

THE LEVY ACID-BLAST METHOD OF ETCHING METAL PLATES.

[*Being the report of the Franklin Institute, through its Committee on Science and the Arts, on the invention of Louis E. Levy. Sub-Committee.—F. E. Ives, Chairman; Samuel Sartain, W. N. Jennings, Geo. H. Buchanan, F. E. Manning.*]

HALL OF THE FRANKLIN INSTITUTE,

[No. 2061.]

PHILADELPHIA, May 3, 1899.

The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, acting through its Committee on Science and the Arts, investigating the merits of Levy's Acid-Blast Method of Etching Metal Plates, reports as follows:

Letters-patent for this invention were applied for under date of November 4, 1897, and granted on October 12, 1898. A second patent was applied for in September, 1898, and has since been granted.

Your committee examined the machine which was exhibited in operation and described by the inventor at the stated meeting of the Institute on February 15th, and which was found in practical operation at No. 628 Chestnut Street, Philadelphia. On this occasion the demonstration of the invention made at the meeting referred to was practically repeated. Besides the work actually in progress, a number of etchings were made especially for this investigation.

The invention consists in the application of an atomized spray of acid or other erodent, projected vertically upwards against the surface to be eroded by means of an air-blast, and in the combination of appliances for that purpose.

In the machine examined the blast was supplied through a receiving tank from an air pump at a pressure of from 5 to 8 pounds. The pump used was a Roots rotary air-compressor, and, in addition to this, the apparatus is composed of an etching case and a washing case. These two compartments adjoin, one in front of the other, and are fixed

over separate parts of an open shallow tank, which is divided by a partition. The compressed air passes from the air tank to the atomizers on the one hand and the washing appliance on the other, through pipes connected by two three-way cocks. These are so arranged that when one is open to let the air current pass to the aspirators, the other is open to let a supply of water pass to a water reservoir placed between them. The two cocks are joined by a connecting bar, which is actuated by a lever. A pipe connection from the first three-way cock carries the air current to a series of metal tubes placed below the bottom of that portion of the tank which contains the acid or other erodent to be used. A large number of atomizers project from these tubes, with their nozzles protruding above the surface of the liquid. The atomizers are constructed in the form of aspirators, consisting of a central tube open to the air current, which is surrounded by other tubes open to the liquid. When the air current is forced out through the central tube, it causes a vacuum in the surrounding tubes, which then become filled with the liquid to the point of the air opening, from which the passing blast carries it out in the form of a finely divided spray, in the manner and on the principle of atomizers generally. The atomized spray is driven by the blast against the surface to be etched, and then falls back into the receptacle below. The liquid is thus continuously used in the operation of the blast.

The atomizers are enclosed in a case, the sides of which are partly of glass, which makes the interior visible from the outside. On opposite sides of the interior of the case, at varying heights above the surface of the liquid, are fixed two pairs of narrow shelves, which serve to support open frames. These are movable, and are connected by a rod running through the back of the case to an arm which is actuated from the shaft of the air compressor. In each of these movable frames, and held in grooves, is another open frame, which slides out at the front of the etching box. This slide frame is rabbeted to receive a board, on the under side of which is fixed the plate to be etched. When this is slid into its place, the etching case is closed

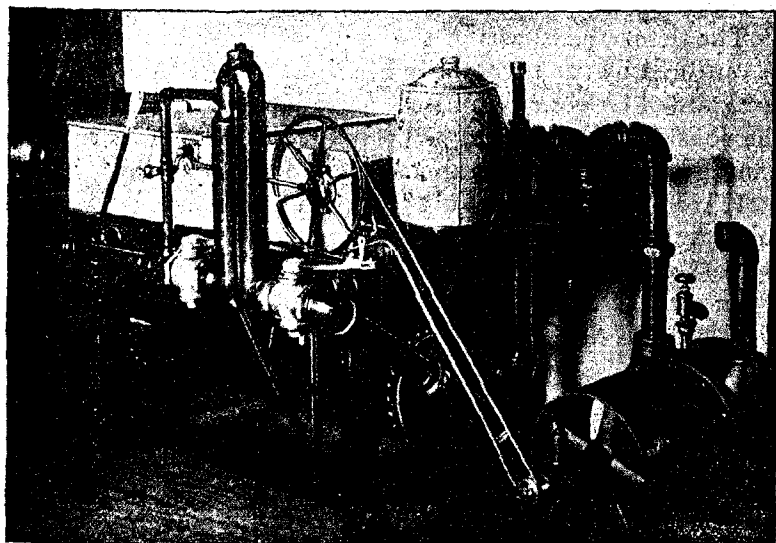
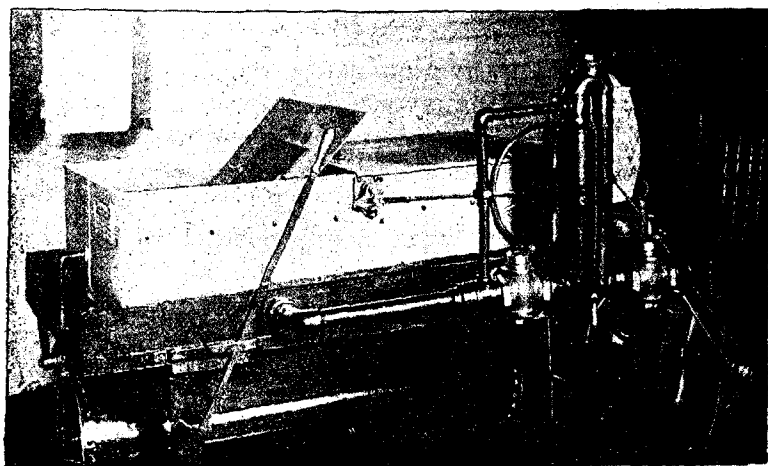
and the plate is then ready to receive the acid blast from the atomizers below it.

During the operation of the blast the frame with the carrier board is moved to and fro in a horizontal plane by the connecting rod and arm above referred to. The movement extends over a space equal to the distance between the aspirators, and serves to evenly distribute the action of the spray over the plate. At the same time it also gives a rocking motion to the drops of liquid which hang from the under surface of the plate, and this tends to deepen the erosion in the wider spaces of the etching and facilitates the fall of the drops.

When the etching process is to be interrupted or ended, the frame with the carrier board is slid out from the etching case to the washing compartment in front. At the bottom of this compartment are a number of perforated pipes connected by the second of the two three-way cocks to the water reservoir.

When the two cocks are turned by the lever and bar connecting them, the air current is directed to the top of the water reservoir and drives the water out through the perforated pipes at the bottom of the washing compartment, upward against the overlying plate. The water issues in a broad fountain jet and instantly washes the plate over its entire surface.

The erosion of the plate under the action of the blast of acid spray is very rapid, as was demonstrated at the Institute. In experiments made in the presence of your committee on zinc plates with nitric acid diluted to 10° Beaumé were etched in three minutes, without any undercutting, as deeply as the so-called "second etch" of the regular immersion method, which, including the four-way powdering, would take some twenty minutes at least. To erode the plate to this depth in an immersion bath with a single etch would require about ten minutes in an equally strong solution. It is, however, quite impracticable, with the bath, to carry the first etch so deep, or to force the erosion so rapidly, as the lines would be eaten away by the underetching, and the plate would become so heated by the decomposition of the



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The above two plates were made on hard zinc in a single etch of one and one-half minutes.

metal that the resistant would be apt to give way. The finely atomized spray of acid, driven by the blast against the plate at a right angle to the surface, etches the metal without undercutting the protected parts. This process is the main principle of the invention, but the effective avoidance of the difficulty presented by the overheating of the plate under strong chemical action is a vital element of its successful application.

The heat developed by the compression of the air is dissipated by radiation from the air tank provided for this purpose, and from the pipes leading to the aspirators, which are submerged in the outer tank containing the wash water overflow; and, in expanding when it emerges into the etching case, it absorbs an amount of heat fully equal to that evolved in the decomposition of the metal. By this means the plate and acid are kept from becoming heated, the large evaporating surface presented by the finely-divided particles of acid especially tending to keep the liquid cool.

The theoretical basis of the application of the acid blast, as outlined by the inventor in his paper before the Institute, is regarded by your committee as substantially correct, and the considerations stated, with reference to the several advantages of the process, appear to be fully justified.

It would appear, from the records accessible to your committee, that the Levy Etching Blast is a novel and original process and appliance.

In view of the importance of this invention, and in consideration of the originality of the idea and of the ingenuity displayed in its application, the Franklin Institute awards the Elliott Cresson Medal to the inventor, Louis Edward Levy, for his "Acid-Blast Method of Etching Metal Plates."

Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, January 3, 1900.

JOHN BIRKINBINE, *President.*

WM. H. WAHL, *Secretary.*

Countersigned by

EDGAR MARBURG,

Chairman Committee on Science and the Arts.