(No Model.) 2 Sheets—Sheet 1.

W. W. STREET & C. L. TRAVIS.

JUSTIFYING ATTACHMENT FOR MATRIX MAKING MACHINES.

No. 480,350. Patented Aug. 9, 1892.

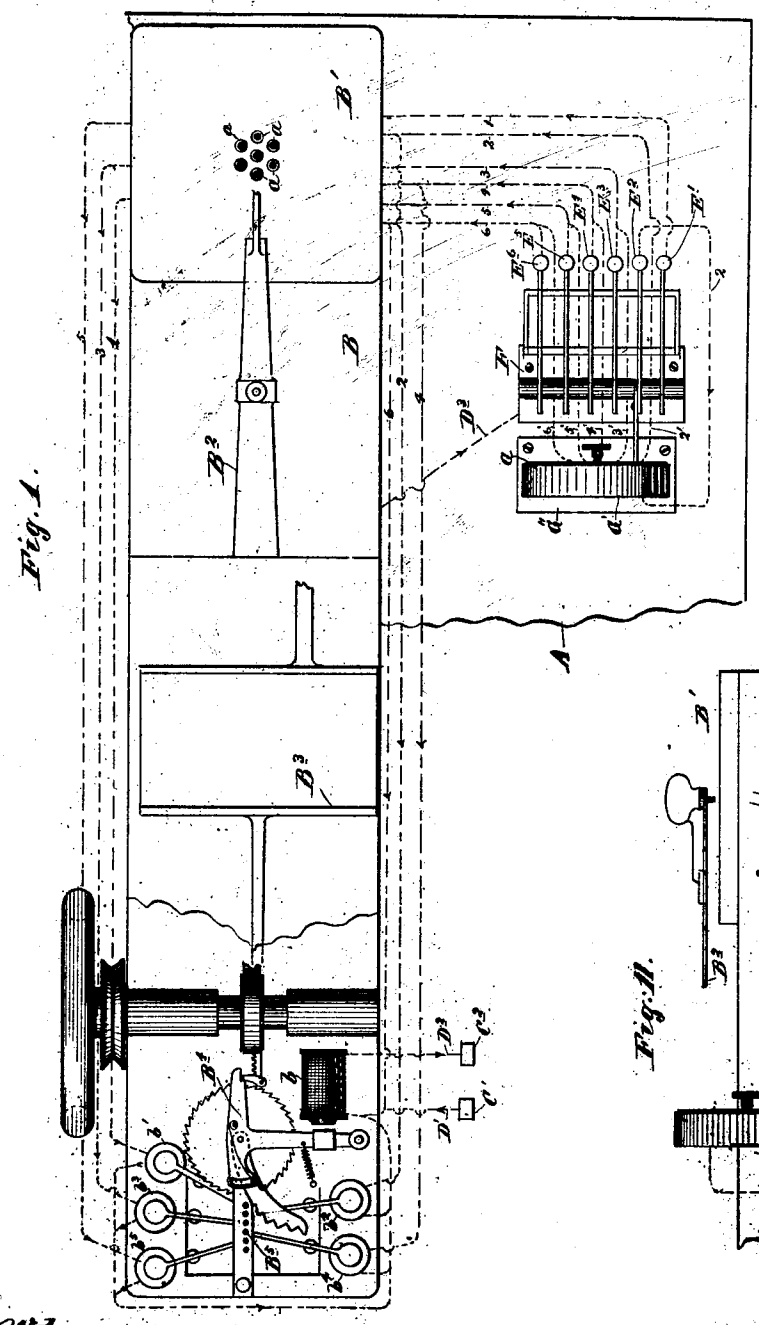

Fig. I.

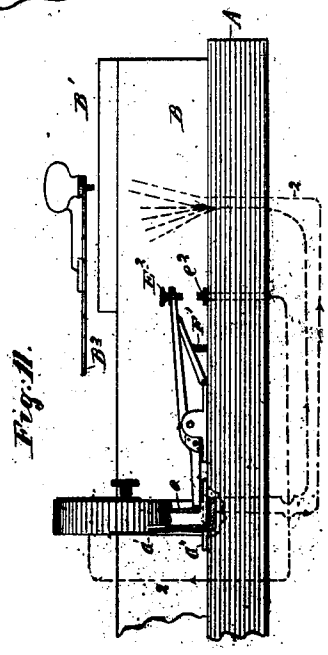

Fig. II.

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Inventors.
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(No Model.) 2 Sheets—Sheet 2

W. W. STREET & C. L. TRAVIS.

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Fig. IV.

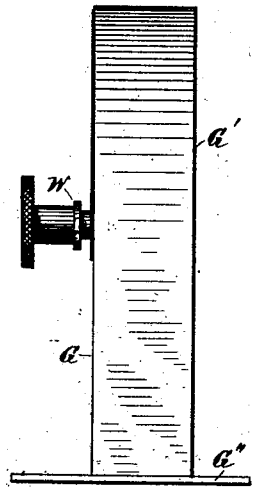


Fig. III.

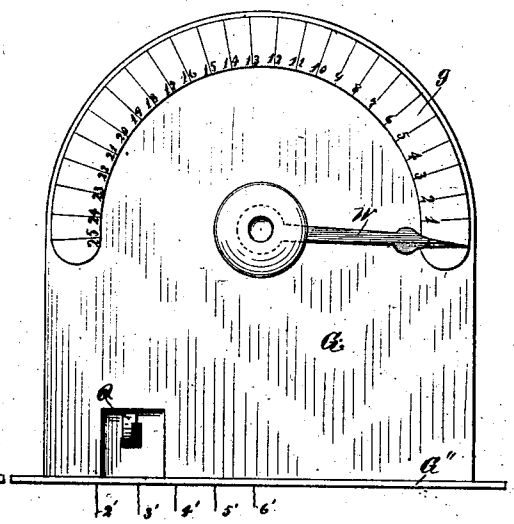


Fig. V.

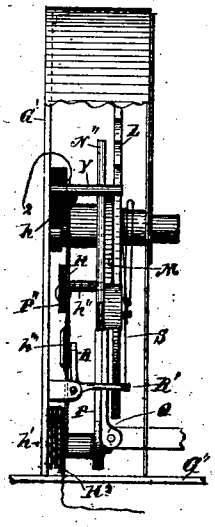


Fig. VII.

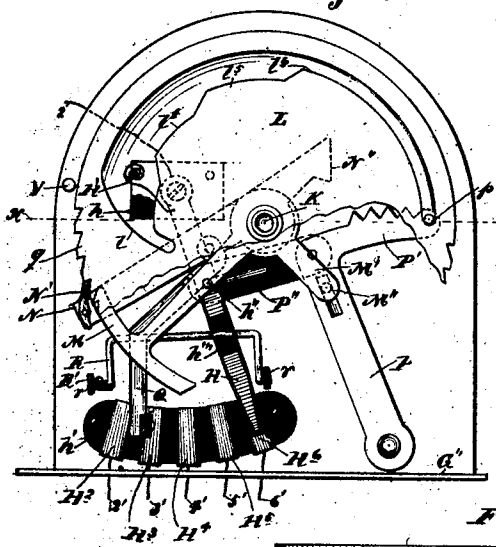


Fig. VI.

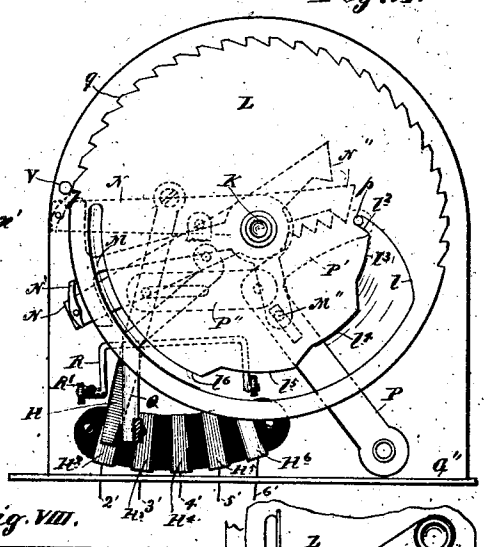


Fig. VIII.

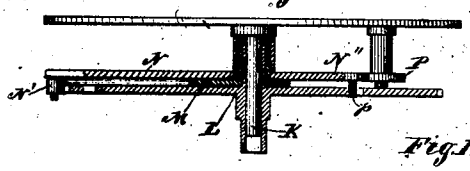
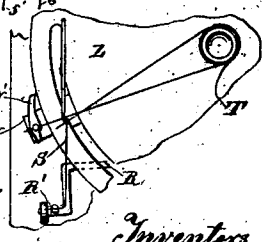


Fig. IX.



Witnesses
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Frank D. Merchant.

Inventors.
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Charles L. Travis.
By their Attorneys
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UNITED STATES PATENT OFFICE.

WILLOUGHBY W. STREET AND CHARLES LESLIE TRAVIS, OF MINNEAPOLIS, MINNESOTA, ASSIGNORS TO THE MINNEAPOLIS ELECTRO-MATRIX COMPANY, OF SAME PLACE.

JUSTIFYING ATTACHMENT FOR MATRIX-MAKING MACHINES.

SPECIFICATION forming part of Letters Patent No. 480,350, dated August 9, 1892.

Application filed April 12, 1890. Serial No. 347,696. (No model.)

To all whom it may concern:

Be it known that we, WILLOUGHBY W. STREET and CHARLES LESLIE TRAVIS, citizens of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Justifying Attachments for Matrix-Making Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to matrix-making machines of the single-die class, wherein the impression is made in the matrix material by a series of dies brought in succession to the printing-point. In this class of machines a printed impression, in appearance like newspaper or book print with justified lines, is produced by differentially-spaced dies, corresponding differential feed movements of the matrix material, and the proper distribution of spaces from pre-prepared copy between words. The copy is prepared by measurement with the common scale used for the dies, the feed movements of the matrix-machine and the newspaper line, and the notation thereon of the extra spaces required to fill out the line. In practice this preparation is effected on a type-writer having a differential registering device or space-indicator which registers like spaces for like characters, the same as the matrix-machine, the extra spaces left over, if any, at the end of the line being indicated by a numeral. The number of extra spaces required to be thrown in between words is thus predetermined and made known to the operator on the matrix-machine. In the plan generally hitherto pursued the operator after noting the number of words in the line and making a calculation as to the best distribution of the extra spaces, throws the same in between the words by a proper manipulation of the space-keys. As the number of extra spaces and the number of words in a line varies widely, this requires the most careful attention, and the best of operators will frequently make a mistake, thus failing to justify the line, necessitating the destruction of the matrix.

The object of our invention is to provide a machine by which the distribution of the extra spaces may be automatically effected. To this end we provide a mechanism which will vary the space-feed movement, so as to put in between words other than normal spaces, and by first predetermining the extra spaces in the customary manner and then adjusting the mechanism to make the required variation of the space movement, the extra spaces are distributed automatically by the operation of the normal space mechanism of the machine with absolute certainty and precision. In practice it revolves itself, so far as the operator is concerned, into simply setting a pointer at the total number of extra units and then operating the machine for normal spacing, just as if there were no extra units of space to consider. In other words, we provide a mechanism for automatic justification, resulting in a great saving of material and time and enabling the employment of lower-priced operators.

Though capable of general application, our invention was especially designed for use in connection with matrix-making machines, illustrations of which may be found in the Patents Nos. 414,399 and 414,400, issued to George A. Goodson of date November 5, 1889, and we have shown the invention as applied to such a machine.

In matrix-machines of the general character to which the present invention is applied the dies are carried on one end of a swinging and sliding lever having a hand-key at the other end moving over an index-plate on the bed. The feed movements are controlled electrically from the index-plate, the act of selecting the characters on the index-plate serving to align the selected die and to close a circuit for effecting the proper corresponding feed movement of the matrix material, and a set of space-keys are connected in multiple for electrically controlling the matrix-material carriage to effect the proper spacing between words.

In the accompanying drawings, Figure I is a plan view of a matrix-machine embodying our invention, some parts being removed. Fig. II is a side elevation of a part of the same, the one unit space-key being removed. Fig.

III is an elevation of the justifier detached. Fig. IV is a right-side elevation of same; Fig. V, a left-side elevation with some parts broken away. Figs. VI and VII are front elevations of same with face-plate removed and some parts broken away, showing two extreme positions of the cam-plate and switch. Fig. VIII is a section on line X X′ of Fig. VII, and Fig. IX is a front elevation of some parts detached.

A is the table on which the machine is mounted.

B is the bed-plate of the machine.

B′ is the index-plate with perforations or key-seats *a*.

B² is the die-carrier.

B³ is the matrix-material carriage under tension. (Not shown.)

B⁴ B⁵ are the escapement and stops for controlling the same. Five of these stops are movable and the sixth is stationary.

b is the electro-magnet for releasing the escapement.

b′ b² b³, &c., are the electro-magnets for controlling the stops B⁵.

C′ C² are respectively the positive and negative binding-posts of a generator.

D′ is the outgoing wire charging the entire bed of the machine.

D² is the return-wire of same coming from escapement-magnet.

1, 2, 3, 4, 5, and 6 represent the feed-circuits. They are all branches of the main circuit, taken from the bed passing through the respective groups of contacts (not shown) under the index-plate, and, with the exception of No. 6, all passing through the respective corresponding stop-controlling feed-magnets. No. 6 passes directly to the escapement-magnet, permitting the escapement to throw to its limit against the stationary member of the stops.

E′ E² E³ E⁴, &c., are a set of spacing-keys pivoted on plate F, charged by wire D³ or otherwise from bed B. These space-keys correspond to the respective feed-circuits 1 2 3 4, &c., and are all provided with corresponding contacts *e′ e² e³ e⁴*, &c., thereunder. (Only *e²* shown.) Each of these contacts, with the exception of *e²*, is directly connected up in multiple in the corresponding feed-circuit. The space-key branches or loops of the circuits are normally open at the keys, the latter being held away from the contacts by a spring-bail F′. With these space-keys and their electrical connections the feed movements may be controlled by hand to effect any spacing desired and is the means hitherto generally used on such machines for this purpose. With our attachment the normal space-key contact *e²* is not directly connected in the corresponding feed-circuits, but the connection is made indirectly through the justifier to a switch or pivoted contact movable over fixed contacts corresponding to and connected with said spacing-circuits. This switch is automatically operated by a cam-plate, which is set or adjusted by hand at the beginning of the line to vary the word-spacing as required to justify the line by closing the circuit from the normal space-key either through the normal or some other space magnet or different magnets in succession, as may be necessary for the purpose. The branches from the respective contacts of the justifier to the spacing-circuits are indicated in Fig. I and marked 2′ 3′ 4′, &c.

Referring now to Figs. III to IX, inclusive, the detailed construction of the justifier is as follows:

G G′ G″ is a suitable case, of which G is the face-plate, G′ the body, and G″ the base-plate for securing the case in position.

H is the switch or pivoted spring-contact under tension by spring H′, pivotally attached at its upper end to a hard-rubber plate *h*, secured to the back of the case.

H² H³ H⁴, &c., are contacts fixed at short distances apart to a hard-rubber plate *h′*, secured to the back of the case, directly under and in a position to make contact with the free end of the switch H. The switch H is in circuit with contact *e²* under normal space-key E², and the fixed contacts H² H³, &c., with the spacing-circuits by branches 2′ 3′ 4′, &c., as before noted.

K is a post or pintle fixed to the back plate of the case at about its center and projecting outward through the face-plate of the same.

L is a cam-plate with extended hubs mounted on the post K.

M is a shield or cut-off lever having an extended hub loosely mounted on the inner hub of cam-plate L.

N is a pawl-carrying lever having hub loosely mounted on the hub of the lever M and is provided with a pivoted spring-pawl N′ at its outer end.

P′ P″ is a lever pivoted at the lower end of its stem to the case.

P‴ is an arm or bar of hard rubber pivotally attached to the lever P and is slotted to receive a stud *h″* of the switch H. The arm P″ of lever P is provided with notches or teeth at its upper surface for engagement with a heel-like extension N″ of the pawl-lever N. The stem of the lever P is also slotted near its upper end to receive a stud M″ on an angularly-extended arm M′ of the shield-lever M. The arm P″ of the lever P is also provided with an outwardly-projecting cam-stud *p*. Q is an operating-arm or connecting-rod connected at one end to the pawl-lever N and at the other to an extension of the normal space-key E². The cam-plate L is provided with a series of cam-surfaces *l*, *l²*, *l³*, *l⁴*, *l⁵*, and *l⁶*, located at different distances from the common axis or center, the latter five of which cam-surfaces are made continuous in a broken path and correspond, respectively, to the fixed contacts H² H³, &c., while the first named or surface *l* is located so as to have its beginning entirely outside the outermost of the others—viz., *l⁶*—and its terminus

at the same radial distance as the innermost of the same—viz., l^2. These cam-surfaces may be provided on the cam-plate in any suitable way. As shown, the cam-plate is suitably cut away for the purpose. When the parts are in proper position, the stud p on the arm P′ of the lever P engages with one or another of said cam-surfaces.

The cam-plate L is provided with ratchet-teeth q on one-half of its periphery, with which the pawl N′ on pawl-lever N may be made to engage for turning the cam-plate.

R is a bail-shaped lever pivoted in lugs r, secured to the case, having its bail portion outside and in position to be made to bear against the switch H. It is provided with a crank-arm R′. A light wire S with a loop is attached at one end to the crank-arm R′. A coiled spring T has its body mounted for a base of resistance on the hub of the cam-plate and has one of its ends attached to the wire S and the other passed through the loop thereon and attached to the pivot-post of the pawl N′ on lever N. The result is that when the pawl-lever is thrown forward (upward) to its limit the bail R is also drawn up, forcing the pivoted contact H tightly against the corresponding fixed contact, over which it may be at the time.

V is a stop fixed to the case for limiting the throw of the pawl-lever.

W is a pointer mounted tightly on the hub of the cam-plate outside the face-plate, with its free end over the dial-plate.

h''' is a hard-rubber face on switch H.

It should be noted that the number of ratchet-teeth correspond to the number of extra units indicated on the dial-plate and the maximum number of extra units of space for which provision is made. It should also be noted that the shield-lever M is of like radius with the cam-plate and that its outer segmental end may be made to coincide through a greater or less portion of its length with the periphery of the cam-plate and prevent the pawl N′ from engaging with the teeth q. Hence the number of teeth with which the pawl may be made to engage or the length of its throw will vary according to the position of the shield-lever M. This position of the shield-lever, in virtue of its connection (by M″ M′ and the slot in stem P) with the lever P, is made to depend on the corresponding relative position of the cam-stud p. This lever and stud is prevented from moving to the left out of its proper position by the heel N″ engaging the proper tooth of P″. Note, also, that the tension on the pivoted contact or switch H tends to throw it to its outside limit in the slotted arm P″.

With the construction in unit and especial attention to the above-noted features and the electric circuits, the operation may be readily understood, which is as follows: When the pointer is at "0," as shown in Fig. III, the cam-plate and the other parts are in the respective positions shown in Fig. VI, the pivoted contact or switch bearing against the two-unit fixed contact H^2 and the cam-stud p being at the extremity of the notch between cam-surfaces l and l^2. This, for convenience, may be called the "normal position." In this position the operation of the normal space-key E^2 will close a circuit through stop-magnet b^2 and the normal two-unit space will be thrown exactly as if the justifier attachment had not been used. If now the pointer be turned to "25" on the dial-plate, the cam-plate will be carried with it and all the parts will be in the position shown in Fig. VII, the cam-stud p will be bearing against the cam-surface l^6 at its limit, the switch H will be bearing against the fixed contact H^6, and the shield-lever M will have been retracted, so as to permit the pawl-lever a throw of four of teeth q at a stroke. If now the normal space-key E^2 be struck, the following will result: first, the feed-circuit will be closed through H^6 to escapement-magnet b, permitting the escapement B^3 to move to its limit, feeding the matrix-carriage forward six units of space, or varying from the normal space between words by four extra units; second, the pawl-lever will throw the cam-plate forward four notches, corresponding to the extra units of space thrown at the feed. As there are twenty-five teeth on the cam-plates, it is evident that six strokes on the key would revolve the plate to within one tooth of its normal position. On the sixth stroke of key E^2, in virtue of the location of the outer cam-surface l, the cam-stud p would be struck thereby and forced toward the post or center K until in same radius with cam-surface l^3, carrying downward the arm M″ and throwing upward the shield-lever M to cut off from the pawl all except one tooth of the plate. Meantime the spring T, wire S, and bail R would hold the pivoted lever against H^6 until the completion of the stroke; but the instant the key is released and the operating-lever Q and pawl-lever N fall to their lowermost position the bail R is released from its tension and the pivoted contact H, being free, is instantly thrown by its tension-spring to its limit in the slotted arm P″, and as the arm is one space from normal the free end of the contact H is over contact H^3. The seventh stroke closes the circuit through H^3 and the feed-magnet b^3, throwing in the one remaining extra unit, and by surface l, &c, as before described, brings all the parts back to their normal position, as shown in Fig. VI. It is evident that if there had been twenty-five extra units, indicated on the prepared copy, required to be thrown in to justify the line and there had been eight words (or seven spaces) in the line, the same would have been distributed by the addition of four extra units to each of the first six spaces and one extra unit to the last. It would rarely ever happen that there would be twenty-five extra spaces to distribute. The number seldom exceeds fifteen and averages about seven or eight. The line will sel-

dom contain less than six words or five spaces. The device has been constructed accordingly. Hence for all the cam-surfaces l^3, l^4, and l^5 five throws of the pawl are allowed to bring the parts from the limit of the surface back to normal. For l^6, as before seen, a possible seven is provided. Suppose there had been one extra unit. The pointer would have been set over *l* on the dial, the cam-wheel would have been turned one tooth from normal, the cam-stud would be near the terminus of cam-surface l^6, and the pivoted contact on fixed contact H^3. Then the first stroke on the normal space-key would throw in the extra unit and bring all the parts back to normal. Suppose there had been five. One extra would have been added to each of five spaces. Suppose ten extras and five spaces. The cam-stud would work on cam-surface l^4 and the pivoted contact on H^4, throwing in two extra units at each of the five strokes. If fifteen extras and five spaces, it operates on l^5 and H^5, throwing three extras at each of the five strokes. If twenty, on l^6 and H^6, throwing four extras each stroke. In other words, the divisions are at "5," "10," and "15." From "1" to "5" it throws one extra unit of space, from "6" to "10" two extras, from "11" to "15" three extras, and from "16" upward four extras each stroke. Of course it is apparent that if there be six words (five spaces) and less than five extras, they will all be distributed between the earlier words of the line. So with intermediate numbers between "5" and "10," "10" and "15," "15" and "20." In case there were only five words, (four spaces,) these intermediate extras would be thrown in uniformly between all the words. In that event, or other cases where the line contains less than six words, (five spaces,) there might be one or two extras left over after the last space was struck; but this can, in all except rare instances, be entirely avoided by an additional or slightly-different manipulation of the device—viz., by adjusting the cam-plate to throw a larger number of extras in all or a part of the key-strokes. For example, suppose the line contain only four words or three spaces and there be twelve extras. The operator will first swing the pointer around to its limit, (or at least past "15,") so as to bring cam-surface l^6 into play and the pivoted contact to operate on H^6, and then return the pointer to "12" on the dial. For each of three strokes of the key there will be then thrown in four extras, distributing the entire twelve. So if there were ten extras and only four spaces the pointer would be first turned past "11" on the dial and then back to "10," causing surface l^5 and contact H^5 to operate for three strokes and l^2 H^2 on the fourth throwing in three extras between the first four words and two extras between the last two words. The device is therefore within the range of all ordinary conditions perfectly automatic when properly adjusted at the beginning of the line. The principle is of course general, and the device could be readily adapted to any number of feed movements which the matrix-machine might possess. For example, if the matrix-machine had a seven and an eight unit feed-magnet by adding additional cam-surfaces and fixed contacts the device could be made to throw five or six extras each stroke. Practical experience has demonstrated, however, that the device as shown has sufficient range for all ordinary work. It will also be understood that the circular form is simply a matter of convenience. The full set of space-keys, from one to six units, is left on the machine for use in case of necessity in extraordinary instances. For example, it might happen that between the last two words it would be desirable to throw only one unit of space instead of the normal amount of two units, the total extras and one more unit having been thrown in by the justifier between the other words. Or, again, suppose the unusual case of eighteen extras and only four words, (three spaces.) Inasmuch as the highest number of extras which the device can add at a throw is four, it is evident that in that particular rare instance resort must be had to the space-keys, using both the normal two-unit plus the six-unit key for every one of three spaces. Such extreme cases require provision to meet, but are of such extremely infrequent occurence as not to make it worth while to add additional feed-magnets to the matrix-machine and additional contacts and cam-surfaces to the justifier in order to make the same exhaustive.

The device shown in Figs. III to IX, inclusive, though designed and shown applied as a justifier for matrix-machines, is, broadly viewed, an automatic switch and might be of use otherwise than in matrix-machines.

What we claim, and desire to secure by Letters Patent, is as follows:

1. In a matrix-making machine of the class described, the combination, with the differential electric feed devices and the space-key, of an electric switch adjustable to close a circuit through any one of said feed devices at will and operated from the space-key to distribute the spaces as may be required to justify the line.

2. In a matrix-making machine of the class described, the combination, with the differential electric feed devices and the normal space-key, of an electric switch capable of closing a circuit through one or another of said feed devices and a cam-plate for operating said switch to shift the connection from said normal space-key to some other than the normal space-feed device.

3. In a matrix-making machine of the class described, the combination, with the differential electric feed devices, of an electric switch adapted to close a circuit through one or another of the feed devices, a normal space-key in circuit with the switch, and an adjustable

cam-plate for controlling the switch to vary the space-feed movement as required to justify the line.

4. In a matrix-making machine of the class described, the combination, with the differential electric feed devices, of an electric switch shiftable into circuit with one or another of said devices, an adjustable cam-plate having different cam-surfaces, adapted to be moved from normal to set the switch and returnable to normal by a step-by-step motion, and a normal space-key in circuit with the switch and having a connection with the cam-plate for operating the same to return it to normal position.

5. An electric switch comprising a pivoted contact, a series of relatively fixed contacts, a movable cam-plate having different cam-surfaces and ratchet-teeth, adjustable from normal position to shift the pivoted contact, and a pivoted pawl-carrying lever engageable with said teeth for returning said plate and pivoted contact to normal position.

6. The combination, with the pivoted contact, of the fixed contacts, the adjustable movable cam-plate with different cam-surfaces and ratchet-teeth, the pivoted pawl-carrying lever engageable with said teeth, and a shield or cut-off also operated from said cam-plate to vary the effective throw of the pawl-lever.

7. The combination, with the pivoted contact, of the fixed contacts, the cam-plate with different cam-surfaces and ratchet-tooth, the pivoted pawl-carrying lever, the teeth-shield or cut-off, the operating-key, and the connecting-rod to said pawl-lever, substantially as described.

8. The combination, with the pivoted contact under tension to hold it in its normal position, of the fixed contacts, the adjustable cam-plate with different cam-surfaces, as described, the pawl-lever, the pivoted shield or cut-off provided with angularly-extended arms, the pivoted lever provided with cam-stud co-operating with said cam-surfaces and slotted to receive a stud from said extended arm, and a pivoted bar attached at one end to said cam-stud lever and provided with a slot to receive stud of the pivoted contact, substantially as described.

9. The combination, with the pivoted contact under tension, of the fixed contacts, the adjustable cam-plate with different cam-surfaces, the pawl-lever, and a tension device controlled by the pawl-lever to hold the pivoted contact at the end of the pawl-lever stroke.

10. In a matrix-making machine of the class described, the combination, with the differential feed devices and the normal space-key, of an automatic switch adjustable to shift the connection from the said space-key to some other than the normal feed device for a certain number of throws and then return to normal for distributing the extra spaces, a dial-plate, and a pointer with a connection to the switch for setting the same at the beginning of the line, substantially as described.

11. The combination, with the pivoted contact, of the fixed contacts, the adjustable cam-plate with cam-surfaces and ratchet-teeth, the pawl-lever, the dial, and the pointer attached to the cam-plate, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLOUGHBY W. STREET.
CHARLES LESLIE TRAVIS.

Witnesses:
WM. H. BLODGETT,
JAS. F. WILLIAMSON.