notch in the lever *p*, which has a reciprocating motion on its axis, and finally falls down one of the grooved passages *c* to the delivery point *d*. These channels are cut by means of a grooving machine in a thick metal plate, and the front of the plate is covered by a glass door, which allows any sticking type to be seen and relieved at once. It will be seen that those passages are arranged in fan-like form, all tending to *d*, but their number makes a special arrangement necessary; a few of the passages are continuous, but the majority end in one or other of what may be called main arteries, and the type continues its course at an altered angle. The passages are opened by the operator touching the keys, D, D, which act upon the levers *h*, *h*, and the bell cranks *i i*, which move the slides already mentioned beneath the type boxes; the type instantly descends and finds an exit at *d*. One passage is, however, made to serve for italic as well as roman characters, so that half the number of passages is saved; to effect this a secondary keyboard is placed above, see *u*, *u*, Fig. 2; these keys are pressed in horizontally, while the others are pressed upon vertically, and act on the sides of the italic type boxes in the direction opposed to that of the roman type slides, and both descend by a common passage.

When each type arrives at the delivery spout *d* it is caught by a spring slide *f*, Fig. 1, which is set in motion by the cam B and the treadle C, and presses the type into the receptacle *e* which represents the printer's composing stick; and as each key is touched the spring slide *f* recedes and advances, introducing another character into the channel *e*. This channel, which is vertical where it receives the type at *d*, is horizontal at the other end towards A that is to say, it has a quarter turn in its length, like the rifling of a gun, and the types which enter it upright are delivered with their faces towards the back of the machine.

Two men are employed to work this machine, the second being the "adjuster." As soon as a line of type of the required length is formed in the channel *e*, the adjuster touches the second treadle C¹, and by a very simple arrangement the line of type is received in the composing frame A, which is a rectangular box; the justification, insertion of spaces, &c., is then made, while the machine is preparing a second or more lines of type.

The distributing or sorting machine, Figs. 3, 4, and 5, may be roughly described as the composing machine inverted, but there are some interesting differences in the parts. Fig. 3 is a side elevation, partly in action; and Fig. 4 a view of the back of the channelled plate with its glass door. The type to be distributed is placed in the receptacle E, which is simply a flat iron box like A in the composing machine; the type is pressed up towards the front by means of a simple bar and ratchet slide; and by a very simple arrangement the line of type nearest to the working part of the machine is raised up and brought well under the eye of the operator, who is assisted, if necessary, by a small mirror placed so as to reflect the first letter on the left of the line of type. This first letter stands over an orifice which leads to the distributing channels, and the instant one type has been allowed to drop through the line is advanced one step by means of a rack motion acted upon by the pressure of the finger keys *g*. The operator touches the key corresponding with the letter presented to his eye; the key acts upon rod *h*, and the bell crank *i* moves back the slide *j*, and opens the lower aperture of the corresponding channel, which leads into the proper type box. These boxes are arranged side by side and in two rows on the table beneath, D, Fig 3. Were this the whole, the machine would be very simple, but in order to keep the parts within moderate compass two special arrangements are made. In the first place, as in the composing machine a large number of channels had to be made to terminate at one given point, so in the distributing machine the type falling into the leading channel has to be discharged into a large number of receptacles, and this is done by a very pretty arrangement shown in Fig 4. Each character falls first into one of three main lines, and is then shunted into its own side line by means of a switch. This is effected in the following manner:—Each connecting rod *h* has a small lug, shown at *l*, Fig. 5, which acts upon the bell crank *m*, *n*¹, *n*²; and turns the switch *n*, closing the main line and opening the proper branch. The action of the finger itself lifts a vertical bar, withdraws a slide, and allows the type to fall into the main channel. Secondly, there are ninety-six type boxes to be filled, but there are only half that number of finger keys and channels, each key and each channel being made to supply two type boxes, and this is effected by the application of switches, or traps, similar to those described above, inserted in the lower ends of the channels. A channel is just twice as wide as a type box, and the switch, flat in this case, usually covers the entrance to the type box on the left hand; when, therefore, a key is touched the type usually falls into the type box on the right hand side. If, however, the operator presses his foot upon the treadle F, the switches are reversed for an instant and the type falls into a left-hand box. In order to simplify this arrangement as much as possible each key serves for two letters, one in frequent use, and the other much less so, such for instance as *b* and *j*, and the treadle is only called into requisition in the case of the latter. It should be mentioned that the upper or feeding orifice of the channels can be instantly widened or narrowed according to the size of the type to be sorted, by means of two keys.

STEVENS INSTITUTE LECTURES.—SUNLIGHT AND ITS SOURCE.

The spring course of lectures at the Stevens Institute, opened on Tuesday, April 15. We are indebted to the columns of the *Scientific American* for the following summary of the opening lecture, delivered by President Henry Morton:

"For the purpose of measuring lights of different brilliancy, the light of a candle serves as a standard of comparison. An ordinary gas flame is equal to the light of fourteen to eighteen candles, a fact we do not generally appreciate until the gas gives out and we are obliged, as in New York city lately, to substitute candles for it. While the shadow of a gas flame is much more sharply defined and more opaque than that of a candle, it is surpassed by that produced with an oxyhydrogen lamp, the latter by a magnesia burner, this again by the lime light, and so on, until we finally come to the electric light, the most intense artificial illumination we are able to produce. All these lights were exhibited by means of the shadows of objects they cast upon the screen, and it was stated that the brilliancy of the electric light was equal to that of five hundred and seventy-two candles. The intensity of sunlight, however, is so very much greater than the latter that it would take a body many times larger than the sun, composed of incandescent carbon points, to give us the same amount of light.

"Next to this brightness of the sun, the whiteness of his light strikes us as a prominent characteristic. Now, this whiteness is due to a harmonious blending of lights of all colors in proper proportion, as is seen in the spectrum, where a ray of white sunlight is broken up by a prism into its component colors. By reason of its composition it has the property of exhibiting all colors with equal effect, a property not shared by colored lights. The lecturer exhibited a large burner in illustration of this fact. It was covered with disks of green, blue, and purple, purposely selected on account of their dullness by gas light. When illuminated by the electric light, they became very brilliant. When light of any color other than white is passed through a prism, its spectrum is not continuous but composed of alternate bright colored and black bands. These vary with the source of light, and are so characteristic as to enable us to tell what substances give the light.

"A piece of brass burned in the electric arch showed upon the screen the bands due to its components, copper and zinc. This is the principle of spectrum analysis. Now, on examining the spectrum of sun light, we notice that it is full of dark lines. Kirchoff was the first to indicate the connection between these and the bright lines produced by the vapors of burning substances. He observed that some of them, for example nickel, iron, and hydrogen, produced bright lines exactly coinciding in position with certain black lines in the solar spectrum, and he concluded that these substances were present in the sun. But why should they produce black lines in this case? It is because light passing through vapors is deprived of certain portions of its rays, which are absorbed by these vapors. This was beautifully shown by causing the spectrum of the electric light to be formed on the screen, and then interposing the vapor of so-