knowledge, and to hold superficially a multitude of disconnected facts. There isn't a part of the human body, or a branch of any science, upon which one could not spend a lifetime of work, and yet leave much untouched. The Greek scholar who died lamenting that he had not confined his work to the definite article, instead of taking up in addition the indefinite, and so leaving both incomplete, is an example of what is demanded of one who means to master any one thing. Herbert Spencer is doing an immense work in the way of collecting facts that have a bearing upon each other in the various departments of science; but familiar as he is with all these subjects, he cannot do the work himself. Human life would not be long enough. Other brains and hands must serve him. And even when a scholar sets himself to do one thing, and nothing else, he finds himself unable to get everything at first hand. He is forced to take something from other workers in the same field. This is the experience of all life as well. You can do well only a few things, and the fewer they are the better you will do them. The Admirable Crichton type of man is very interesting to read about, but in actual life he is likely to raise great hopes, be very entertaining, and die without doing anything. The man who concentrates must often admit his ignorance, and he need not be ashamed to do so, for he knows that on his own ground he can accept the challenge of every comer.—*Christian at Work.*

A NEW BOTTLE STOPPER.

The accompanying engraving illustrates a device by which any quantity of liquid, even single drops, can be drawn from a bottle without incurring any loss by spilling. The device consists of a stopper and a faucet provided with a spout on one side. The whole apparatus is made of Britannia metal, and is covered with cork on the part inserted into the bottle. By opening the faucet more or less the flow of the liquid may be regulated.

POCHTLER'S BOTTLE STOPPER.

This stopper is the invention of Mr. Carl Pochtler, of Vienna. Several stoppers similar to this have been patented in this country.

Our National Surveys.

The United States coast survey steamer, Blake, left Washington, November 28, for the West Indies. She will be gone six or eight months on a scientific cruise. Professor Agassiz, of Cambridge, joined the Blake, and will remain aboard her throughout the cruise. The work of the Blake will consist principally of deep sea soundings and dredging. The following is a list of her officers: Commander J. R. Bartlett, commanding; Lieutenant W. O. Sharrer; Lieutenant J. P. Wallace; Master, H. L. Jacobs, and Engineers, George H. Peters and E. L. Reynolds.

Professor F. V. Hayden and Major J. W. Powell have reported to the Secretary of the Interior the general results of their topographical and geological services the past season. The former says the results have been on the whole very satisfactory. About 12,000 square miles of very difficult country were surveyed, much of it in minute detail. The Yellowstone Park and the Wind River range of mountains formed a part of the region covered by Professor Hayden's survey.

The work under Major Powell has been prosecuted south and east of the grand cañon of the Colorado river, and little irrigable, but extensive grazing lands have been discovered. He reports having collected much ethnological material, and states he has nearly completed a map showing the distribution of the various Indian tribes within our present boundaries at the dates they were first known to Europeans.

The annual report of Lieutenant George W. Wheeler on the surveys west of the 100th meridian shows that nine districts and three astronomical parties were sent into the field this year. Their field labor will continue until some time in December. The survey this season embraces areas in California, Colorado, Nevada, Oregon, Texas, New Mexico, Utah, and Washington, connecting intimately with those of former years. A geological survey of portions of Colorado and New Mexico, by Professor J. J. Stevenson, was also carried toward completion, supplementing work of a former season by the same gentleman. During the winter and spring a topographical and hydrographical survey of the Great Salt Lake basin was carried forward. The detailed surveys of the interesting Lake Tahoe region and the Washoe mining district receive special notice. During the year ten topographical atlas sheets have been completed and published, several of which show land classification, and to all of which that important feature will ultimately be added. The second volume of the quarto reports of the survey, entitled "Astronomy and Barometric Hypsometry," and "Catalogue of the Mean Declination of 2,018 Stars," has also been published during the year, and other important works are in progress, of which Volume 6, "Botany," of the quarto reports, is in press. The area which will be surveyed by the parties in the field during this season is, approximately, 40,000 square miles in extent.

Last spring, in the original draught of the Sundry Civil Bill, containing the appropriations for these surveys, appeared a paragraph directing the American Academy of Science to prepare a plan before the next session of Congress under which the Interior Department Surveys should be consolidated, with a view to greater efficiency and economy. It is charged that this emanated from those interested in the War Department survey. At all events, as drawn it did not touch the Wheeler survey. The Hayden and Powell survey people were on the alert, however, and had the clause so amended as to include the entire lot of Government surveys. The amendment was passed, and the Academy of Science met November 5, to complete its report. Since then General Humphreys, chief of the engineers, has resigned his seat in the Academy, it is said because the report reflects so severely on the surveys made by his corps. However this may be, it is known that it recommends a sweeping change by proposing to consolidate the Wheeler, Hayden, and Powell surveys with the Coast Survey (now connected with the Treasury Department), transfer it to the Interior Department, giving it the new title of Coast and Interior Survey, equip it with a geological bureau for closet work, placing the topographic and geodetic work in the hands of civil engineers appointed for life, and turning over to this survey all appropriations made for geographical purposes, as well as those for the survey of public lands preparatory to sales. It is also recommended that the duties of the Surveyor General and of the General Land Officer be limited to the sale of the public lands.

Windmills.

Windmills are so constructed that the sails move in a nearly vertical direction. Motion is by this means communicated to the wind shaft, the brake wheel, and the center wheel that conveys the motion to the spur wheel driving the burrs. It is of importance that the sails be made in such a manner that the wind may have the greatest possible effect on them; for the wind does not act perpendicularly on the sails of a windmill, but at a certain angle, as the sail varies in its degree of inclination at different distances from the center of motion. As early as 1759, Smeaton made experiments upon the inclination of the sails in windmills. The inclination of the sail to the plane of revolution he found should vary in the following ratio, where the radius is supposed to be divided into six equal parts, and the angle of the sail given at each point:

	Angle with the axis.	Angle with the plane of motion.	
0		—	center.
1	72°	18°	
2	71	19	
3	72	18	middle.
4	74	16	
5	77½	12½	
6	83	7	extremity.

This inclination of the sail to the plane of revolution is known as its weather.

The velocity of the windmill sails, whether loaded or unloaded, so as to produce a maximum, is nearly the velocity of the wind, their shape and motion being the same. A windmill with 4 sails, the circle described by them being 72 feet in diameter, can raise 1,000 lbs. 230 feet in a minute. It is generally calculated that the millstones in a windmill should make five revolutions to every one made by the sail. The sails do not begin to turn until the velocity of the wind is about 12 feet per second. When the wind has a velocity of 19 feet per second, the sails will make from 10 to 12 revolutions per minute, and the burrs will grind from 880 to 990 lbs. per hour. When the wind reaches a velocity of 30 feet per second, a mill will carry all sail and make 22 revolutions per second, grinding 1,984 lbs. of flour in an hour. Following is a table of the velocity of wind:

Character.	Feet per second.	Pressure per square foot in pounds.
Scarcely sensible	1·5	1·005
Gentle wind	3	·123
Moderate breeze	6	·133
Brisk breeze	18	1·21
Good breeze	22	2·85
Brisk gale	30	4·44
High wind	45	9·96
Very high wind	60	17.71
Storm	70–19	30·49
Hurricane	100 or more.	

The tips of the sails in a windmill often move at the rate of 30 miles an hour, or 44 feet per second.

It is of great importance in windmills that the wood and iron work be of the best possible description. The brake wheel should be strongly constructed and covered with hard wood, and of ample length. The backs for straightening and carrying the sails should be made of the best timber, free from imperfections; and, consequently, pine or oak is generally employed for this purpose. The sails are attached to these backs by means of strong iron screw bolts. If the sails are 38 feet each in length, the backs should be made 40 feet in length, or two thirds the length of the sails. The

back is made as thick and wide at the middle as will fit the mortise in the wind shaft. The proper bearing must be given the back on the neck and journal. The proper inclination varies in different circumstances; the general rule is to give them from one to two inches to the foot of fall.—*American Miller.*

New Car Heating Apparatus.

A new car heating system has been adopted by the Metropolitan Elevated Railroad, of this city, and the apparatus has been applied to all of the cars on the road. Each car is provided with two radiators, composed of sections of three inch cast iron pipe, connected end to end by short pieces of one inch wrought iron pipe. These radiators are arranged along the sides of the car, one on each side, under the seats, and the steam pipes of the several cars in a train are connected by flexible pipes. Steam is taken directly from the locomotive boiler and reduced to about 5 lbs. pressure. It is conducted through all of the radiators in the train upon one side, and is returned to the locomotive by the radiators and connections on the other side. The water resulting from the condensation of steam is discharged into the water tank of the locomotive.

A steam siphon, which is connected with the discharge pipe, is used to remove water from the pipes, and to accelerate the circulation when required.

This system promises to be very successful. It is controlled by the American Car Heating Company, of Albion. N. Y.

Iron Working Improvements.

An English inventor proposes to prepare from iron a hydrated peroxide by forming heaps or beds of the metal, and keeping it moist with water or a saline solution, and in some cases he hastens the oxidation by the use of a galvanic battery. He takes the hydrated peroxide thus obtained and reduces it to a fine powder. He places at the bottom of a crucible a quantity of the oxide, and over it places cast iron; the crucible is then heated in a furnace until the iron is melted, and as soon as the oxide has acted sufficiently the metal is cast into ingots. These ingots are employed in the manufacture of steel by remelting them with steel or iron scrap, according to the quality of resultant required.

This hydrated oxide is also used with good effect in puddling furnaces, being spread over the bottom, and the iron melted and worked over it.

INCLINE CUTTING, DRAWING, AND STAMPING POWER PRESS.

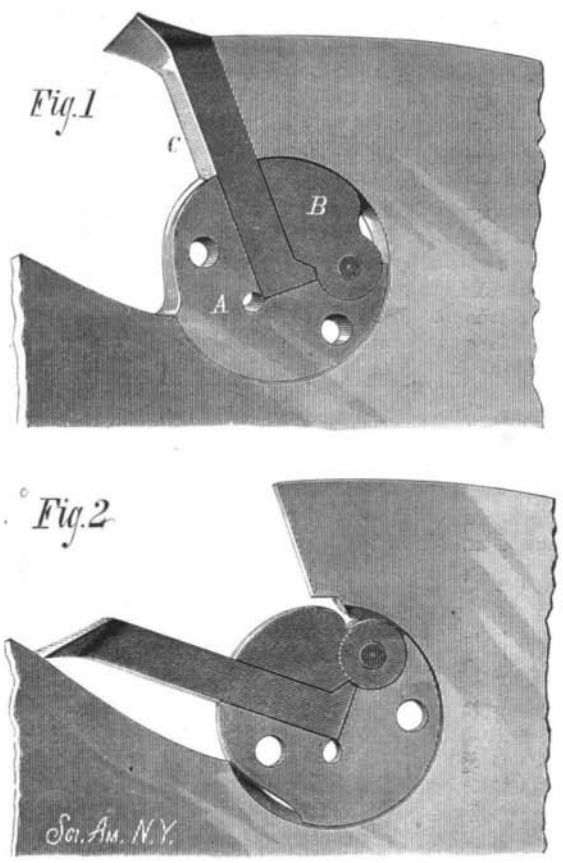
Nearly every size and description of power cutting, drawing, and double action, also screw lever, pendulum, and drop presses is made by Messrs. Bliss & Williams, of Brooklyn, N. Y. The uses to which these are applicable are very numerous, being employed by manufacturers of house-furnishing wares, sheet iron goods, silver and plated ware, etc. The one represented here is of an entirely new pattern, having been designed especially with a view to insure simplicity, rapidity of action, and the effectual accomplishment at one and the same time of that which has hitherto only been done by two or three operations. As its name indicates, it is for cutting and drawing boxes and many other articles formed from sheet metal.

This press has a new motion that is operated by a cam outside the press, and which actuates the (incased) under slide, upon which is fastened the die or pattern. This die, meeting the punch as it descends, embosses the design on the cover or box, which is at the same time formed by the process of drawing. One operation is thus saved, and the work is performed well and with great accuracy. This press is especially adapted for the formation of sardine boxes, spice box covers and bottoms, blacking boxes and covers for the same, besides many other articles of similar character, with or without embossing or lettering. Work 6 inches in diameter and 1¼ inch in depth can be drawn. When required the press can be arranged to draw 10½ inches in diameter and 1¼ inch in depth. The engraving represents the press to a scale of three quarters of an inch to one foot. The speed of the balance wheel is 60 revolutions per minute; diameter 36 inches, width 5 inches, weight 600 lbs. The total weight of the machine is about 3,300 lbs. The manufacturers have been very successful in the construction of presses for sheet metal work. They received a bronze medal and diploma at the Centennial Exhibition in 1876, and have recently been awarded a gold medal at the Paris Exhibition for the presses exhibited there.

Further information may be had from Bliss & Williams, 167 to 173 Plymouth street, corner of Jay street, Brooklyn, N. Y.

A NEW INSERTED SAW TOOTH.

Our engraving represents a novel inserted saw tooth recently patented by Mr. Frederick Schley, of 88 Cannon street, New York city. It consists of a circular holder made in two parts, hinged together, grooved around its edge, and fitted to a circular notch at the base of the saw tooth, the saw plate having a V shaped edge which fits the periphery of the holder. A space is left between the hinged portions, A B, of the holder, to receive the tooth, C, and there is a notch for receiving the small projection at the base of the tooth. This prevents the tooth from drawing out, and it is prevented from lateral motion by a groove in the tooth and a V shaped edge on the holder and saw plate. The tooth is inserted in the holder when it is in the position shown in Fig. 2. It is then raised up into the position shown in Fig. 1.



SCHLEY'S IMPROVED SAW TOOTH.

The tooth is in this manner clamped very tightly, and cannot become accidentally loosened except by a fracture of some of its parts. It will be noticed that the holder (which is shown full size in the engraving) takes up only 1¼ inch of the saw plate, and the entire depth of the tooth is not over 1¾ inch. This is an important saving when the recutting of the saw is considered.

For further particulars address the inventor as above.

A Curious Experience.

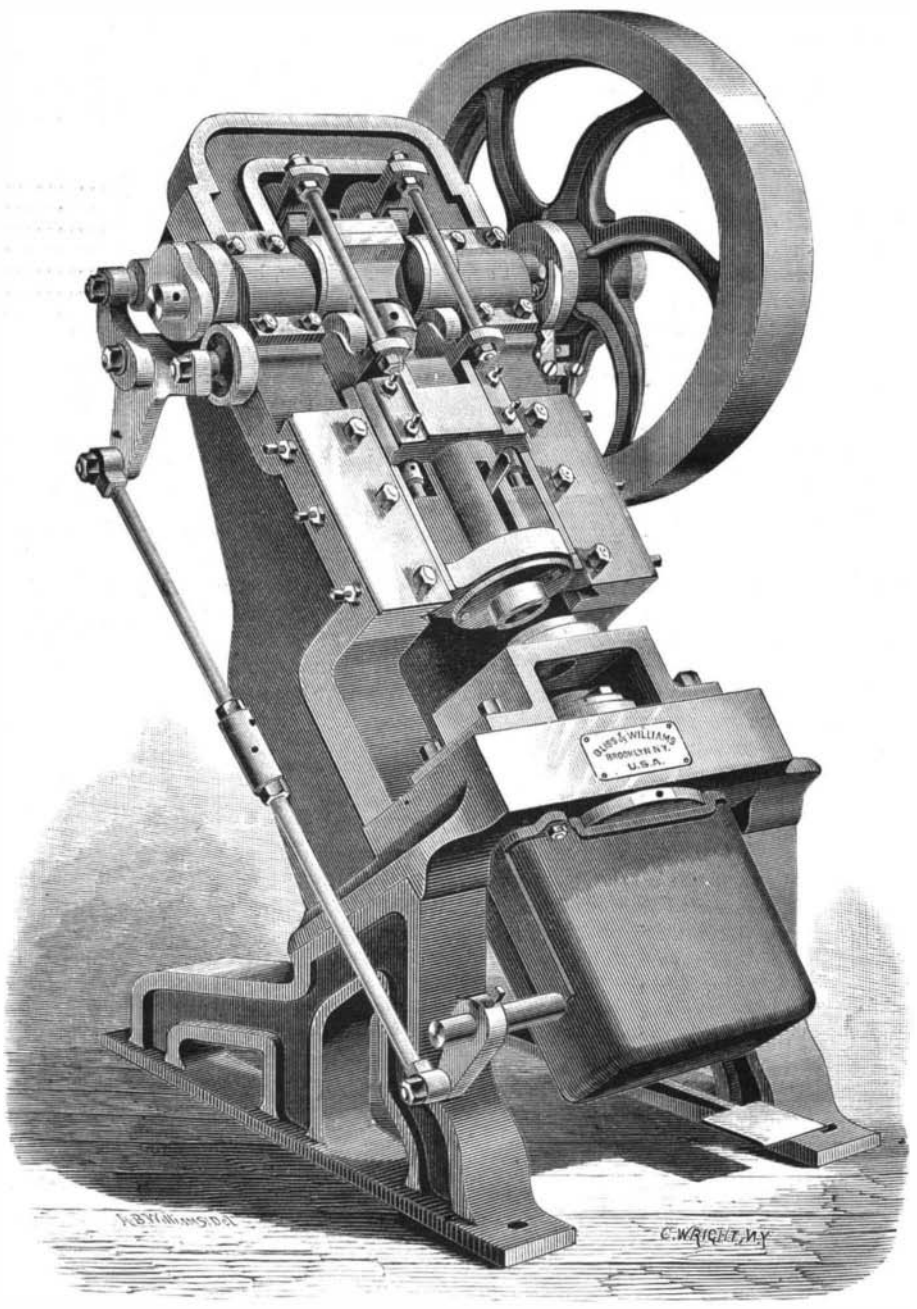
In an account of the part played by General Gordon, of the Confederate Army, at the battle of Sharpsburg, Va., where he was wounded five times, the Atlanta *Constitution* says:

"We hear from General Gordon's own lips a story that, in a metaphysical point, is exceedingly interesting. He says that when he fell (struck by a rifle ball in the face) he was utterly incapable of moving. He gradually began to think of his condition, and this is the half dream and half soliloquy that he carried on: 'I have been struck in the head with a six pound solid shot. It has carried away my head. On the left side there is a little piece of skull left. But the brain is gone entirely. Therefore I am dead. And yet I am thinking. How can a man think with his head shot off? And if I am thinking, I cannot be dead. And yet no man can live after his head is shot off. I may have consciousness while dead, but not motion If I can lift my leg, then I am alive. I will try that Can I? Yes, there it is, lifted up! I'm all right.'

"The General says that every stage of this soliloquy is indelibly stamped on his mind, and that in this exhausted state the reasoning was carried on as logically as ever man reasoned at his desk. Doubt succeeded argument and argument displaced doubt just as logically as could be. He says he will never forget with what anxiety he made the test of lifting his leg—with what agony he waited to see whether or not it would move in response to his effort, and how he hesitated before trying it for fear that it might fail and his death be thereby demonstrated."

Accurate Tunneling.

An exceedingly difficult piece of underground engineering, and one which furnishes an admirable illustration of the accuracy of calculation based on scientific principles, has just been completed in Pennsylvania, at the Hampton mine of the Delaware, Lackawanna, and Western Railroad Company. The Scranton *Republican* says: "The mine has been idle for improvements for some time, and the work under notice is the construction of a tunnel in the rock vein, making one slope serve the purpose for which two slopes and a 'dip' were formerly employed, effecting a considerable saving in men, mules, and machinery, and shortening the distance from the scene of the mining operations to the foot of the shaft by at least 2,000 feet. The survey was begun six months ago by Mr. Joseph P. Phillips, Mine Surveyor, under directions of Mr. Snyder, the company's Chief Mining Engineer, and from the outset was attended with the greatest difficulty. Over seven eighths of a mile, principally through old tumble-down workings, had to be surveyed, and 85 sights, at as many different angles, taken before reaching the point opposite the shaft from which operations for the tunnel should be commenced. The most difficult feature was to strike the exact starting point, so that the tunnel, when completed, would be found mathematically correct on grade and point. A variation of a few feet up, down, right, or left would entail additional cost and labor in going over the task to secure uniformity, so that it is not to be wondered at that those responsible for the work regarded it with some anxiety until the workmen met in the middle of the tunnel, and proved the problem to be correct. At least a quarter of a mile of the survey was made through old workings where the roof had fallen in, and in some places the space was no more than two feet high, so that Mr. Phillips and his assistants were compelled to crawl through it. The survey was plotted on a scale of 100 feet to the inch, and the result, when the men who had been tunneling in opposite directions cleared away the last barrier, and met face to



BLISS & WILLIAMS' CUTTING DRAWING, AND STAMPING PRESS.