

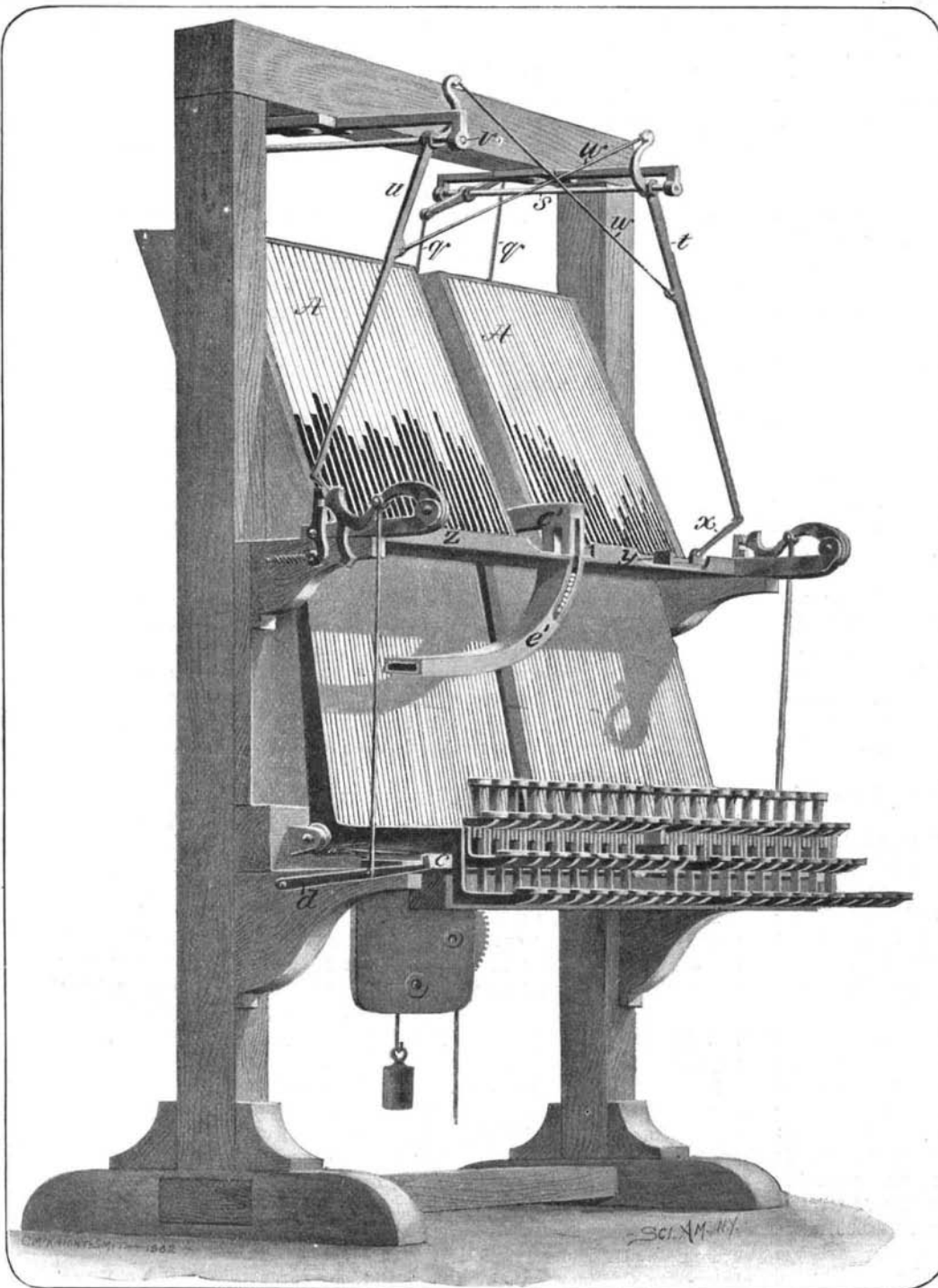
## THE INVENTIONS OF DR. WILLIAM CHURCH—THE FIRST PATENTED TYPE-CASTING AND COMPOSING MACHINE.

In its issue of May 17, 1823, the American Advocate and General Adviser published, under the title "Is This Not a Hoax?" the following item:

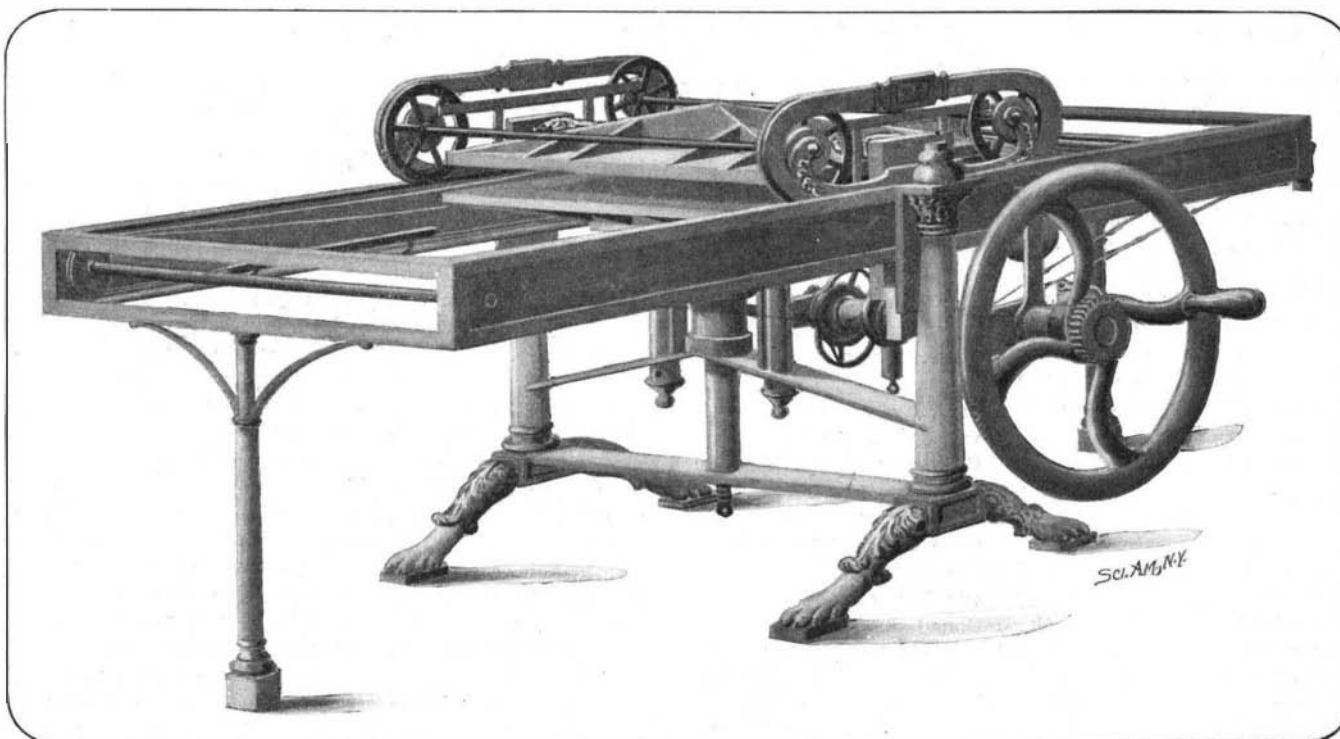
"Dr. Church is now at Birmingham (England) preparing his new printing press. The compositor has only to sit down at this curious piece of mechanism as he would to a piano-forte, and as he strikes the keys the types all fall into their proper places with a velocity that keeps pace with the most rapid speaker. The form having been worked off, the type moves into a melting pot, from which it is returned, recast in its original state, without diminution of material, and then distributed into the case quite new. One of these presses placed at the bar of the House of Commons would always insure a correct report of the debate. Dr. Church, the inventor, is a native of Boston, New England."

The modern printer may recognize in this vague description the prototype of the machine which has come into such general use within recent years. Although it was not the first invention of its kind, Church's device is interesting from a historical point of view, for the reason that it was probably the first patented device for casting and composing type. To the credit of American ingenuity be it said, that William Church was a Yankee. Strange to say, however, he did not procure a United States patent for his interesting inventions, but for some reason contented himself with an English patent only. He seems to have invented his machine in 1821; for in that year he was in England for the purpose of introducing a new press which he had devised. One year later he received his English patent, in which he describes three distinct machines—a machine for casting printing types, and also for arranging them in boxes of letters, so that the types of the same denomination are placed side by side in ranges; a machine by which these individual types are selected from the ranges and composed into words and sentences; and a press for printing and delivering the sheets into a pile.

The type-founding machine, in some of its features, seems strangely modern. The molten metal was contained in a trough or box extending across the machine, and flowed from this trough or box into the type mold B, which was provided with grooves in-



THE FIRST PATENTED TYPESETTING MACHINE. DATE 1822. INVENTED BY DR. WILLIAM CHURCH, OF BOSTON, MASS.



CHURCH'S PRESS FOR PRINTING AND DELIVERING SHEETS IN A PILE. PATENTED 1822.

tended to form the body of the letter. The matrices were placed in a groove in the matrix bar. The metal trough or box was supplied by a fountain D. The trough or box being furnished with fluid metal, a plunger contained in a casing F<sup>n</sup> was forced into it, thereby driving the metal into the molds. A hand-wheel G gave motion to a shaft H, upon which a cam-wheel I was fixed. This cam-wheel was of peculiar construction, and its various protuberances were the means whereby the casting was, to a large extent, effected. The wheel was provided with an elevated cam c on its periphery, which cam was situated, when the machine was at rest, under the friction roller at the end of the lever J, by which the plunger was held up. As soon as the wheel I had turned sufficiently to slide the cam c from under the friction roller of the lever J, the plunger was instantly drawn down by the weight K attached to the lever J. In its descent, the plunger drove the molten metal into the type mold. When the wheel I had revolved some distance further, a cam d on the periphery came into contact with the friction roller at the end of the lever L, and lifted it. At the opposite end of the shaft which carried the lever L was a shorter lever which, by means of a connection with the type mold B, shifted the moldbar endwise for the purpose of cutting off the communication of the mold with the fluid metal, and also of bringing the molds under certain punches. In this stage of the operation, it became necessary to unlock the matrix-bar C. This was done by the further progress of the wheel I, which brought the cam e on the inside of wheel I in contact with the friction roller of the lever M, thereby shifting the lever side-

wise and causing the bar N (attached to the opposite end of the lever) to be so far shifted laterally as to unlock or withdraw wedges formed on the bar, from sockets or slots of loops which held the matrices in contact with the molds. By this means the matrix bar was allowed to descend about an eighth of an inch, so as to withdraw the matrices from the cast types. The matrix bar C was now to be drawn forward from under the types in order to clear the way for their descent into the boxes, where they were ranged. This was

(Continued on page 116.)

## THE INVENTIONS OF DR. WILLIAM CHURCH.

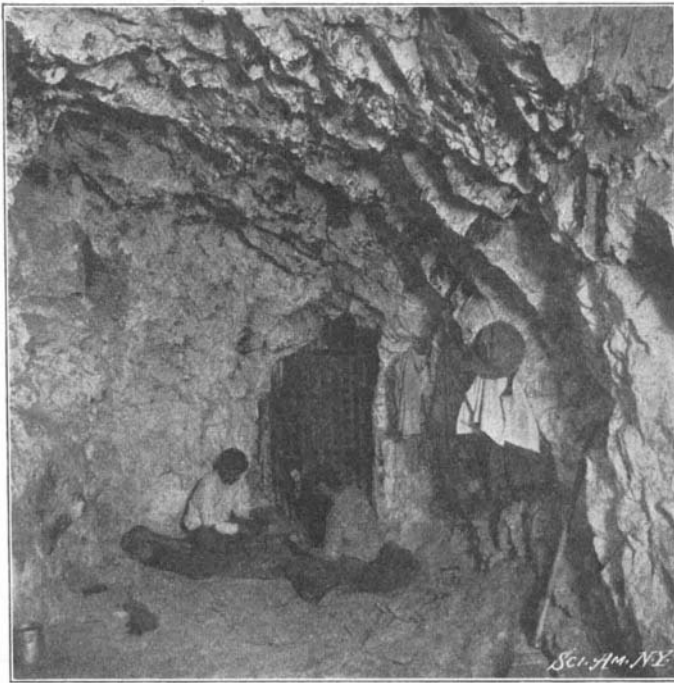
(Continued from first page.)

effected by means of a cam (not shown), which, in the further advance of the wheel *I*, struck the friction roller at the upper end of the lever *O*, and caused the opposite end of that lever to draw forward the matrix bar by its connecting piece *P*.

The next operation was that of discharging the types from the mold, which was done by a cam (not shown) on the periphery of the wheel *I* coming into contact with the friction roller of a lever, connected by its shaft with the lever *R*, so that both moved together. By the movement of the first-mentioned lever, the lever *R* forced down the punch-bar *S*, connected with it by the link *m*, from the underside of which bar clearing punches protruded. By the descent of the punches into the groove of the mold-bar *B*, the types were projected downward and descended into a guide which was twisted one-quarter around, in order to bring the bodies of the type into proper position, so that they could arrange themselves side by side in the same manner as when placed in a line by a compositor. The last-mentioned cam having passed the friction roller of the lever *Q*, the weight *V* descended and lifted the lever *R*, which raised the punches out of the molds to their former position. Another cam, on one of the spokes of the wheel *I*, now struck the roller at the lower end of the lever *O*, and pushed it back, thereby causing the connecting piece *P* to drive back the matrix bar *C* to its former position. The locking of the matrix-bar was now to be effected by still another cam (not shown) which came into contact with the under side of the friction roller of the lever *M*, which pushed it back again, and drew the previously mentioned wedges up into the slots of the loops. The next motion of the mechanism was the sliding of the mold bar back into its former position. This was done by the friction roller of the lever *L* (as the wheel *I* passed onward), descending from an enlarged part of the periphery of the wheel *I* to the reduced part of the periphery. The lever *L* connected with its short lever was pulled down by the weight and shifted the mold-bar back to its initial position. The wheel *I* having performed an entire revolution, brought the cam *c* again under the friction roller of the lever *J*, thereby raising the plunger and permitting another operation of the casting to begin. After the types descended in the twisted guides, they were pushed backward into the ranges of the box *U*, by means of the guide cams *V*, fixed upon the shaft *H* of the hand wheel *G*. The friction roller at the end of the lever *W* acted between these cams. By the revolution of the shaft and the cam, the lever *W* was caused to oscillate so that the bar *X* connected with the punch projector bar was reciprocated. Thus, at every revolution the punches were forced through the twisted guides to drive the types one after the other in their exact position into the ranges of the box *U*.

Having disposed and arranged the several types into narrow boxes or slips, each slip containing a great number of types of the same letters, was placed in the upper part of the composing machine in boxes *A*. From these boxes the types were removed by a mechanism operated through the movement of a keyboard, very much as in the modern typewriter or linotype machine. But since Dr. Church knew nothing of typewriters, he quaintly tells us that this composing machine of his is operated "in a manner somewhat similar to the jacks and keys of a harpsichord." The heads of the vertical key-levers or "jacks" slide in slits formed in a plate. The number of jacks is equal to the number of boxes of

type. When one of the keys was depressed by the finger, the end of the corresponding jack was caused to advance and push forward the undermost type of the corresponding file. By the descent of the key the bar *c* was forced down, thereby depressing the arm's *d*, and raising a lever, by which a clock train, situated back of the machine and therefore not shown, was set in operation. This clock train gave oscillating motion to two rods, *Q*, rising up to a cross lever which was fixed upon a shaft *s*. At the front end of the shaft the arm *t* was fixed, forming nearly a right angle with



INTERIOR OF AN ARIZONA CAVE-JAIL.

the cross lever. Our illustration shows the action of this arm *t* upon the shaft *v*. To the right of the arm *t* is fixed a corresponding arm *u*. Both arms were operated together by cross rods *w*. The clock train, on the depression of a key, caused the ends of the cross lever to vibrate, which caused the arms *t* and *u* to swing from side to side. To the lower ends of these arms small rods *x* were attached, which at every vibration of the arms carried attached collectors *y* toward the middle of the race *z* and back again.

It is now necessary to refer to the situation of the type which has been pushed forward by a key lever into the race *z*. The collectors in advancing brought the type into the center under the beak of the lever *c'*, at which instant the clock train caused the back part of the lever *c'* to be lifted and the type to be placed under its beak and to be pushed down the aperture *d'* into the curved channel *e'* which "acts as a composing stick," Dr. Church tells us. In this mechanical composing-stick the types accumulated and were progressively collected into words and sentences, and these

were then taken and adjusted into lines by hand or collected into pages by means of a box which was placed at the side of the machine at the end of the "composing stick" *e'*.

The third portion of Mr. Church's invention is a press for printing and delivering the sheets in a pile. The inking rollers were mounted in a frame, and were supplied from a distributing table with a lateral movement. At each movement of the frame ink was transferred by the rearmost inking roller from an endless band connected with a trough, and having a ratchet movement consequent on that of the roller frame. The roller frame was driven to and fro over the form by means of a belt connected with the shaft of a crank wheel. Having proceeded nearly over the form the roller frame was locked by means of a slider with the frisket frame and carried it under the platen. The impression was given by the rising of the type by a knee lever or descent of the platen. The printed sheet was then removed by nippers on endless bands passing over and under the platen and discharged. The register points were attached to the frisket "in a manner similar to that by which they are attached to the tympan of an ordinary press." The frisket was furnished with wedges which dropped into corresponding recesses in the platen or in the table and thus insured perfect register.

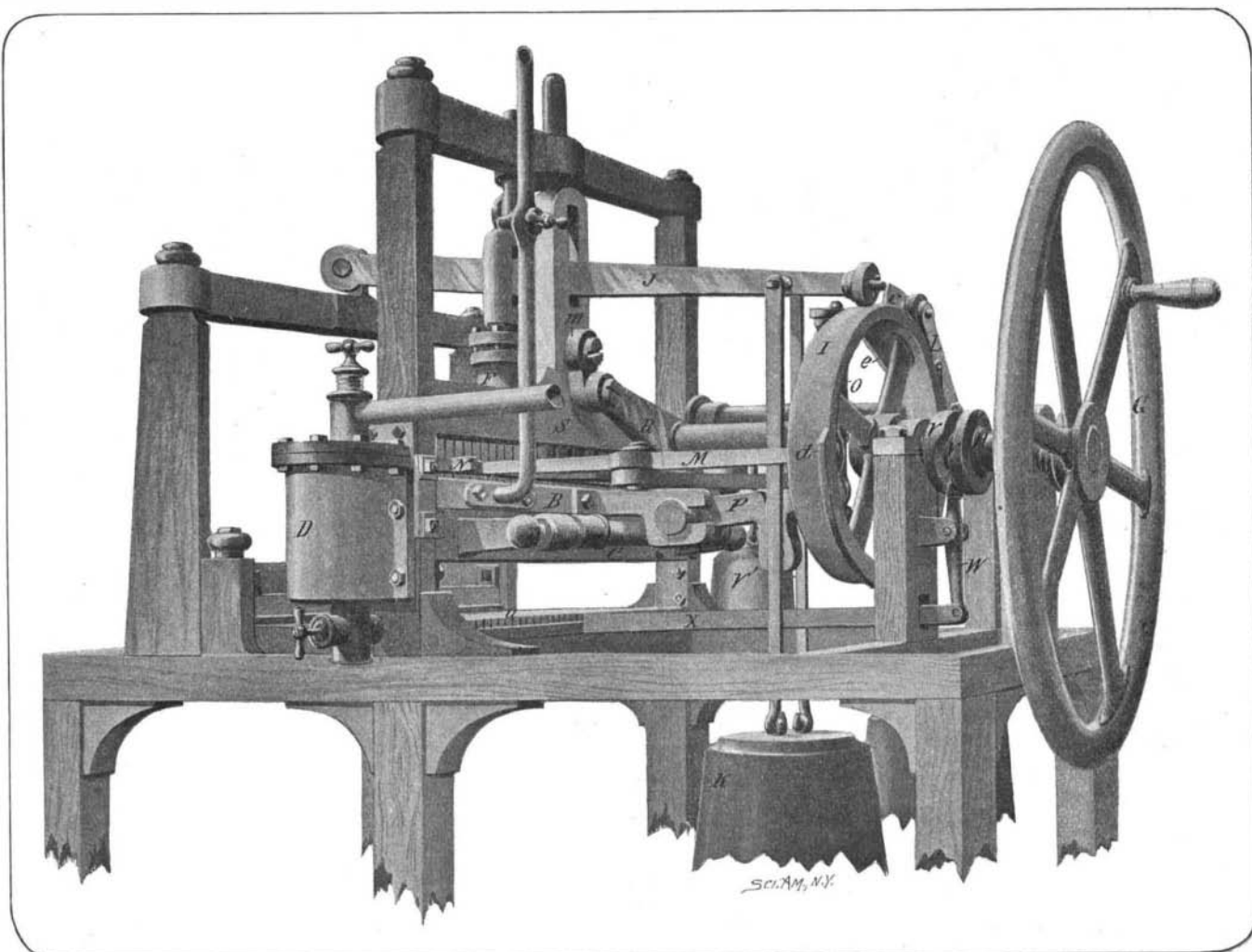
In Hansard's "Typographia," published in 1825, some interesting criticisms are to be found on Church's method of casting and composing type. After disclosing the operation of Church's machines, the writer remarks: "Well—suppose all this done, the performer also perfect in his knowledge of the keys and beginning to play his lesson—how long would he proceed with his tune without meeting with some unlucky note in his ballad; without having to call for some performers to play in concert? One to help the instrument to space out its lines; set its heads

(italics I suppose would be provided for by another row of keys and pipes to answer those of the swell organ); then another to set smaller type for notes; a word or two of Greek or Hebrew, or, perhaps, side notes to the word; to space out heads, gage and tie up the pages; to emboss, correct, etc. To effect this saving of three parts in four of a compositor's labor, would take one key player, two helpers, one reader; one engineer, and one artist to keep such a machine in repair; and then if a simple key or trigger out of the 153 wanted for the boxes or a pair of cases should get out of tune, the whole foundry and composing machinery must all be brought to a dead stop." Hansard also refers to the "invention of one M. Henri Didot of Paris, made patent in this country by Louis John Pouchée, for casting type at the rate of 24,000 per hour." Hansard states that there is a complete identity in the machinery of M. Didot and Dr. Church; "and this, according to the law of patents, will put the exclusive right of the latter to any part of his patents to some jeopardy if ever contested. But an English

expired patent anticipated them all; at least that this idea of casting type in multiplex molds is not entirely novel will be seen by referring to an expired patent of William Nicholson, granted to him in 1790." In this Hansard is wrong. The SCIENTIFIC AMERICAN has taken the trouble to look up this patent of Mr. Nicholson of 1790, and does not find that it involves the setting of type by machinery as in the Church patent. We are, therefore, probably correct in assuming that Dr. Church's invention is about the first patented type-casting and type-composing machine.

## A CAVE USED AS A JAIL.

One of the strongest jails in the country is located in Graham County, Arizona, in the town of Clifton. This com-



DR. WILLIAM CHURCH'S TYPE-CASTING MACHINE OF 1822.