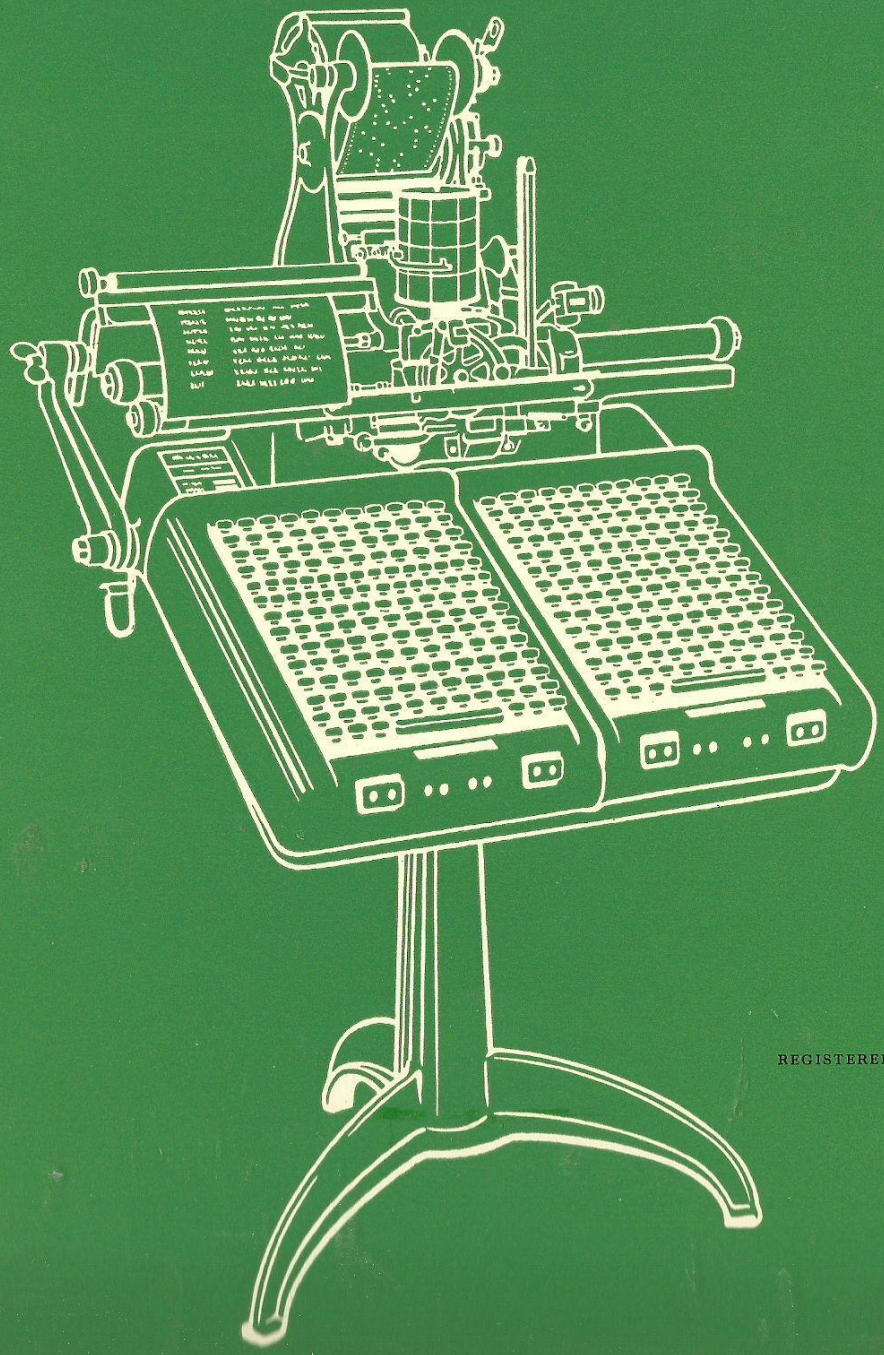

REGISTERED TRADE MARK

A

'MONOTYPE' KEYBOARD

EXPLANATIONS

& DIAGRAMS

MONOTYPE

PLEASE NOTE

The following are the addresses of

THE MONOTYPE CORPORATION LIMITED

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PRINTED IN ENGLAND

A 'MONOTYPE' KEYBOARD

EXPLANATIONS AND DIAGRAMS

The keyboard mechanism is explained and illustrated in the following pages. Skeleton drawings with brief descriptions make clear the different mechanisms.

Universal Typewriter Key Arrangement

The advantage to the compositor of the typewriter key arrangement of a 'Monotype' keyboard cannot be overestimated. This is the perfect grouping of keys for transforming words into key-strokes at the maximum speed with the minimum effort. A 'Monotype' keyboard is the only composing machine that has this key arrangement; it is the only composing machine in which the key arrangement is determined by the requirements of the operator instead of by the mechanical limitations of the machine. It is, therefore, the simplest and fastest composing machine—the easiest to learn and the easiest to operate.

The Air Cushion Touch

Second only to this key arrangement as a means to speed is the light cushion-touch of the keys.

The motive power of a 'Monotype' keyboard is compressed air, and the work of the operator is confined to starting the air to do the work for him. When the operator depresses a key he moves little plungers and the air does the rest.

The Three Functions of the Keyboard

A 'Monotype' keyboard has been, not inaptly, described as a combination of a perforating machine and an adding machine, for the work of the air when a key is depressed is as follows:

(*a*) It drives the punches representing the characters through the paper.

(*b*) It registers the width of the character, adding it to those previously struck for the line being set.

(*c*) It advances the paper to position to receive the perforations for the next character to be struck, at the same time winding the paper already perforated on to the spool to be transferred to the casting machine.

These three functions will be explained separately although, since they are all operated by the keys, they are interdependent.

'Monotype' Measures, Sets and Units

A 'Monotype' operator has only to think of the space occupied by the width of the characters and spaces; he is not concerned with the body or point size of the type.

All 'Monotype' type is cast to some definite number of units. The "em" of a fount is usually 18 units, the figures usually 9 units, the lower-case i and l are usually 5 units.

The measure of any line is therefore made up to a given number of units. For convenience the measure is divided into ems and units of the type that is to be composed, each em being reckoned as 18 units. The measure is not made up to pica ems, but to their equivalent in ems and units of the fount to be composed.

The width of 'Monotype' type is known as "set", and for the purposes of adjusting keyboard measures the set has nothing to do with the body size.

The differences in the set of 'Monotype' type faces are known by numbers, such as 6 set, 8½ set, and so on. The larger the set number of a fount the wider will be the width of the characters.

How Sets are Defined

The "point" is taken as the base of all 'Monotype' type measurements. The decimal measurement of 1 point is ·0138333″. This would be the measurement of the em of 1-point type if such could be made.

The em measurement of 1 point may be multiplied by any number to give the em measurement of any larger type. Thus: if multiplied by 8½ the measurement becomes ·11758″, and type with this width of em is known as 8½ set; if multiplied by 12 the em measurement becomes ·166″, and type with this width of em is known as 12 set.

A unit is the 18th part of an em.

As the body size of type is now almost universally designated in points it follows that if the set of the em is equal to that of the point size of the body of the type the em will be exactly square in section, such as 8 set on 8-point body, or 12 set on 12-point body; in such cases the set of the type face will be relatively normal compared with the body size.

If the set of the em is less than the point size of the body of the type, the em will be lesser in width than the point size of the body of the type, such as 9¼ set on 10-point body; in such cases the set of the type face will be relatively condensed compared with the body size.

If the set of the em is greater than the point size of the body of the type, the em will be greater in width than the point size of the body of the type, such as 10¾ set on 10-point body; in such cases the set of the type face will be relatively expanded compared with the body size.

From the foregoing it will be understood that the width of any character in any fount is always proportionate to the em; there will be three 6-unit characters to an em, two 9-unit characters to an em, or one-and-a-half 12-unit characters to an em, and so on. Also, the measure of a given set will always be proportionate to the measure of another set. For example: 24 ems of 12 set will be equivalent to 48 ems of 6 set, or to 33½ ems 7 units of 8½ set.

Instructions are usually given to the operator to compose his copy to so many ems of pica. Pica ems are now always understood to be the same as 12 point or 12 set. The operator must therefore convert the pica measure into ems and units of the type in which the copy has to be composed. A card of equivalent measures is provided for this purpose, so that the operator can readily find his measure in any required set.

As the operator composes his copy the unit value of every character and space is registered upon a unit wheel on the keyboard, which escapes one tooth for every unit composed. The space between words is usually registered as 4 units.

If a line is short (that is, if sufficient units have not been composed) provision must be made so that on the casting machine all spaces in such line will be cast to an increased thickness so that the line shall be of the correct width.

To provide for this a ready-reckoning scale in the form of a drum is provided. When the line is 4 ems from completion this drum partly revolves as each key is struck, and when the last character or space has been inserted a pointer, which rises when each space key is struck, will indicate two keys which have to be struck so that on the casting machine the spaces will be cast to a thickness sufficient to make the line complete.

To indicate how far the line is from completion, an em scale is positioned in front of the operator, along which a pointer advances, propelled by the unit wheel.

Justification and the Justifying Scale

Justification is accomplished by means of the justifying keys and the justifying scale. The latter is a light cylinder mounted upon its vertical axis. It revolves automatically when the end of the line is approached; or it may be revolved by hand when necessary for justifying sections of a line, such as in tabular composition. Vertical lines divide the surface of this cylinder into 72 sections representing units of the type being composed; horizontal lines divide the surface into 20 divisions, representing expandable spacing bodies. In the squares produced by the intersection of the horizontal and vertical lines are two numbers indicating the justifying keys that must be struck so that the wordspaces in the line when cast will be automatically increased in thickness to make the line the correct length. The rotation of the unit wheel therefore indicates the number of units to be added to complete the line, and a justifying scale pointer counts the justifying spaces by rising one space on the scale each time the justifying space bar is struck. Justifying spaces are registered by the unit wheel as 4 units wide, and to make them the proper size to justify the line when finished the operator reads from the justifying scale the numbers of the justifying keys, indicated by the scale pointer, and strikes these keys to swell the spaces (on the casting machine) the required amount to make the line fill the measure.

Each justifying key adds a definite amount to the minimum size of the justifying space which is counted as 4 units of the set in use. The justifying scale is simply a ready-reckoning table that indicates the amount which must be added to each justifying space to make it the required size so that the line fills the measure. Instead, however, of this amount being expressed in thousandths of an inch the table indicates the two keys which must be struck to obtain this amount in thousandths of an inch. This table is figured for any number of justifying spaces from one to twenty, and for any amount the line may be short up to 4 ems. Since this table varies for faces of different widths (sets) it is necessary that the justifying scale be of the same set as the face being composed.

The casting machine is completely controlled by the holes produced in the ribbon by the 31 punches of the keyboard. Not more than two of the 28 positioning punches are required to bring the matrix-case (in which the matrices are arranged in a square of 15 matrices on a side) to casting position, while each of the two rows of justifying keys has its own punch, as has also the justifying space. On extended matrix-case casters three perforated holes are sometimes required to effect this result and the matrix-case contains 17 rows of 15 matrices each, a total of 255. As the work on a line at the keyboard progresses, the paper winds on to the spool, and the last perforations for a line are those made by the justifying keys struck (as indicated by the justifying scale pointer) to justify this line; consequently, as the ribbon unwinds at the caster, these perforations are presented first, and they cause the space-sizing mechanism (the justifying wedges) to be adjusted to the proper position to produce the justifying spaces in that line of the required width to make the line exactly fill the measure.

The Paper Punching Mechanism

Bearing the foregoing points in mind, let us return to the keyboard mechanism. *Note:* of the 225 matrices in the matrix-case 196 require two perforations to bring them to casting position, 28 require only one perforation, and for one (the zero position of the matrix-case) no perforation is required. A blank, in place of a perforation, represents an imaginary fifteenth position, as on the casting machine a blank permits the matrix-case to be carried to the fifteenth (fixed) stop. On the extended machine 28 matrices require three perforations to bring them to casting position. When a key is depressed the movement of the key lever is transferred through its keybar to its rock shafts, which in turn move their valve bars to open plungers to admit air to raise the punches for this character, as shown in Fig. 1.

The keybars referred to above are carried in a keybar frame which, by lifting off the keybank, may be exchanged, so that the method of coupling the key levers to the plungers may be changed in less than a minute to suit any matrix-case arrangement.

The Counting Mechanism

The counting mechanism will be understood by referring to Fig. 5, which shows the unit wheel and the method of driving it. When a key is depressed the unit wheel pawl lifts, after the unit rack has raised and engaged the unit wheel. As the unit wheel rotates it drives the unit rack to the right until its movement is arrested by a unit rack stop.

There is a different stop for each different unit size, and when a key is depressed the proper stop for this size character is thrown up in the path of the unit rack. These stops are operated from the punch bars as shown in Fig. 4. By altering the connections between these unit stops and the punch bars the unit values of the latter may be altered. This is done by changing stopbar cases.

The mechanism for raising the justifying scale pointer one division on the justifying scale for each time the justifying space bar is struck is shown in Fig. 13, while the mechanism for automatically revolving the scale at the end of the line is shown in Fig. 6. After twenty justifying spaces have been composed in a line the keyboard automatically records fixed 6-unit spaces should the operator again strike the justifying space bar in that line. That the space bar may be arranged, at the will of the operator, to produce 6-unit spaces is a great convenience when setting poetry or many classes of tabular work where justifying spaces are not used. This is done by pulling forward a knob (K) located below the unit wheel standard as shown in Fig. 14. Pulling the knob forward raises the heel (N) in a manner similar to that in which it is raised by pin (B) when the twentieth justifying space is struck as shown in Fig. 15.

Reversing the em rack—that is, returning it to the left, ready to start a new line—is effected by depressing the green key at the left of the right-hand keybutton bank; or it may be reversed by depressing any key in the lower row of justifying keys when justifying the line. If the latter method is used, the piston block valve handle 29KC17 must be turned to point to the rear of the keyboard.

The Paper Feeding Mechanism

The paper feeding and winding mechanism is illustrated in Figs. 9, 10, 11 and 12. Attention is called to Fig. 11 which shows the mechanism for releasing the feeding and winding pawls so that the paper may be turned forward when putting on a new paper roll, or backward for purposes of correction.

Air Passages

The air passages of the standard keyboard are shown in Fig. 22 and those of the duplex keyboard are shown in Fig. 24. These will be found especially valuable to the student in studying the operation and co-ordination of the various minor mechanisms, and to the operator in checking adjustments.

Duplex Keyboard

The duplex keyboard differs from the standard keyboard in that it has mounted, side by side, two separate counting and perforating mechanisms which may be operated simultaneously or separately at the will of the operator by means of the two green keys in the lower centre of the keybanks, or turning the lock switch on the front of the piston block base.

Acknowledgment

We record our appreciation of the many suggestions and valuable criticisms we have received from 'Monotype' operators; their expert advice is always helpful.

No one realizes better than we do, the enthusiasm of experienced 'Monotype' operators, and their pride in the diversity of the keyboard's functions. To the experienced operator any caution as to the importance of caring for the keyboard properly is quite out of place. The new operators, we feel sure, cannot but be impressed with the evident care we have given to the preparation of this book, realizing that if the keyboard is worthy of our making such a book, it is worthy of all the study they can give it. Their personal reputations depend upon the results they obtain from the keyboard, and surely those who use the keyboard are no less interested in taking proper care of it and in using it to the best advantages than are we who built it.

To all who use a 'Monotype' keyboard we offer this book and with it two suggestions of great worth:

(*a*) Learn to apply the correct method of fingering.

(*b*) Keep your keybars clean.

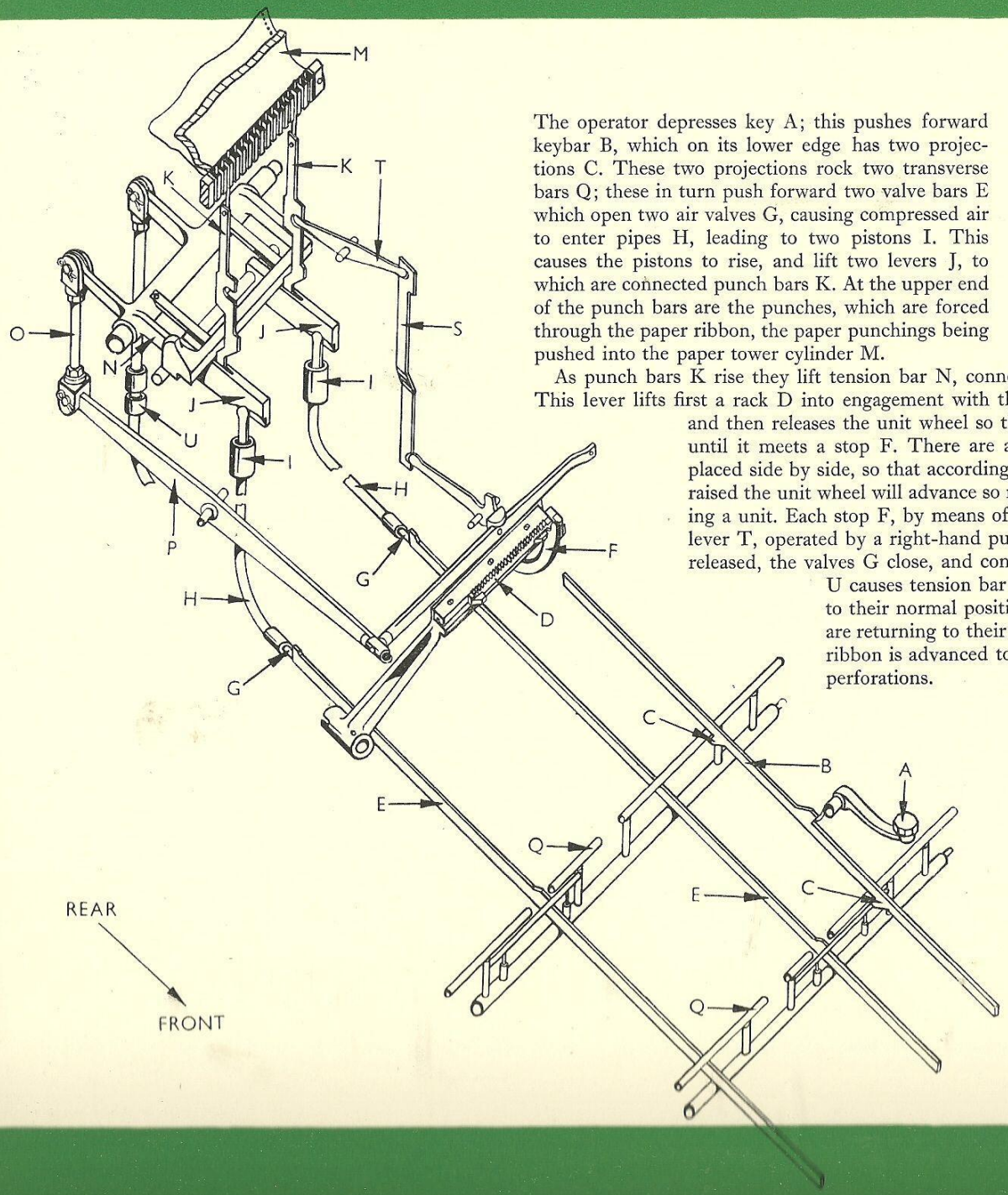
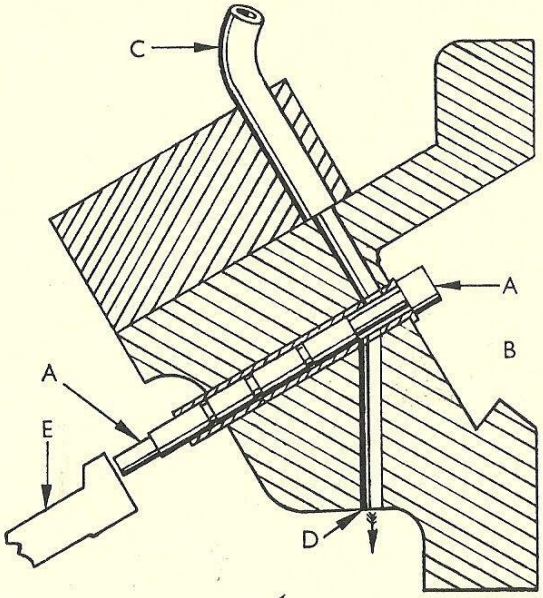


FIGURE I

Key and mechanism for transferring its motion to the plungers when the operator depresses key to admit air to pistons that bring up the punches for this key.

The operator depresses key A; this pushes forward keybar B, which on its lower edge has two projections C. These two projections rock two transverse bars Q; these in turn push forward two valve bars E which open two air valves G, causing compressed air to enter pipes H, leading to two pistons I. This causes the pistons to rise, and lift two levers J, to which are connected punch bars K. At the upper end of the punch bars are the punches, which are forced through the paper ribbon, the paper punchings being pushed into the paper tower cylinder M.

As punch bars K rise they lift tension bar N, connected by rod O to lever P. This lever lifts first a rack D into engagement with the unit wheel (not shown), and then releases the unit wheel so that it can advance the rack until it meets a stop F. There are a number of these stops F placed side by side, so that according to the position of the stop raised the unit wheel will advance so many teeth, each representing a unit. Each stop F, by means of a link S, is connected to a lever T, operated by a right-hand punch bar K. When key A is released, the valves G close, and compressed air beneath piston U causes tension bar N to return punch bars K to their normal position. Whilst punch bars K are returning to their normal positions the paper ribbon is advanced to receive the next character perforations.



Plunger which admits air to the pistons that drive the punches through the paper. Fig. 2 shows the position of plunger when key is released; Fig. 3 when key is depressed.

FIGURE 2

A Plunger a41KC12 released by valve bar E (shown also at E, Fig. 1) and held against its seat by the air pressure in Chamber B. This is the position the plunger occupies when the key is not depressed.

B Air chamber in valve bank c41KC1. Note that the air cannot pass into pipe C because plunger A is seated.

C Pipe 30KC8 (to 30KC42 inclusive) leading to the piston controlled by this plunger (see Fig. 4).

D Vent, which is here uncovered by plunger A permitting the air in pipe C to escape so that the piston (see Fig. 4) can drop freely.

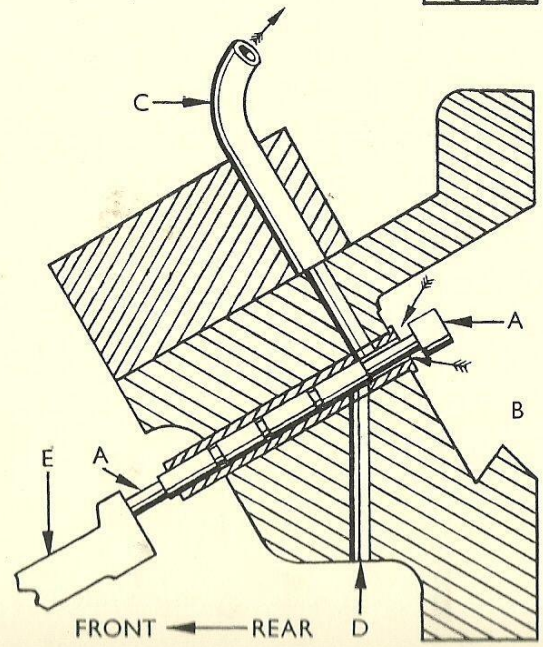


FIGURE 3

A Plunger a41KC12 pushed open by valve bar E (shown also at E, Fig. 1).

B Air chamber in valve bank c41KC1. There is constant air pressure in this chamber. When the plunger A is pushed open, as in this figure, air is free to pass from the chamber into the pipe C.

C Pipe 30KC8 (to 30KC42 inclusive) conveys the air to a piston for driving the punch up through the paper (see Fig. 4).

D Vent, which is closed while the plunger A is pushed open as here shown.

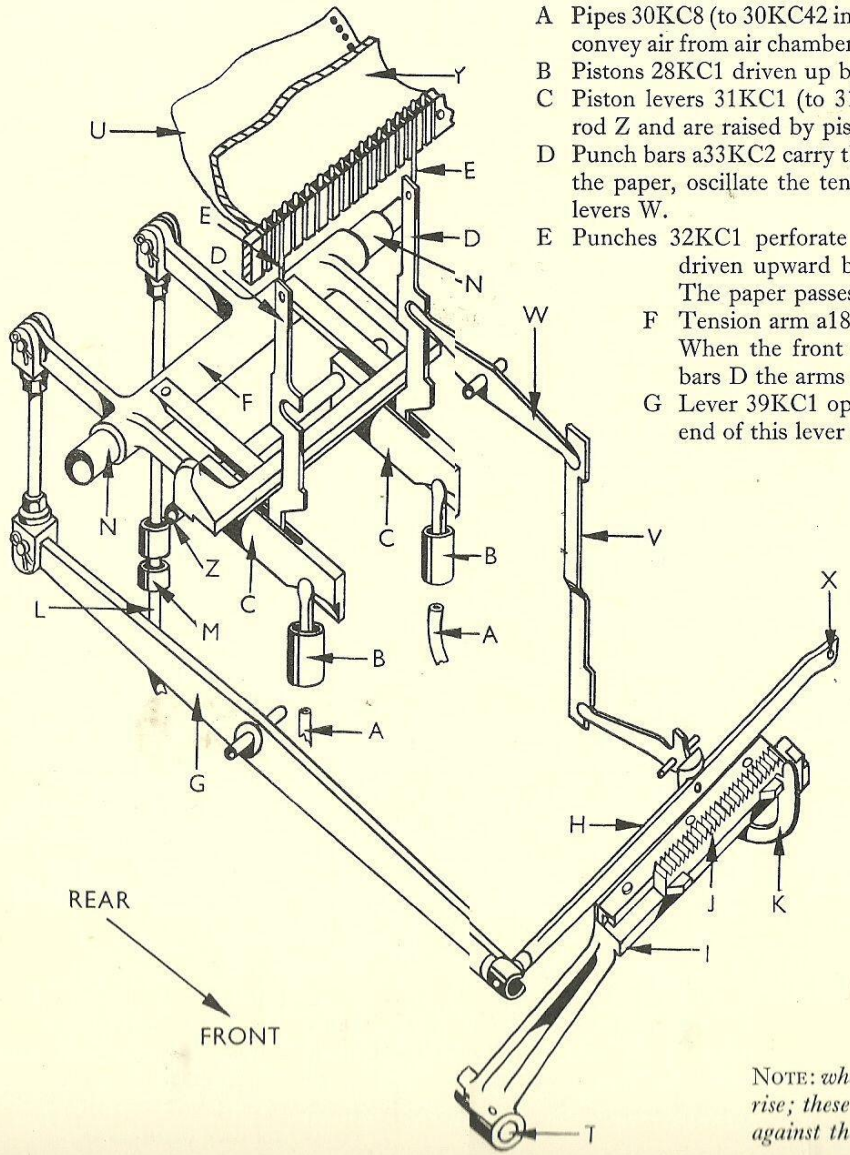


FIGURE 4

Mechanism for (1) driving the punches through the paper, (2) raising the unit rack slide so that the unit rack meshes with the unit wheel, (3) raising the proper unit rack stop and returning all these parts to their positions of rest when the key is released.

A Pipes 30KC8 (to 30KC42 inclusive, excepting a30KC26) convey air from air chamber (see Fig. 3) to the pistons B.

B Pistons 28KC1 driven up by air pressure from pipes A.

C Piston levers 31KC1 (to 31KC6 inclusive) fulcrum on rod Z and are raised by pistons B.

D Punch bars a33KC2 carry the punches E for perforating the paper, oscillate the tension arm F and operate the levers W.

E Punches 32KC1 perforate the paper ribbon U when driven upward by pistons B as here shown. The paper passes under the die Y.

F Tension arm a18KC34 fulcrums at points N. When the front end is raised by the punch bars D the arms on the rear are depressed.

G Lever 39KC1 operated by tension arm F; thus when a key is struck the rear end of this lever is depressed and the front end raised as here shown.

H Lever b38KB12 fulcrums at point X until rack J is raised into mesh with the unit wheel (see Fig. 5).

I Slide d29KB1 for unit rack J fulcrums at point and T is raised by lever H.

J Unit rack d26KB1 carried in slide I. This rack meshes with the unit wheel when slide I is raised, and is carried to the right by the wheel until the lug on the rack strikes stop K.

K Stop b31KB1 raised into the path of the lug on rack J by the upward movement of the punch bar D acting through lever W and bar V.

L Pipe 30KC45 direct from air chamber to piston M without any controlling plunger (see B, Fig. 22).

M Piston a28KC3 under which there is constant air pressure from pipe L. It acts through the tension arm F to press down the punch bars D and restore all parts to their initial position of rest when the key is released. Groove in piston M provides an extra exhaust opening to quicken return of space piston (see C, Fig. 13, and Z, Fig. 22).

NOTE: *when any key is struck to perforate the paper two pistons B always rise; these two are sufficient to overcome the one piston M, which is acting against them, and to operate the mechanism as described.*

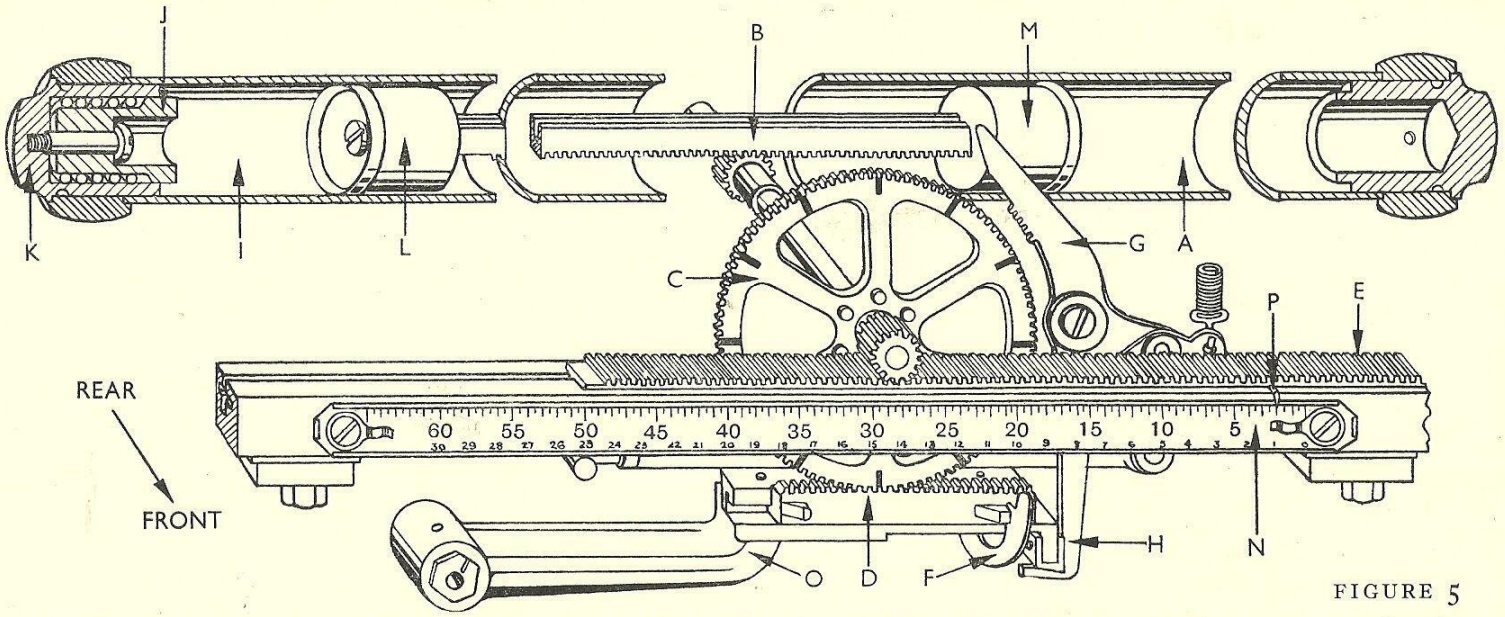


FIGURE 5

Mechanism for rotating and stopping the unit wheel; that is, for registering the number of units in a character when its key is depressed.

A Driving cylinder in which there is constant air pressure for driving rack B to the left (except at reversal).

B Rack drives wheel C anti-clockwise when wheel is released by pawl G.

C Unit wheel drives racks D and E to the right.

D Unit rack raised into mesh with wheel C and driven to the right by it.

E Em rack registers, by means of pointer P, on scale N, the amount that must be added to the line to complete it.

F Stop rises into the path of the lug on the right end of the rack D and stops the rack's movement to the right at the proper point to register the width of the character struck. These stops are raised by the punch bars (see Fig. 4) and consequently each different width character has its own stop. Note that the stops limit the rotation of the unit wheel C and consequently the movement of the pointer P to the right when a key is depressed.
Note: a lever (see P, Fig. 7) presses against the lug at the left end of rack D and moves the rack D back to the left when it is out from mesh with unit wheel C.

G Pawl lifts out of unit wheel C to allow it to revolve and again engages the unit wheel when it has been brought to rest (see next paragraph).

H Latch attached to pawl G is a safety device to prevent the unit wheel C from racing. The pawl G cannot move out from mesh with unit wheel C until rack D has been raised high enough to mesh with unit wheel C and permit latch H to pass under slide O. In like manner rack D cannot move down out from mesh with unit wheel C until the latch H has withdrawn from below slide O and before this can occur the pawl G must have again engaged the unit wheel C.

I Driving cylinder into which air is admitted at reversal for driving the rack B to the right and restoring rack E for the next line. When air is admitted to cylinder I it is shut off from cylinder A; cylinder A is connected with a vent to permit the air behind piston M to escape as rack B is driven to the right. When the key for restoring is released, air is again admitted to cylinder A and is shut off from cylinder I, cylinder I being connected with a vent.

J Abutment in the left cylinder head K absorbs the shock due to the sudden stopping of piston L at the end of its stroke.

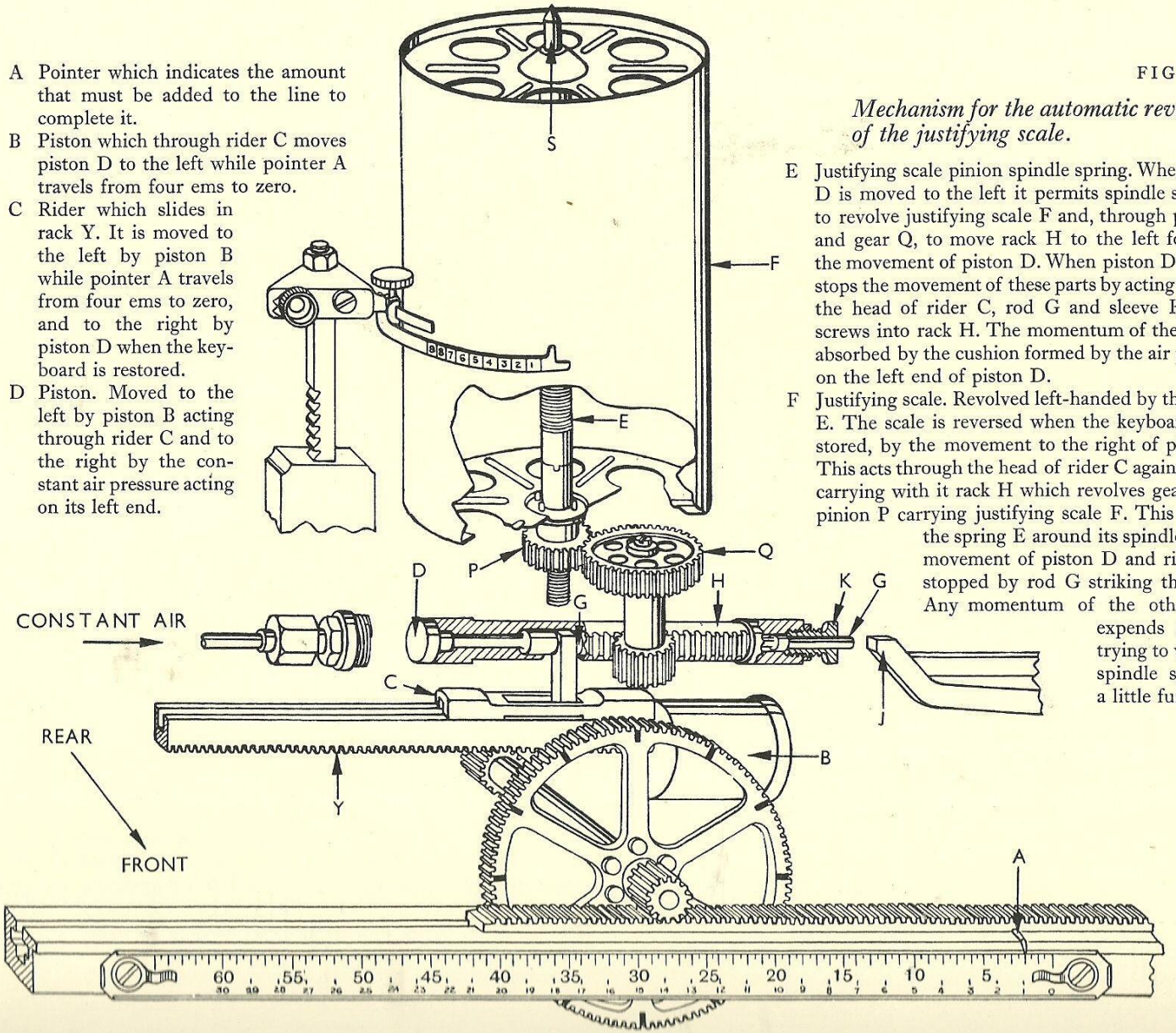


FIGURE 6

Mechanism for the automatic revolution of the justifying scale.

A Pointer which indicates the amount that must be added to the line to complete it.

B Piston which through rider C moves piston D to the left while pointer A travels from four ems to zero.

C Rider which slides in rack Y. It is moved to the left by piston B while pointer A travels from four ems to zero, and to the right by piston D when the keyboard is restored.

D Piston. Moved to the left by piston B acting through rider C and to the right by the constant air pressure acting on its left end.

E Justifying scale pinion spindle spring. When piston D is moved to the left it permits spindle spring E to revolve justifying scale F and, through pinion P and gear Q, to move rack H to the left following the movement of piston D. When piston D stops, it stops the movement of these parts by acting through the head of rider C, rod G and sleeve K which screws into rack H. The momentum of the parts is absorbed by the cushion formed by the air pressure on the left end of piston D.

F Justifying scale. Revolved left-handed by the spring E. The scale is reversed when the keyboard is restored, by the movement to the right of piston D. This acts through the head of rider C against rod G carrying with it rack H which revolves gear Q and pinion P carrying justifying scale F. This rewinds the spring E around its spindle S. The movement of piston D and rider C is stopped by rod G striking the cap J. Any momentum of the other parts expends itself in trying to wind the spindle spring E a little further.

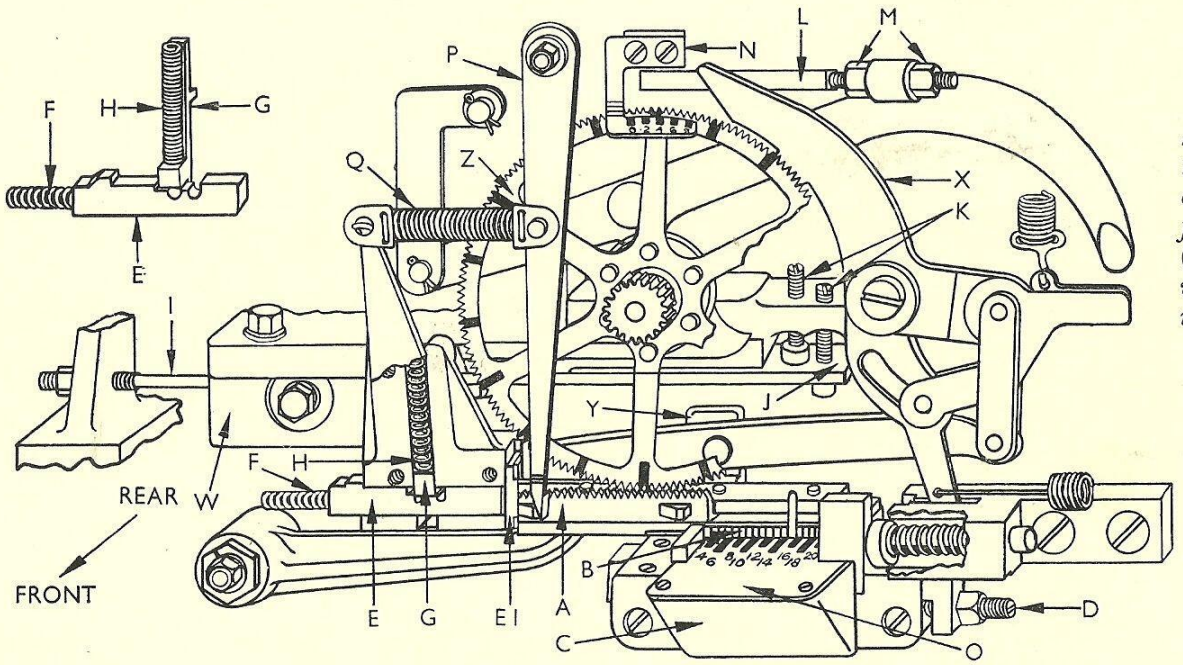


FIGURE 7

Shows (1) *the stops for the unit rack at each end of its travels*, (2) *the stop for the unit rack slide*, (3) *the stop for the unit wheel pawl, and* (4) *the unit indicator.*

A Unit rack is driven to the right when raised into mesh with unit wheel Z and returned to the left by lever P, actuated by spring Q, when moved down and out from mesh with unit wheel Z.

B Stops for unit rack A to limit its movement to the right.

C Guide for positioning stops B.

D Screw for adjusting guide C and through it the stops B.

E Abutment against which the rack A strikes at the left end of its travel.

E1 Abutment pad coming between abutment E and rack A, for receiving the blow of the latter at the end of its return.

F Spring holds abutment E to the right.

G Detent which drops into a notch in abutment E as shown, when abutment E is driven to the left against the pressure of spring F, by the return stroke of unit rack A. This prevents any recoil from abutment E which would throw unit rack A to the right and out from position to engage the proper teeth of the unit wheel Z on the next key-stroke, when the keyboard is being operated rapidly. Detent G is raised by unit rack slide Y when the unit rack A is in mesh with unit wheel Z and moving to the right on its next stroke. This permits spring F to move abutment E slightly to the right, ready to receive the return stroke of unit rack A as shown in the small diagram in the upper left-hand corner of the figure.

H Spring holds detent G down against abutment E.

I Stud for adjusting position of bracket W and through it the position of abutment E.

J Abutment for stopping the upward movement of unit rack slide Y.

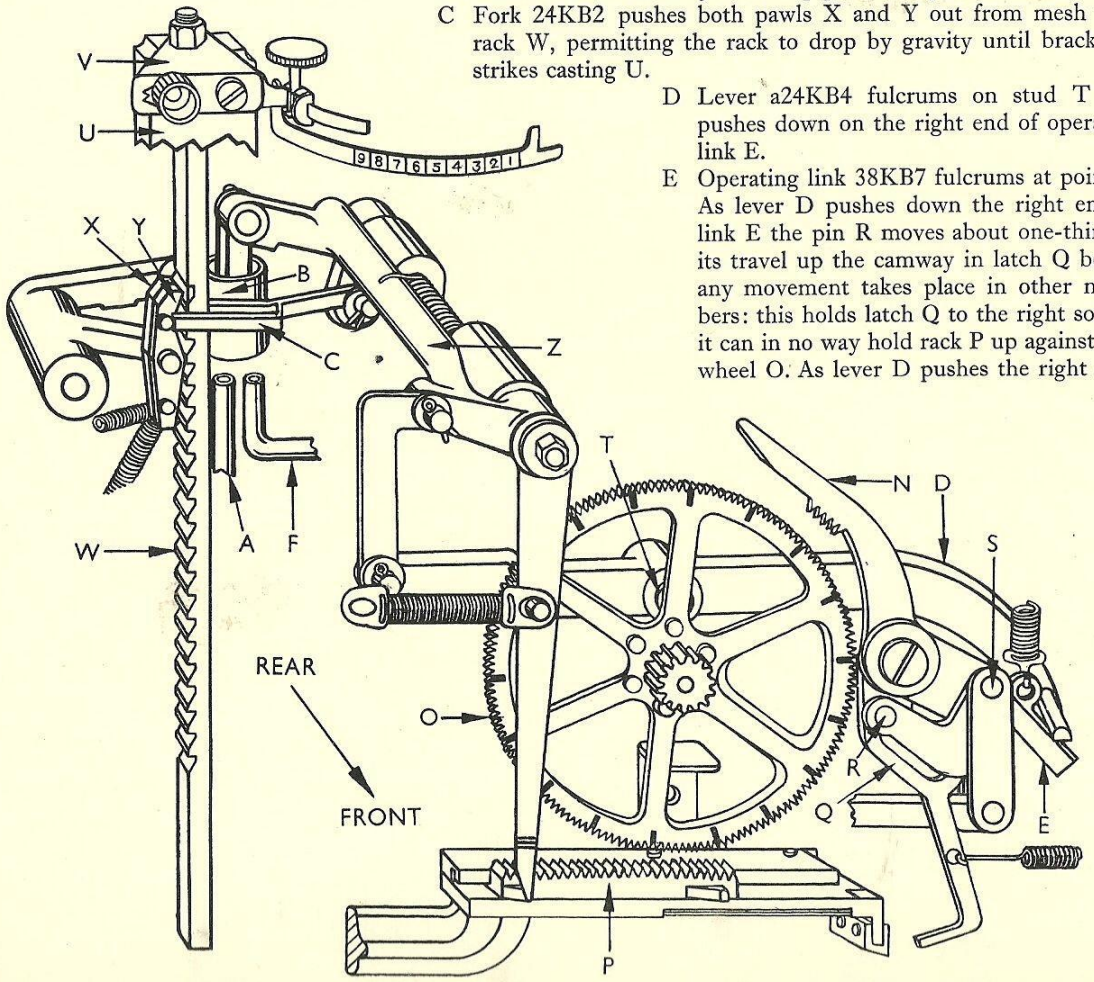
K Screws for adjusting and locking abutment J.

L Bar stops the downward stroke of pawl X.

M Nuts for adjusting bar L.

N Unit indicator shows how many units the keyboard is off from an even em or half em.

O Unit value indicator shows the unit value of the character of any key depressed.



A Pipe 30KC47 (see W2, Fig. 22) admits air under piston B (see Q, Fig. 22) when a key is depressed for reversing (see K, Fig. 18).

B Piston 28KC2 raised by air from pipe A and operates rocker arm Z.

C Fork 24KB2 pushes both pawls X and Y out from mesh with rack W, permitting the rack to drop by gravity until bracket V strikes casting U.

D Lever a24KB4 fulcrums on stud T and pushes down on the right end of operating link E.

E Operating link 38KB7 fulcrums at point S. As lever D pushes down the right end of link E the pin R moves about one-third of its travel up the camway in latch Q before any movement takes place in other members: this holds latch Q to the right so that it can in no way hold rack P up against unit wheel O. As lever D pushes the right end of link E further down and pin R continues up the camway in latch Q the link E acts as a lever with a sliding fulcrum at R and draws the right end of pawl N down, raising the pawl out from mesh with wheel O, and leaving wheel O free to be driven in right-hand rotation by the unit wheel driving rack (see B, Fig. 5).

F Pipe a30KC49 leads to bell and line counter (see E, Fig. 16, and R, Fig. 22).

FIGURE 8

Restoring mechanism for (1) dropping justifying scale pointer to its zero position, and (2) for permitting the unit wheel to rotate clockwise to bring the em rack into position to start a new line; this last requires that the pawl and unit rack be kept out from mesh with the unit wheel.

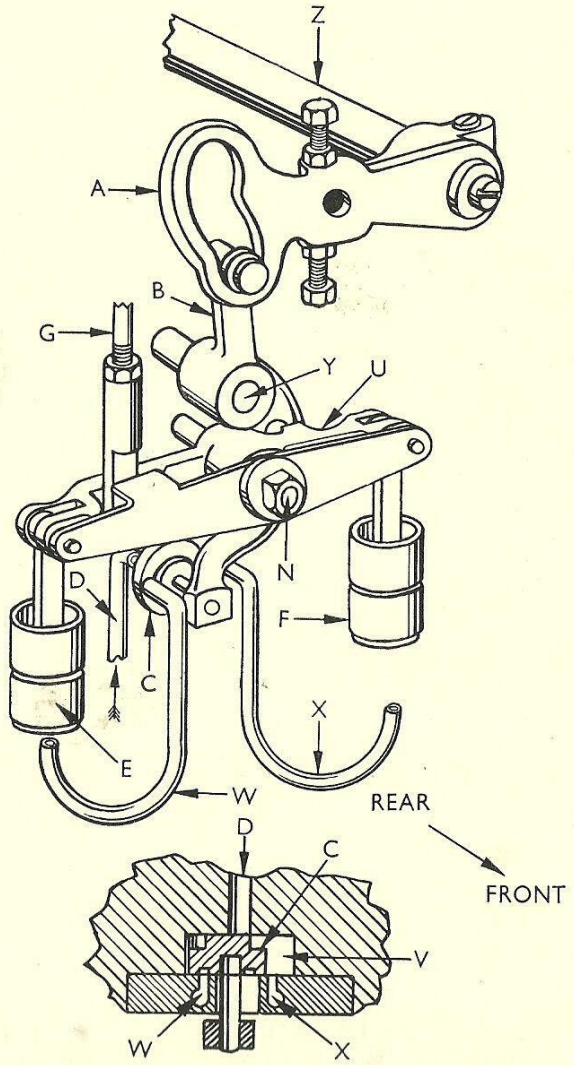


FIGURE 9

Mechanism for operating the paper feeding and winding mechanisms. The parts are shown in the position they occupy when a key is depressed; that is, when the paper has been perforated but the punches have not withdrawn.

A Cam a12KC1 is clamped to the right end of the tension arm Z and oscillates up and down with it (see Fig. 4 for an explanation of the movement of the tension arm).

B Lever 10KC2 fulcrums at point Y. Its upper end is moved by cam A, its lower end moves valve C. As here shown its upper end is to the right. When cam A moves down, the upper end of lever B will be moved to the left.

C Valve 10KC1 moved by lever B. As here shown (see cross section in lower figure) it connects pipe W (see D, Fig. 22) with the open air, forming an exhaust, and uncovers pipe X (see E, Fig. 22) so that air can pass into it to drive up piston F. When valve C is moved to rear by lever B it connects pipe X with the open air and uncovers pipe W (see D, Fig. 22) to admit air to drive up piston E.

D Pipe 30KC53 leads from beneath tension arm piston (see M, Fig. 4) and gives constant air pressure in the chamber V (see C, Fig. 22).

E and F Pistons 28KC1 driven up alternately as valve C is moved back and forth; they operate the lever U which fulcrums on stud N.

G Rod 9KC1 connects the lever U with the paper feed mechanism (see A, Fig. 10).

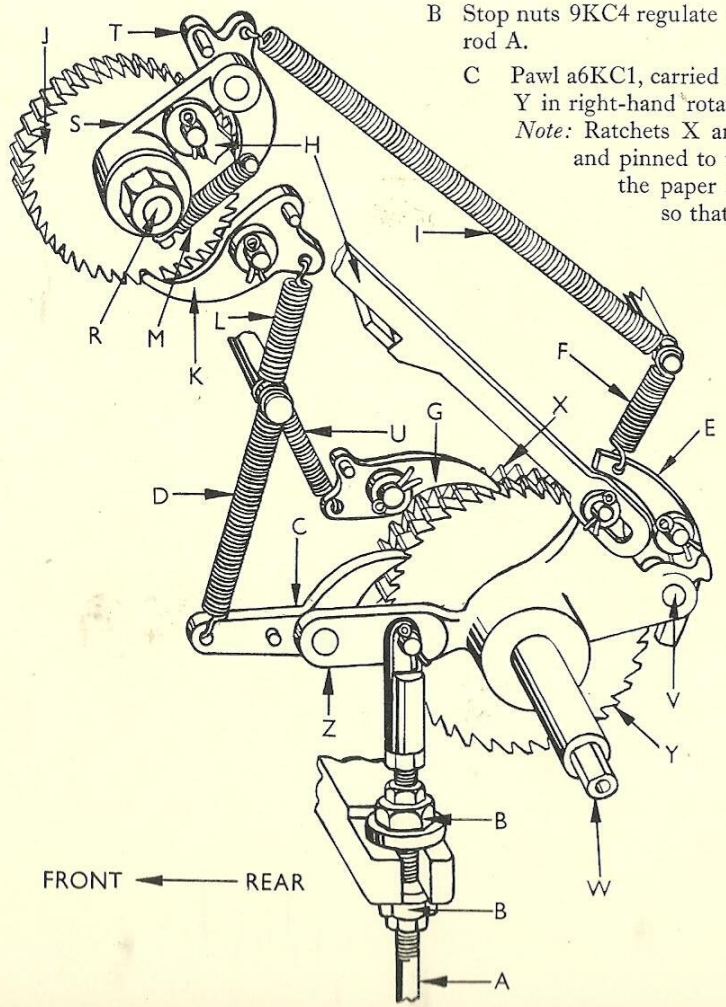


FIGURE 10

Paper feeding and winding mechanisms. The parts are shown as they appear when a key is depressed; that is, when the paper has been perforated but the punches have not withdrawn.

A Paper feed rod 9KC1 connects the driving mechanism shown in Fig. 9 with lever Z on this plate.

B Stop nuts 9KC4 regulate the length of stroke of the rod A.

C Pawl a6KC1, carried on lever Z, drives ratchet Y in right-hand rotation (like hands of clock). *Note:* Ratchets X and Y are riveted together and pinned to the shaft W which carries the paper feed wheels (see Fig. 12) so that all turn as one piece.

D Spring 6KC3 holds pawl C in mesh with ratchet Y.

E Pawl 7KC1 is pushed into mesh with ratchet X by the pin V, as pawl C rises; thus pawl E stops the ratchets X and Y after they have been revolved one tooth by pawl C.

F Spring 7KC2 draws pawl E out from mesh with ratchet X when pawl is released by pin V rising.

G Detent 5KC1 is held in mesh with ratchet Y by spring U and prevents the ratchets turning backward.

H Rod a21KC7 connects lever Z with lever S. The rod is here broken to show the pawl T and detent K back of it. Note the elongated slot in the lower end of the rod; this gives a positive upward stroke, but the downward stroke is caused by spring I. This prevents tearing the paper ribbon.

I Spring 24KC2 draws pawl T down to turn ratchet J and wind the paper. In conjunction with spring M it also holds the pawl T in mesh with the ratchet J.

J Ratchet 22KC1 which winds the paper spool by rotating shaft R.

K Detent a23KC1 prevents ratchet J turning backward. This detent is held in mesh by spring L.

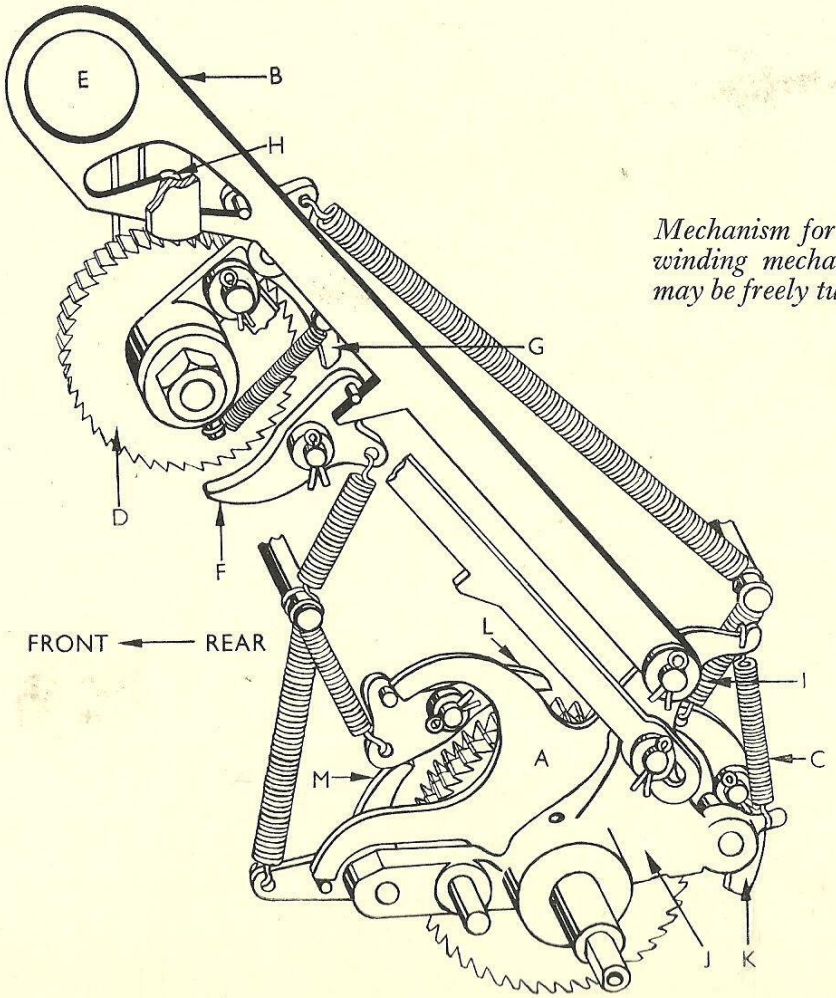


FIGURE II

Mechanism for releasing the paper feeding and winding mechanisms so that the paper ribbon may be freely turned either backward or forward.

A Release plate 8KC1 pulled in left-hand rotation by link B, as here shown, lifts pawls L and M out from mesh with ratchet and raises the rear end of lever J far enough to release pawl K and allow spring I to pull it out from mesh with the ratchet.

B Link b8KC2 operates plate A and also holds pawls F and G out from mesh with ratchet D as shown. To lock the pawls out as shown in this plate, pull the link B up, using finger hole E, and hook it over pin H. To put the parts again in action, push link B down until it slips off the pin H, and the spring C will pull the parts back to operating position.

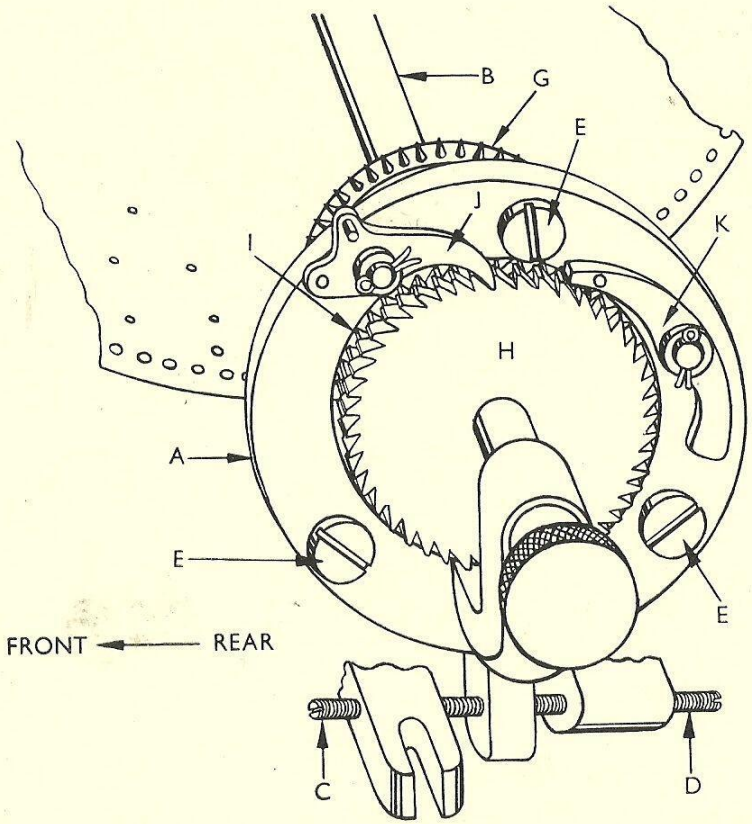


FIGURE 12

Mechanism for adjusting the paper feed wheels so that the marginal perforations in the paper shall align with the perforations made by the punches.

A Pawl ring 3KC1 carries detent J which is constantly in mesh with ratchet H and pawl K which is in mesh with ratchet I when no key is depressed.

B Shaft 13KC9 to which are pinned the paper feed wheels G (left-hand wheel not shown) and the ratchets H and I so that all turn as one piece.

C and D Adjusting screws 3KC2 rotate the pawl ring A in either direction and through it the paper feed wheels G. The marginal perforations may thus be brought into line with the perforations made by the punches.

E Screws 3KC3 (2) and 3KC10 (1) clamp the ring A after it has been positioned by screws C and D. The holes in the ring A through which the screws E pass are elongated to permit the ring to be rotated when adjusting it by screws C and D.

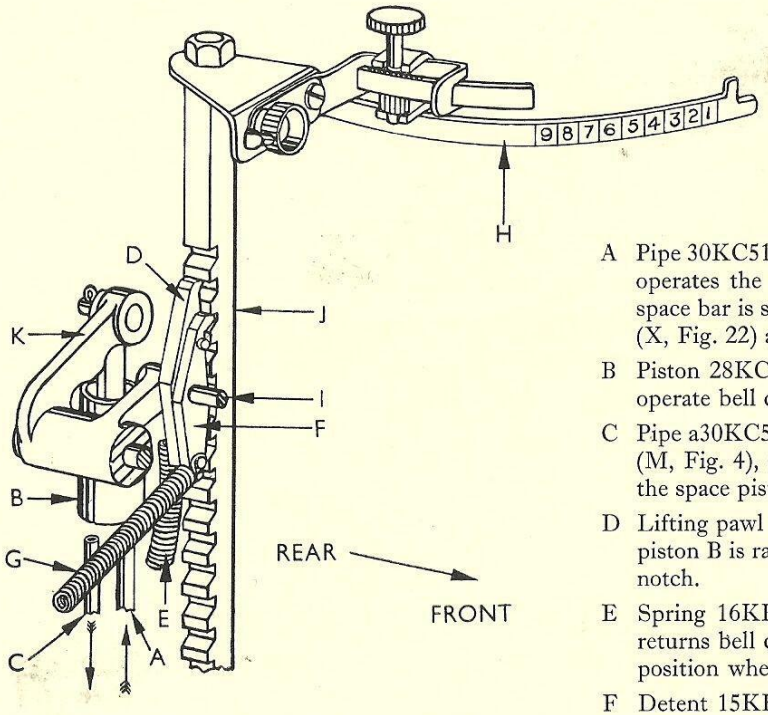


FIGURE 13

Mechanism for raising the justifying scale pointer one space on the justifying scale each time the justifying space bar is struck.

A Pipe 30KC51 leads from below the piston (see X, Fig. 22) that operates the justifying space punch, so that when justifying space bar is struck air will be admitted below the space piston (X, Fig. 22) and from there to piston B (see Y, Fig. 22).

B Piston 28KC1 (see Y, Fig. 22) raised by air from pipe A to operate bell crank K.

C Pipe a30KC58 (see Z, Fig. 22) leads to cylinder wall of piston (M, Fig. 4), and provides a quicker exhaust for piston B and the space piston through the groove in piston (M, Fig. 4).

D Lifting pawl 16KB1 carried by an arm of bell crank K. When piston B is raised by the air pressure, pawl D raises rack J one notch.

E Spring 16KB3 keeps pawl D in mesh with rack J and also returns bell crank K and pawl D carried by it to their lowest position when air is shut off from pipe A.

F Detent 15KB1 holds rack J from dropping after it has been raised by pawl D. Detent F rotates about stud I but has no movement up or down.

G Spring 15KB3 keeps detent F in mesh with rack Y.

H Pointer g14KB1 carried by rack J indicates on the justifying scale the proper justifying keys to strike.

A Rack carries the justifying scale pointer and is raised one notch each time a justifying space is put in the line.

B Pin in rack A lifts heel N when rack A rises to the twentieth (and last) notch. Note that this pin has no action on heel N until this last position of rack A is reached; at any preceding position, pulling knob K forward, by hand, slides the high part of rod I under cut out J raising it and heel N in position for registering six-unit spaces, as shown in Fig. 15.

C Plunger (see S, Fig. 22) held up against its seat by air pressure from pipe D.

D Pipe (see X2, Z2, Fig. 22) from air chamber, gives constant pressure below plunger C.

E Pipe (see T, Fig. 22) is here connected with vent M by the recessed portion of plunger C.

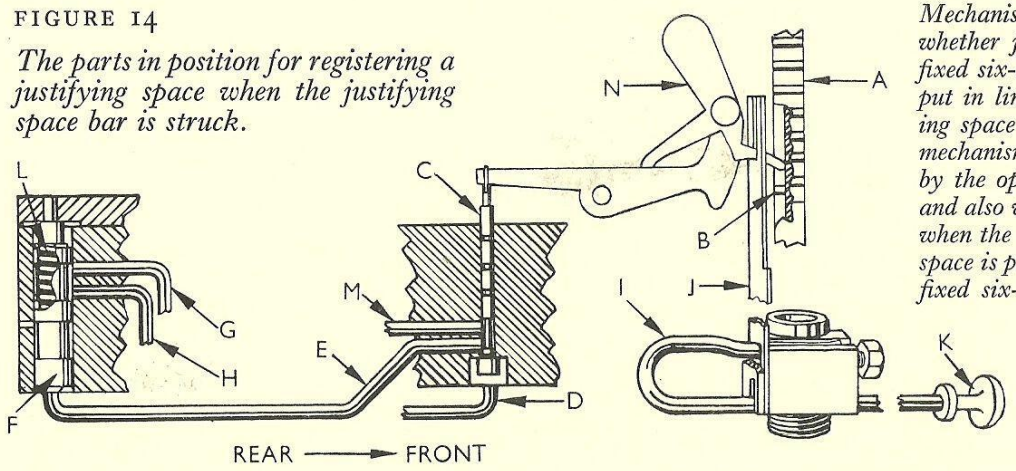
F Piston held down by spring L and in this position connects pipes G and H.

G Pipe (see V, Fig. 22) from "S" plunger has air admitted to it whenever the justifying space bar is struck.

H Pipe (see W, Fig. 22) to piston (see X, Fig. 22) which drives the "S" punch up through the paper. It is this "S" punch which gives a justifying space in place of a fixed six-unit space.

FIGURE 14

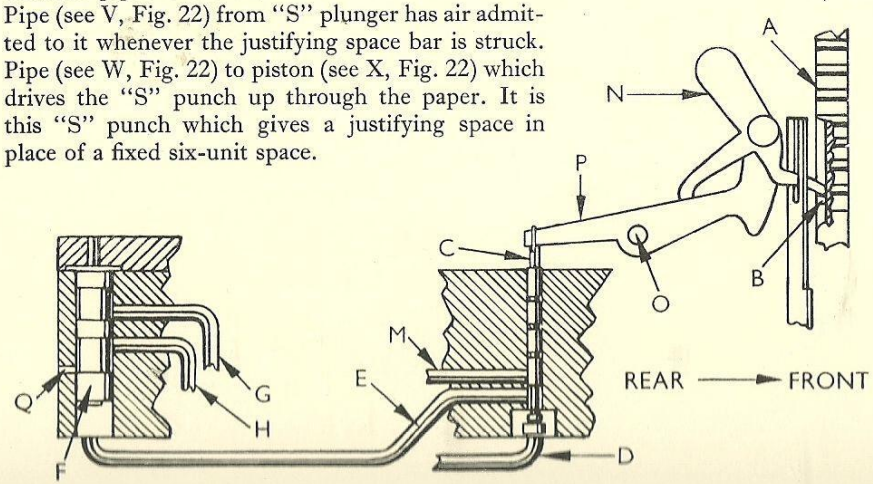
The parts in position for registering a justifying space when the justifying space bar is struck.



Mechanism which determines whether justifying spaces or fixed six-unit spaces shall be put in line when the justifying space bar is struck. This mechanism may be controlled by the operator at any time and also works automatically when the twentieth justifying space is put into a line so that fixed six-unit spaces will be put in the line thereafter whenever the justifying space bar is struck.

FIGURE 15

The parts in position for registering a fixed six-unit space when the justifying space bar is struck.



A Rack which carries the justifying scale pointer. It is here shown at the top of its travel; that is, after twenty justifying spaces have been put into the line.

B Pin in rack A has raised heel N and through it the front end of the lever P swinging it about fulcrum O, thus depressing the rear end (read again B, Fig. 14).

C Plunger (see S, Fig. 22) pressed down by the rear end of lever P admitting air to pipe E and closing vent M.

D Pipe (see X2, Z2, Fig. 22) from air chamber gives constant pressure below plunger C.

E Pipe (see T, Fig. 22) is opened by plunger C to admit air from pipe D to the space below piston F.

F Piston forced up by air from pipe E (see L, Fig. 14). This prevents air passing from pipe G (see V, Fig. 22) to pipe H (see W, Fig. 22) and connects pipe H with vent Q. When the plunger C is seated a spring returns the piston F.

G Pipe (see V, Fig. 22) from "S" plunger. When the justifying space bar is struck, air is admitted to this pipe but it can now go no further and produces no action of the keyboard. Therefore a six-unit space is then registered by the space bar.

H Pipe (see W, Fig. 22) to piston (see X, Fig. 22) which operates the "S" punch. It is here cut off from pipe G and connected with vent Q.

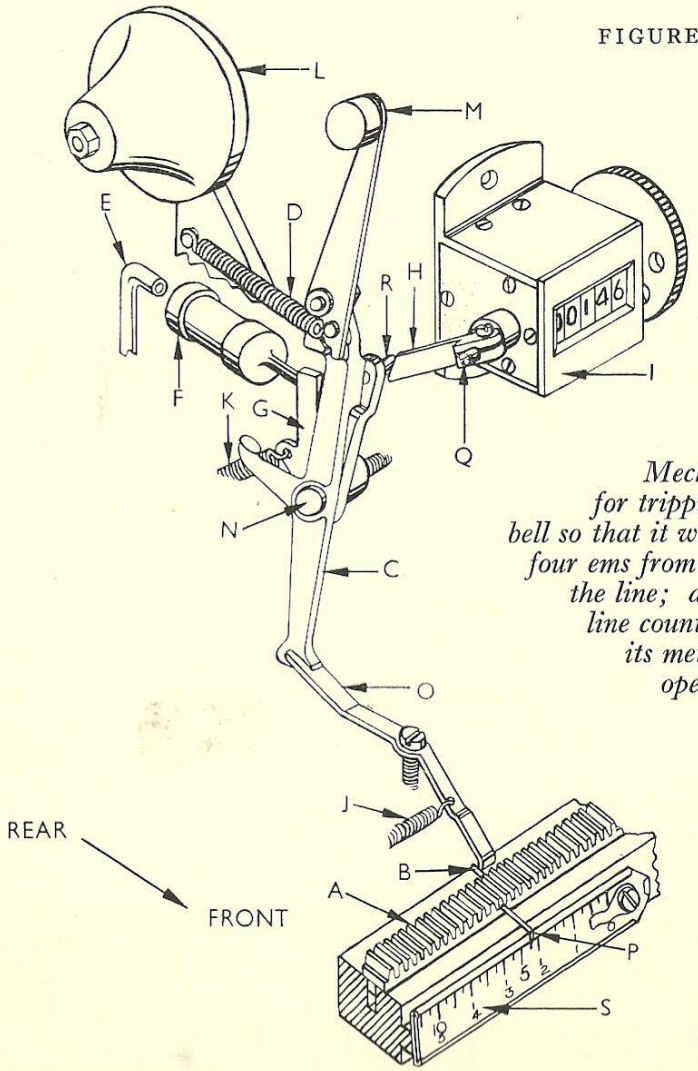


FIGURE 16

Mechanism for tripping the bell so that it will ring four ems from end of the line; also the line counter and its method of operation.

A Em rack a4KB1 is driven to the right or left by the unit wheel as the latter is respectively advanced or restored (see Fig. 5).

B Bell trip 4KB2 is carried by the rack A and trips the lever O when the pointer P comes to the four-em mark on scale S.

C Lever a2KB3 fulcrums on stud N, its upper end swings to the rear when its lower end is released by lever O and is pushed forward again by piston F acting through bell crank G.

D Spring 2KB12 swings lever C to the rear when lever C is released by lever O, thus causing hammer M to strike bell L.

E Pipe a30KC49 (see R, Fig. 22) leads from beneath the restoring piston (see F, Fig. 8) and admits air behind the piston F every time the keyboard is restored.

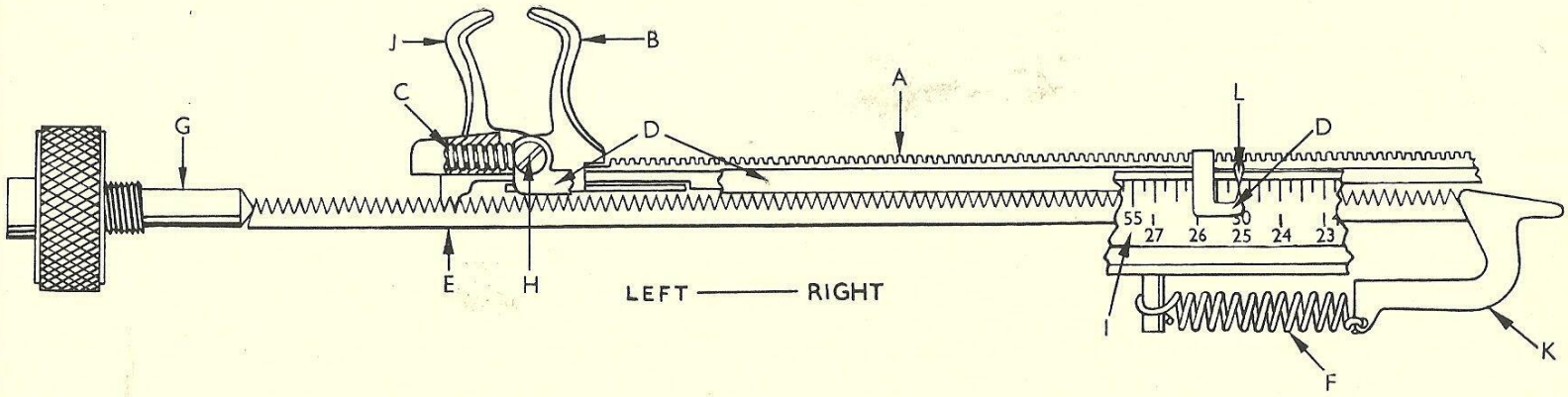
F Piston a1KB5 driven forward when air is admitted through pipe E at reversal. This rotates bell crank G, which in its turn pushes forward the upper end of lever C and operates arm H.

G Bell crank a2KB6 which is rotated forward by piston F and returned to the rear by spring K when released by the piston F. The rear arm of bell crank G acts as an interponent between piston F and a lug on lever C, causing lever C to be pushed forward by piston F. The front arm of bell crank G, carrying pin R, operates arm H.

H Arm b23KB2 clamped to shaft Q of line counter I; it is operated by pin R and turns the line counter forward one number each time the bell crank G swings forward.

I Line counter b23KB1 registers the number of lines set. The figures give a continuous register, but may be set at zero at any time.

J Spring 3KB2 turns lever O so that the notch in its rear end engages lever C when the upper end of that lever is pushed forward.



A Em rack a4KB1 is driven to the left, when the keyboard is reversed, until it strikes stop B. In this position its pointer L always comes directly above the right end of pointer D.

B Stop a6KB2 forms an abutment for rack A when the rack is driven to the left at reversal. By pressing together the handles B and J, the teeth in the under side of handle J are raised out of rack E and the stop may then be moved in either direction. Each tooth of rack E corresponds with half an em on scale I.

C Springs a6KB7. There are two of these in handle J which press against the right handle B and make it a spring abutment, instead of a solid abutment, to stop the travel of the em rack to the left at reversal. The hole for stud H in handle J is elongated to permit springs C to be compressed when rack A strikes handle B.

D Pointer 6KB3, carried by stud H, indicates on scale I the number of keyboard ems to which the measure is set.

E Stop rack b7KB1 held to the left against adjusting screw G by spring F acting through hook K.

F Spring 7KB3 holds the rack E firmly against the end of adjusting screw G.

G Adjusting screw b8KB1. By screwing this in or out, the rack E is moved to set the measure to the required number of units after it has been set to the nearest half-em by stop B.

FIGURE 17

Mechanism for setting the measure to any desired number of keyboard ems and units.

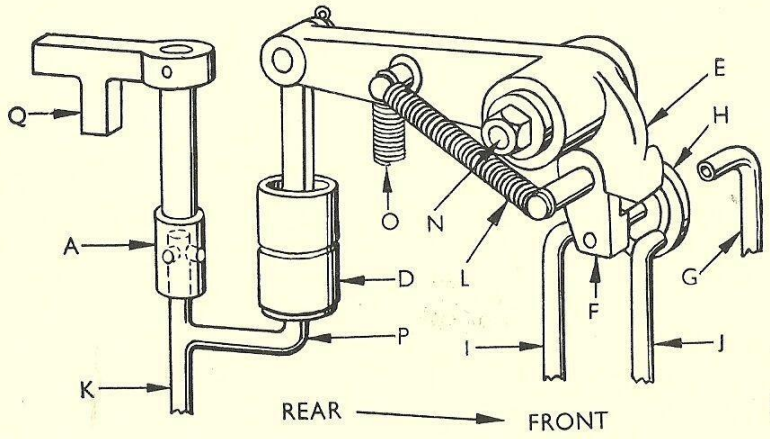
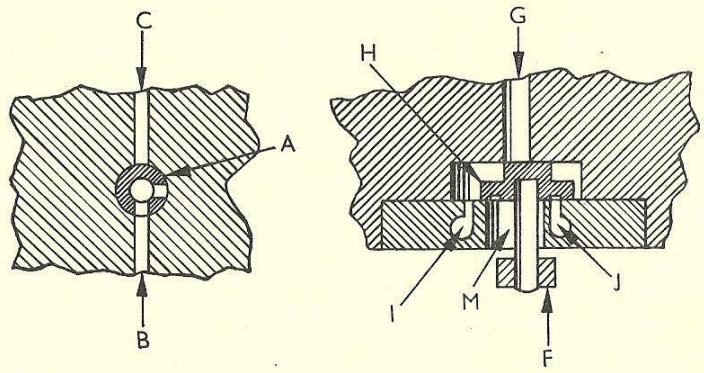


FIGURE 18

This shows the mechanism which (1) controls the air driving forward or reversing the keyboard, (2) determines whether the keyboard shall be reversed by the green reversing key or by a key in the lower row of justifying keys. As the parts are shown in the sketch the keyboard can be reversed only by the lower row of justifying keys.



A Valve 29KC15 (see O, Fig. 22) connects either pipe B or C with the air passage P according to whether the handle Q is turned to the rear or to the left.
Note: the piston block shown around the valves A and H in the lower (cross-sectioned) figures is omitted from the upper figure.

B Pipe 30KC48 (see M, Fig. 22) leads from the side of the ·0005″ justifying piston cylinder in the piston block. Air is admitted to this pipe when any justifying key in lower row is struck.

C Pipe 30KC25 (see N, Fig. 22) leads from the restoring plunger in the valve banks. Air is admitted to this pipe when the green restoring key is struck (see Fig. 19).

D Piston 28KC1 (see P, Fig. 22) is driven up when air is admitted through passage P; this operates bell crank E.

E Bell crank a36KC2 fulcrums on stud N, is rotated by piston D and returned by spring O.

F Valve lever a36KC10 fulcrums on stud N, is moved back and forth by bell crank E as piston D moves up and down; it in turn moves valve H. Spring L holds lever F against rear lug of bell crank E so that the two ordinarily move as one piece. In case the valve H should stick, the small space between lever F and the front lug of the bell crank E permits the bell crank E to give lever F a slight tap to free the valve.

G Pipe a30KC44 (see H, Fig. 22) direct from the air chamber.

H Reversing valve 36KC1 moved back and forth by valve lever F for alternately uncovering pipes I and J.

I Pipe 30KC50 (see I, Fig. 22) leads to the cylinder for driving the keyboard forward (see A, Fig. 5).

J Pipe 30KC46 (see J, Fig. 22) leads to the cylinder for reversing the keyboard (see I, Fig. 5).
Note: when the bell crank E is down, as here shown, Pipe I is uncovered to admit air from pipe G and pipe J is covered by valve H which connects with vent M. When bell crank E is moved up, pipe I is covered by valve H which connects with vent M and pipe J is uncovered to admit air from pipe G.

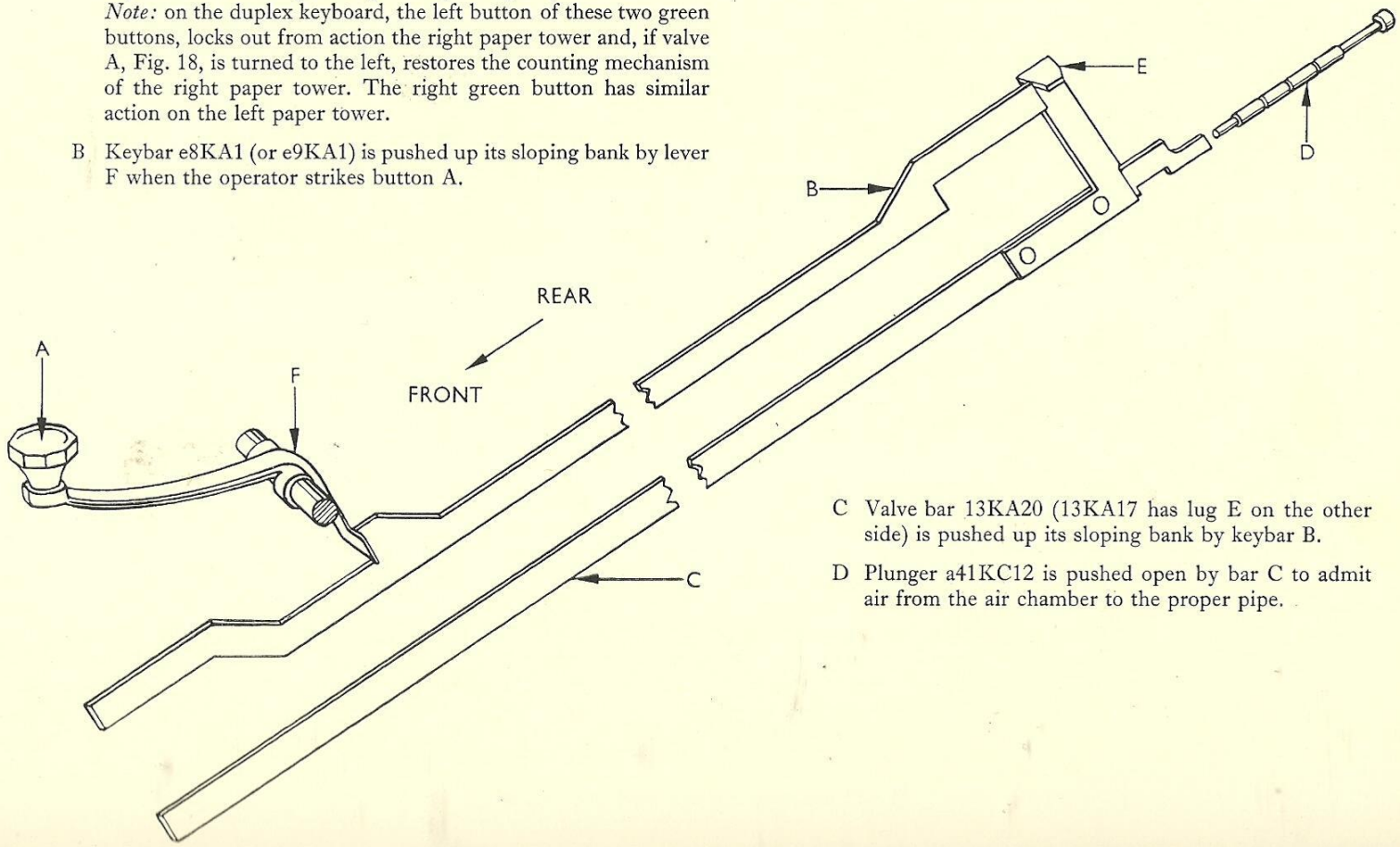
K Pipe 30KC47 (see W2, Fig. 22) leads to restoring rocker arm piston (see A, Fig. 8).

FIGURE 19

Manner in which the restoring key operates its plunger without affecting the rock shafts (see Fig. 1).

A Keybank button—refers only to the two green buttons, one in the lower right-hand corner of the left keybank (no function on standard keyboard) and one in the lower left corner of the right keybank for restoring the keyboard (see Fig. 18).
Note: on the duplex keyboard, the left button of these two green buttons, locks out from action the right paper tower and, if valve A, Fig. 18, is turned to the left, restores the counting mechanism of the right paper tower. The right green button has similar action on the left paper tower.

B Keybar e8KA1 (or e9KA1) is pushed up its sloping bank by lever F when the operator strikes button A.

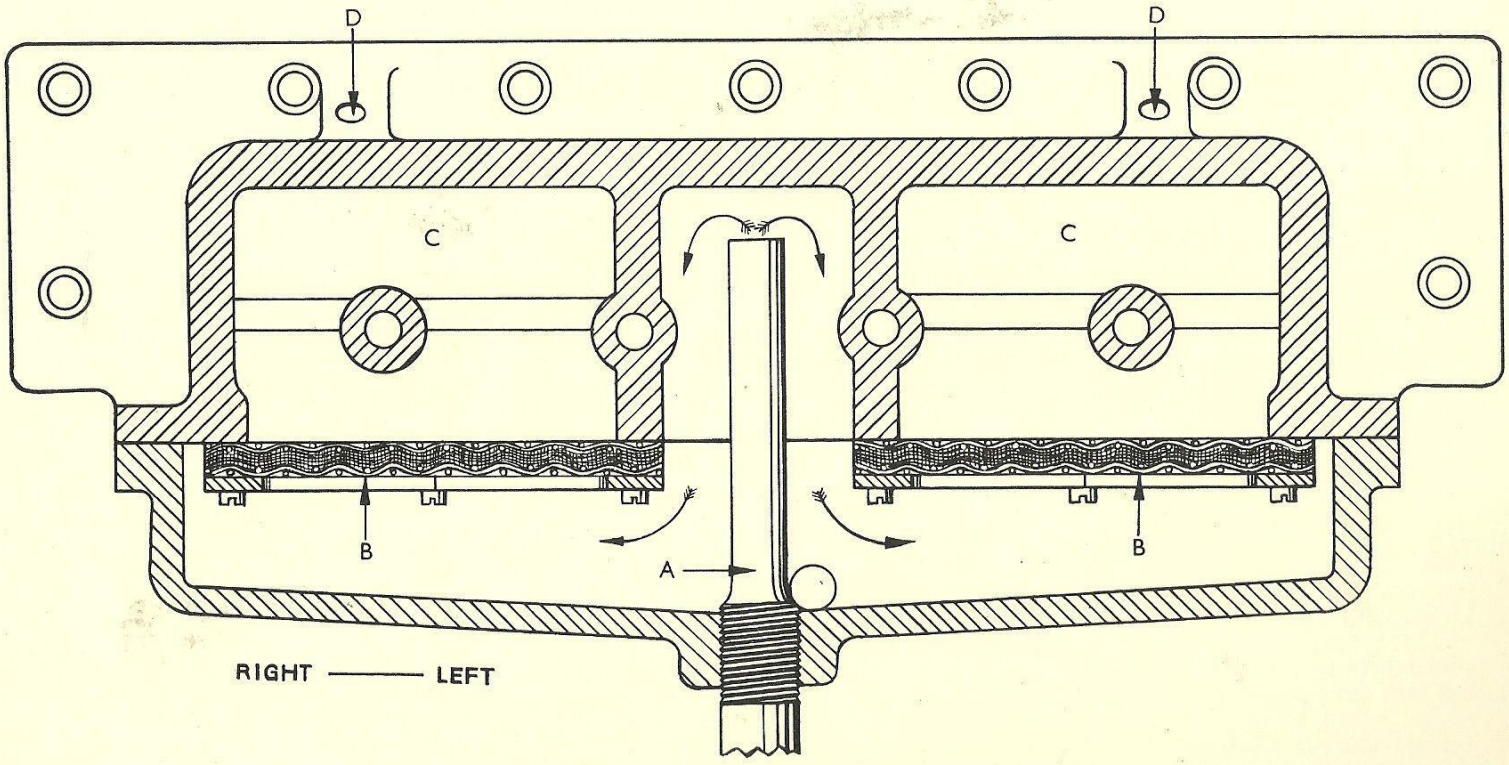


C Valve bar 13KA20 (13KA17 has lug E on the other side) is pushed up its sloping bank by keybar B.

D Plunger a41KC12 is pushed open by bar C to admit air from the air chamber to the proper pipe.

FIGURE 20

Air chamber and the method of filtering the air to remove all dust, oil or moisture that may have been carried this far.



A Nozzle a1KC4 supplies air from the hose. Note that the air strikes the top of the casting and is deflected downward.

B Packing 41KC7. This consists of several thicknesses of muslin held between two wire screens. The air in passing up through these is thoroughly cleansed from all dust, oil or moisture.

C Passages to the valve bank and plungers (see Fig. 2).

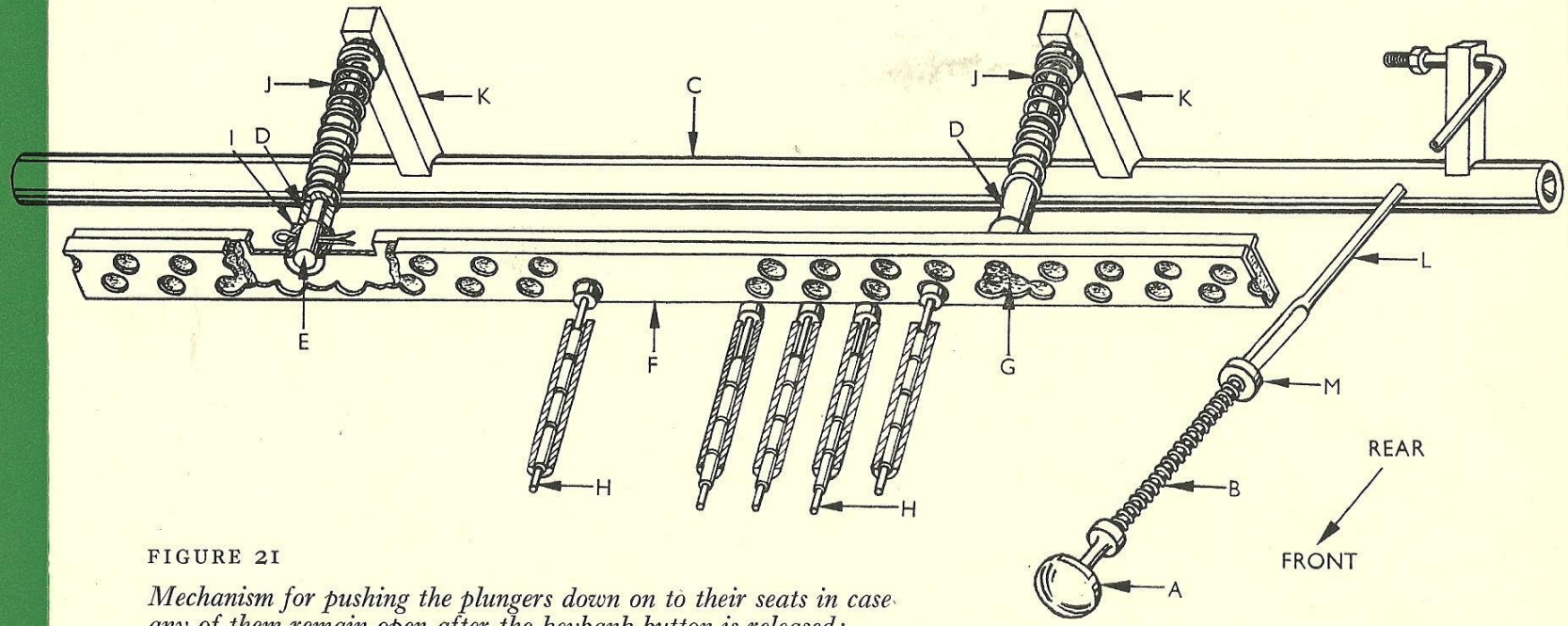


FIGURE 21

Mechanism for pushing the plungers down on to their seats in case any of them remain open after the keybank button is released; also for keeping the plungers oiled (*see Fig.* 1).

A Head 14KA7 projects from the front of the base of the keyboard just below the right end of the unit wheel standard. The operator pulls this to return the plungers to their seats.

B Spring 14KA9 is compressed between the inside of the base and the washer M when the head A is pulled forward. This spring returns rod L and rotates fingers K to the rear after the head is released.

C Rock shaft a14KA1 pushes with fingers K on the ends of the plungers E.

D Bushings 41KC18 forced into the holes marked D on Fig. 20.

E Plungers a41KC17 work in bushings D; after being pushed down by fingers K they are raised again by springs J when head A is released.

F Return bar a41KC15 is pinned to plungers E by cotters through bushings I which are fast in the return bar F. This bar F pushes the plungers H down on to their seats when head A is pulled forward.

G Felt pad a41KC23 kept saturated with oil and supplies plungers H with oil. This lubricates the plungers and prevents rusting from moisture in the air.

H Plungers a41KC12, two of which are here shown open (see Figs. 1, 2 and 3).

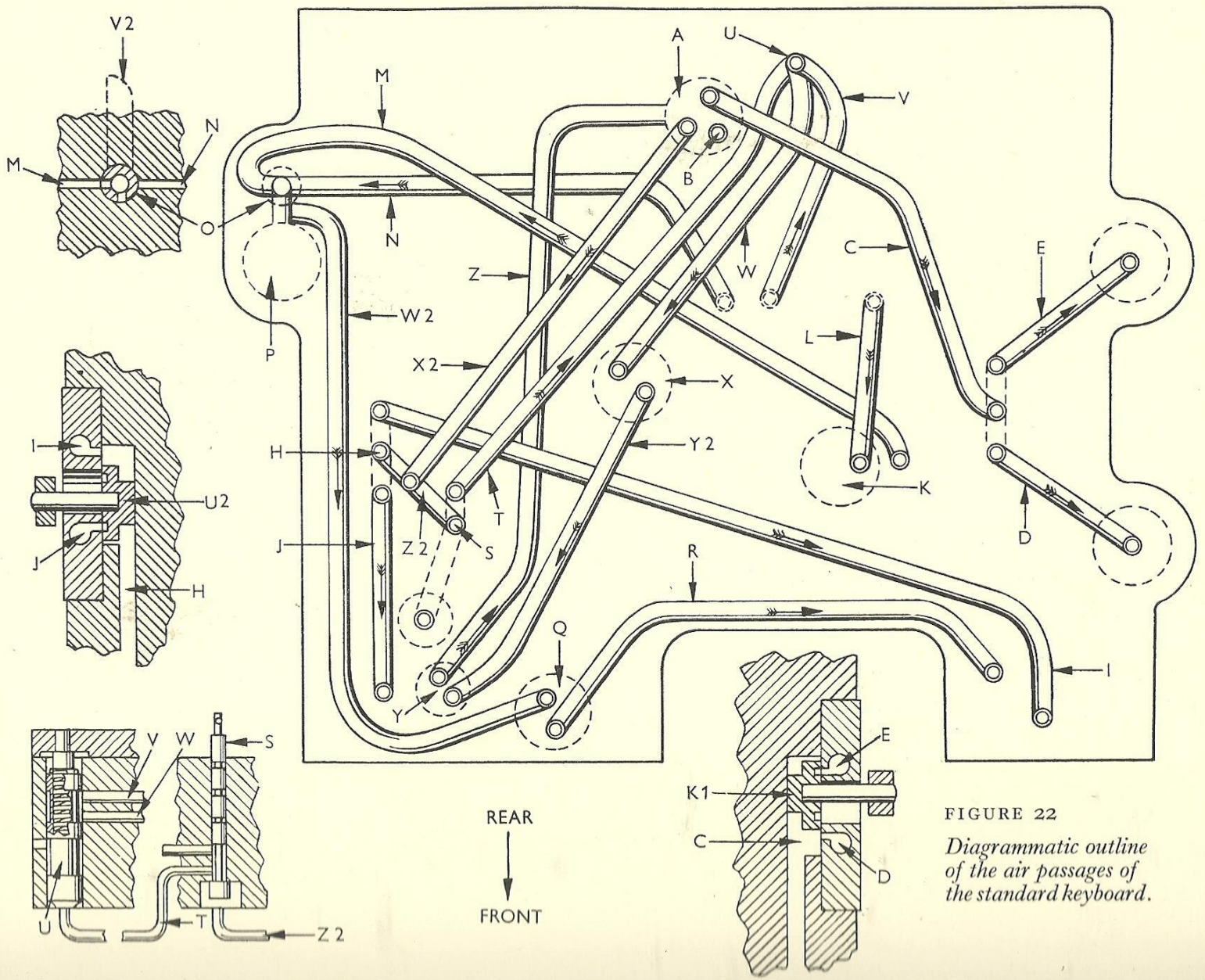


FIGURE 22

Diagrammatic outline of the air passages of the standard keyboard.

A Tension arm piston (see M, Fig. 4).
B Constant air supply from air chamber (see L, Fig. 4).
C Pipe to paper feed valve receives constant air supply from beneath A (see D, Fig. 9).
D Pipe to paper feed piston (front); constant air supply from C, except when a key is depressed (see W, Fig. 9).
E Pipe to paper feed piston (rear); air supply from C only when a key is depressed (see X, Fig. 9).
H Pipe to reversing valve; receives constant air supply beneath from air chamber and auxiliary air supply from beneath A (see G, Fig. 18).
I Pipe to unit wheel driving cylinder (right); constant air supply from H except when restoring (see Figs. 5 and 18).
J Pipe to unit wheel driving cylinder (left); receives air supply from H only when restoring (see Figs. 5 and 18).
K ·0005″ punch piston.
L Pipe from ·0005″ valve plunger; air supply whenever any justifying key in the lower row is depressed.
M Pipe from beneath ·0005″ punch piston K; receives air supply at same time as K (see B, Fig. 18).
N Pipe from restoring key plunger (green key in lower left corner of right keybank); air supply whenever this key is depressed (see C, Fig. 18).
O Piston block valve; its position determines whether air is admitted beneath P from M or N.
P Piston for operating reversing valve at H; receives intermittent air supply through valve O from M (which see) when handle V2 of valve O is to the rear (as shown) and from N (which see) when handle V2 is to the left (see D, Fig. 18).
Q Piston for restoring rocker arm, raises the justifying scale pointer pawls and unit wheel pawl out from mesh at reversal; air supply same as P (see B, Fig. 8).
R Pipe to bell bracket piston, operates line counter and restores bell; air supply same as P and Q (see F, Fig. 8 and E, Fig. 16).

FIGURE 22

Diagrammatic outline of the air passages of the standard keyboard—see preceding sheet. Study the diagram, paying special attention to the arrows showing the direction of flow of air through the passages.

S Space switch valve plunger. Its position determines whether space bar shall produce justifying or fixed six-unit spaces. Operated automatically at 20th space or at any time by hand at the will of the operator; constant air supply from beneath (see C, Figs. 14 and 15).
T Pipe from space switch valve plunger S to beneath U; air supply whenever S is depressed to give fixed six-unit spaces (see E, Figs. 14 and 15).
U Piston block space switch piston. Its position is controlled by S, which when depressed admits air through T to beneath U, forcing up U and cutting off air supply from V (see F, Figs. 14 and 15).
V Pipe from space bar plunger to side of U; air supply whenever space bar is depressed (see G, Figs. 14 and 15).
W Pipe from side of U leading to X; air supply each time space bar is depressed; providing piston U is down (see H, Figs. 14 and 15).
X Justifying space punch piston; air supply through W.
Y Justifying scale pointer piston raises pointer one space each time air is admitted beneath it; air supply same as X (see B, Fig. 13).
Z Exhaust pipe, from Y and X, through groove around tension arm piston A (see M, Fig. 4).
K1 Paper feed valve, admits air alternately to pipes D and E.
U2 Reversing valve; admits air to pipes I and J for advancing or reversing the unit wheel driving rack.
Y2 Pipe from "S" piston to justifying scale pointer piston Y.

FIGURE 23

Piston block, showing by figures and letters the position of the pistons for producing the corresponding perforations in the paper strip.

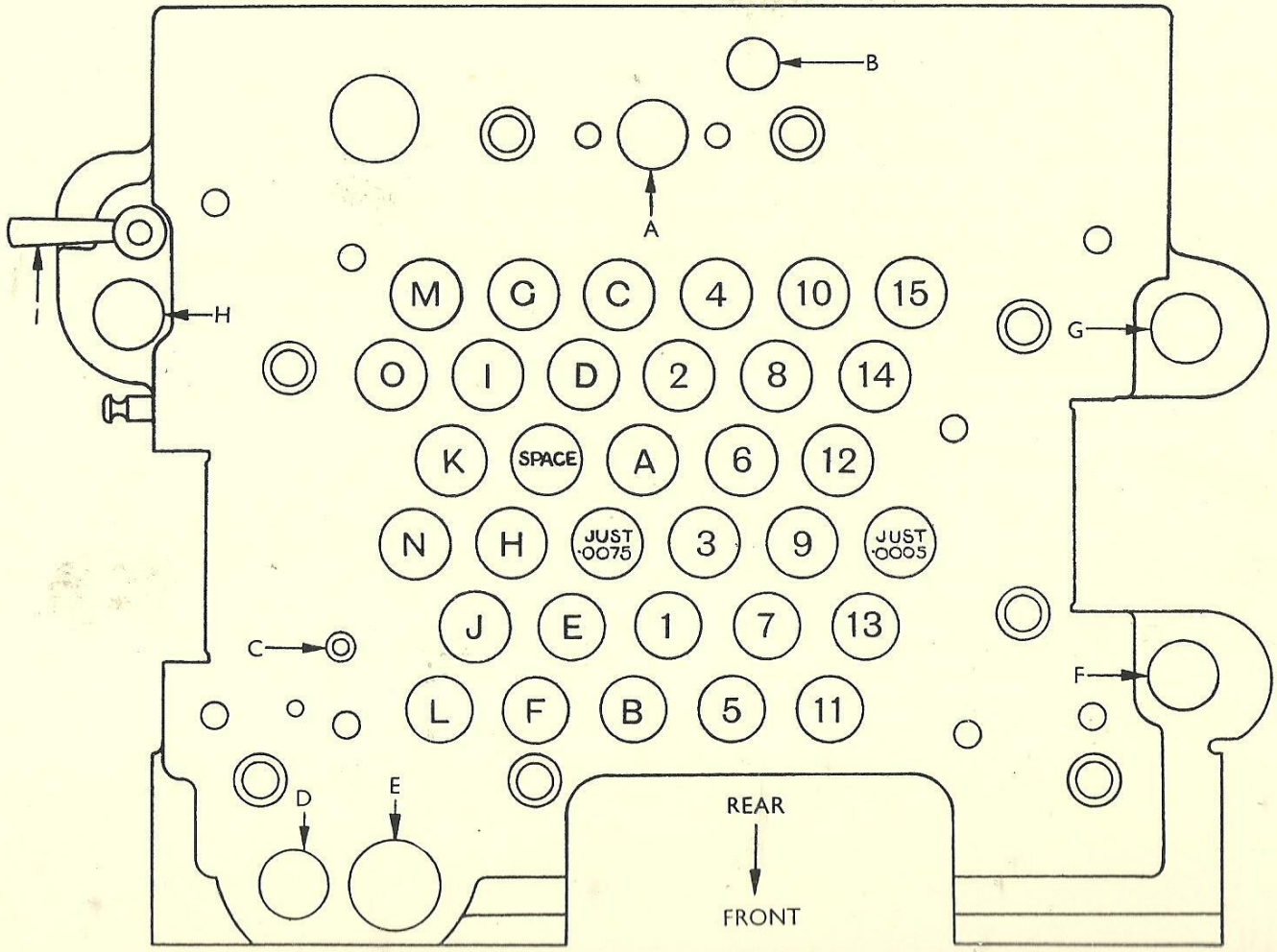


FIGURE 23

Piston block, showing by figures and letters the position of the pistons for producing the corresponding perforations in the paper strip.

The pistons O and 15 are balance pistons, and no perforations are produced by them.

Tension arm piston A for returning the pistons when the key-bank key is released.

Space switch piston B, held downward by a spring. When the space bar is depressed the air goes around the upper groove in this valve, and thence to the space piston; from the latter the air goes to the justifying scale pointer piston causing space pointer to rise.

Space switch valve C. When twenty spaces have been struck this valve is automatically depressed by the action of a pin in the space pointer rack (or it may be depressed by hand), and air is then conducted to beneath the space switch piston B, causing the latter to be lifted; this cuts off the air from the space piston when any additional justifying spaces are composed in the line, causing on the casting machine a 6-unit space to be cast in place of a justifying space, as the space transfer wedge will not function in the absence of a space perforation.

Space pointer piston D. Raises the justifying scale pointer one step each time the space bar is depressed.

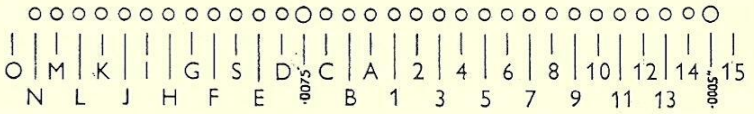
Restoring piston E. Raises the justifying scale pointer pawls and unit wheel pawls out from mesh during restoring.

Paper feed pistons F and G. Air is transferred from one to the other by the action of the tension arm.

Piston for operating reversing valve H.

Restoring valve switch handle I. When turned to left, as shown, the line is restored by depressing the green restoring key; when turned to the rear the line is restored when depressing a lower (red) justification key, which opens the ·0005″ valve plunger.

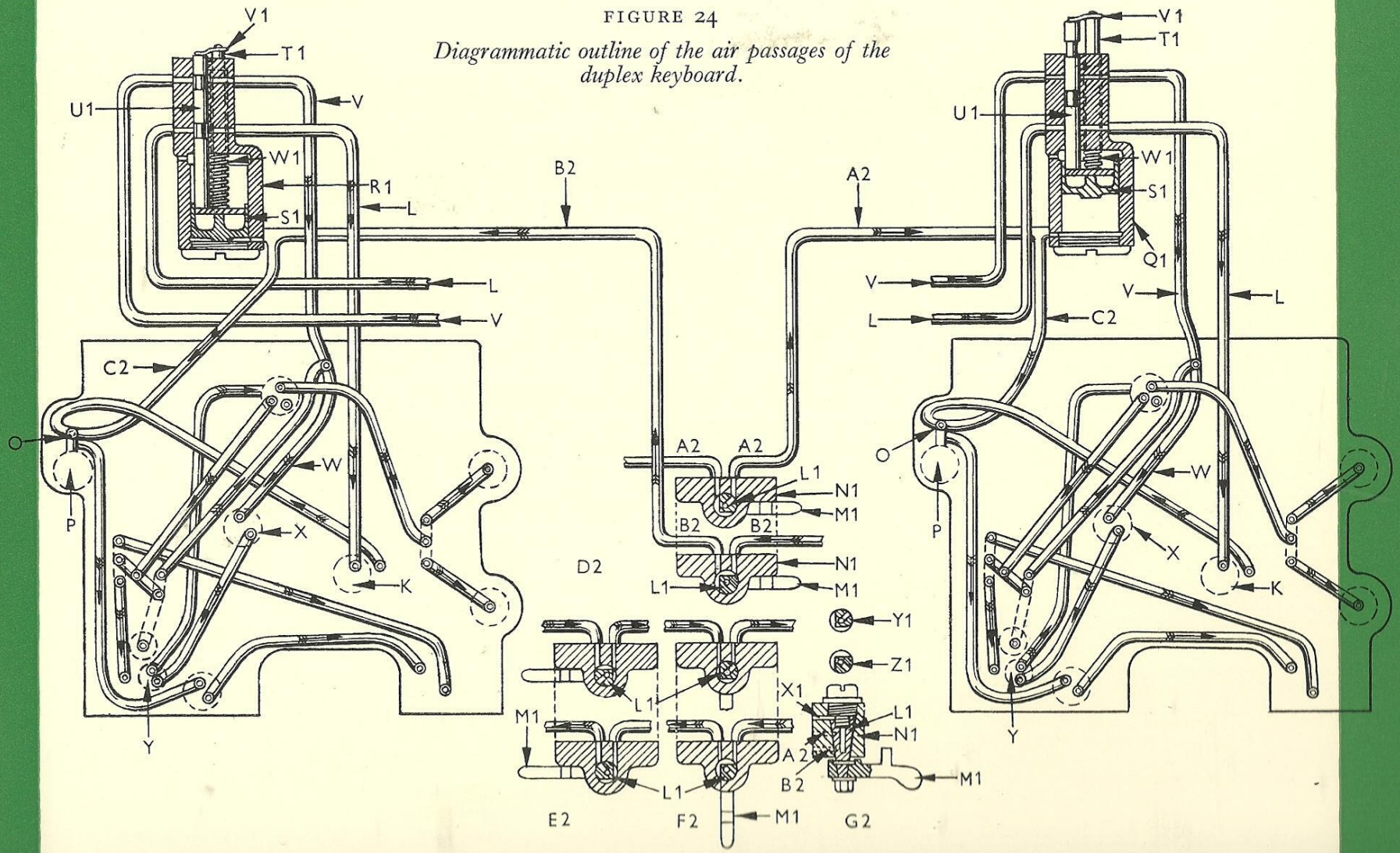
The order of the perforations in the paper strip, as shown on the paper tower punch guide index plate, reading from left to right, is:



The matrix-case positions O and 15 are obtained by the matrix-case being carried to zero in the absence of a respective perforation. No punches are therefore carried by the O and 15 punch bars; the pistons operating these bars are used to maintain a balance of pressure against the tension arm.

FIGURE 24

Diagrammatic outline of the air passages of the duplex keyboard.



L Pipes (right and left) receive air simultaneously whenever any justifying key in the lower row is depressed. If one paper tower is locked, air from L is cut off that tower by plunger U1, raised as shown in Q1. This prevents restoring on the locked tower (valve O being set with handle to the rear in position to restore by the lower row of justifying keys).

V Pipes (right and left) receive air simultaneously whenever space bar is depressed. If one paper tower is locked, air from V is cut off that tower by plunger U1 raised as shown in Q1. This prevents spaces being counted at Y on the locked tower.

L1 Lock switch valve 52KC1 controls air passages to the punch lock cylinders Q1 and R1.

M1 Lock switch valve handle 52KC5 for turning valve L1; when to the right the right tower is locked, to the left the left tower, to the front both towers operate together.

N1 Lock switch valve body 52KC2 contains air passages for A2, B2 and X1.

Q1 Punch lock cylinder b59KC1 for right paper tower.

R1 Punch lock cylinder b59KC1 for left paper tower.

S1 Pistons a59KC3; raise rods T1 and plungers U1 when air is admitted beneath as shown in Q1. When air is shut off, the springs W1 return these parts to the position as shown in R1.

T1 Rods a59KC9. When raised by piston S1, as shown in Q1, the Guide V1 bears up against the tension arm connecting rod lever 39KC1 (G, Fig. 4) near its rear end, preventing its action and locking the punches. This with U1, which see, locks out from action that entire paper tower.

U1 Plunger a59KC4. When raised, as in Q1, shuts off the air passage L leading beneath piston K (now locked by T1) to restoring piston P and prevents restoring on the tower locked out from action. Passage V leading through pipe W and beneath piston X (now locked by T1) to space rack piston Y, is also closed, preventing spaces from being counted on the tower locked out from action.

V1 Guide a59KC8 for plunger U1 and rods T1, which see.

W1 Springs a59KC11, return pistons S1 to bottom of cylinders, as in R1, when air is released from beneath pistons.

X1 Constant air direct from air chamber to centre passage in valve L1.

Y1 Horizontal section of valve L1 in plane of pipes A2.

Z1 Horizontal section of valve L1 in plane of pipes B2.

A2 Pipe from valve plunger (controlled by green key in lower right corner of left keybank), to punch lock cylinder Q1 through lock switch valve body N1. Air supply whenever green key is depressed, or constant air if valve handle M1 is pointing to the right.

FIGURE 24

Diagrammatic outline of the air passages of the duplex keyboard. Study the diagram, paying special attention to the arrows showing the direction of flow of air through the passages.

Note: passages which are the same or have the same functions as those of the standard keyboard have the same letters as on Fig. 22, which see for description. On Fig. 24 the majority of passages will be found duplicated at the right and left of the diagram. Two passages (right and left) lead from each valve plunger, with the exception of the single passages A2 and B2.

B2 Pipe from valve plunger (controlled by green key in lower left corner of right keybank) to punch lock cylinder R1, through lock switch valve body N1. Air supply whenever green key is depressed, or constant air if valve handle M1 is pointing to the left.

C2 Pipe from punch lock cylinder to piston block valve O. Air supply for left paper tower same as B2, for right tower same as A2 (see N, Fig. 22).

D2 Horizontal sections through valve L1 and body N1 in the planes of pipes A2 and B2. Valve handle M1 pointing to right.

Note: constant air from the centre passage of valve L1 is admitted to A2; piston S1, in cylinder Q1, is raised. The right paper tower is locked out from action. The left paper tower alone can be operated. The right green key admitting air through B2 can be used as a restoring key for the left tower by turning to the left valve O of left tower (see Fig. 18).

E2 Sections same as D2 but with valve handle M1 pointing to the left.

Note: constant air is admitted from L1 to B2 locking the left tower the same as was the right tower under D2. The green key admitting air to A2 can be used as a restoring key for the right tower by turning to the left valve O of the right tower (see Fig. 18).

F2 Sections same as D2 but with valve handle M1 pointing to the front. The constant air from the centre passage of valve L1 is cut off from both A2 and B2.

Note: both towers will operate simultaneously. To lock out from action the right tower, depress left green key admitting air to A2; to lock out from action the left tower, depress the right green key admitting air to B2. Valve O should be set to restore with lower row of justifying keys.

G2 Vertical section of lock switch valve and body with handle M1 pointing to the front as in F2.