May 5, 1936.

O. HAASS

TYPEWRITER

Filed March 3, 1934

2,039,991

6 Sheets-Sheet 1

Fig. 1

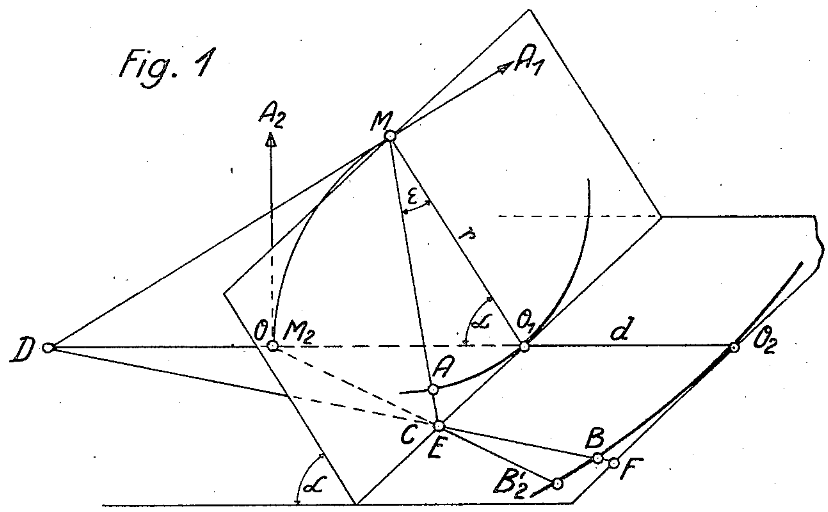
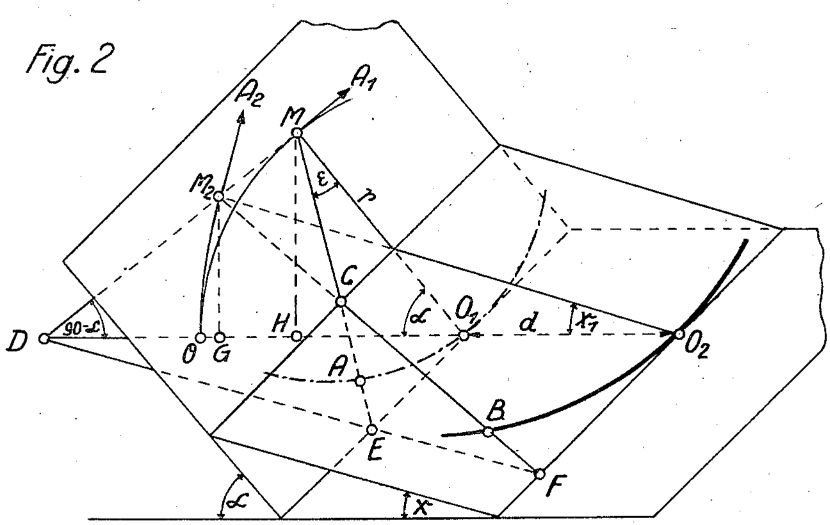


Fig. 2



Inventor:
Otto Haas

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Fig. 3

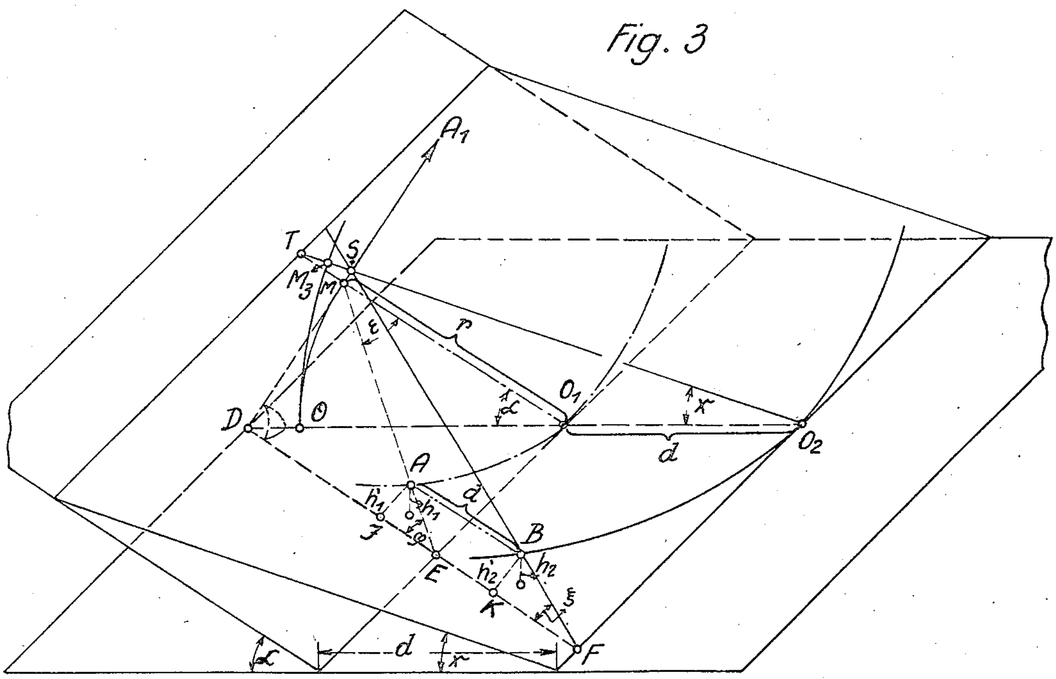


Fig. 4a

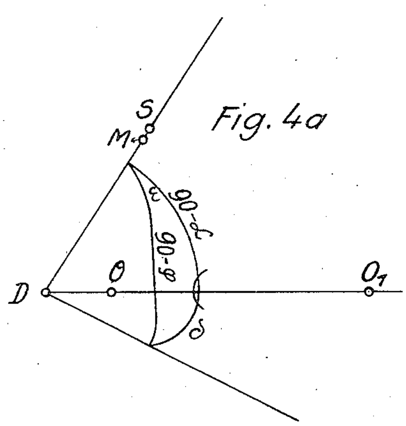
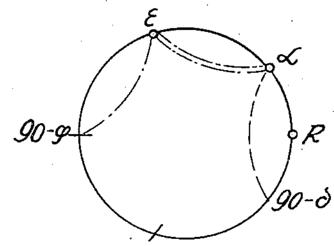


Fig. 4b



Inventor:

Otto Haas

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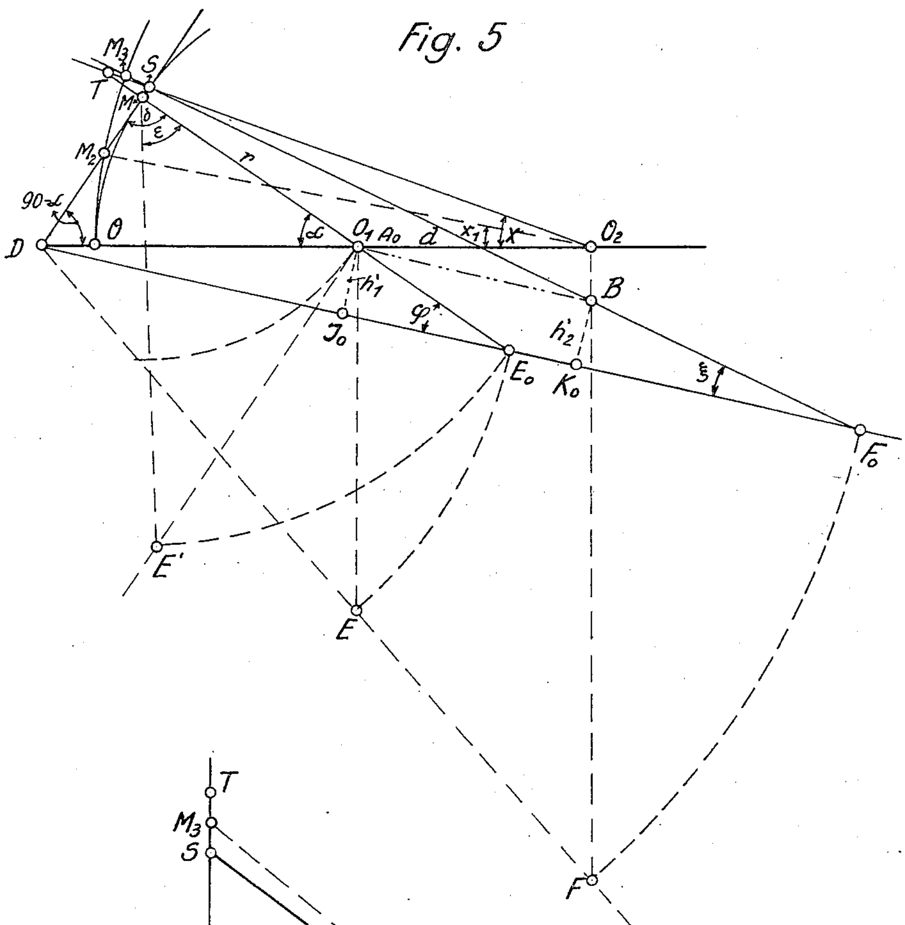
Fig. 5



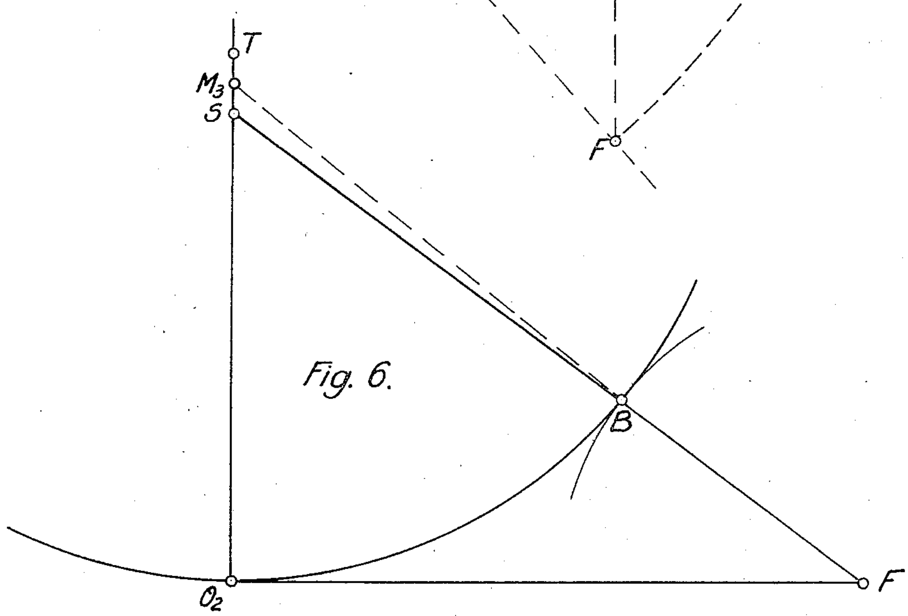


Fig. 6.

Inventor:
Otto Haas.

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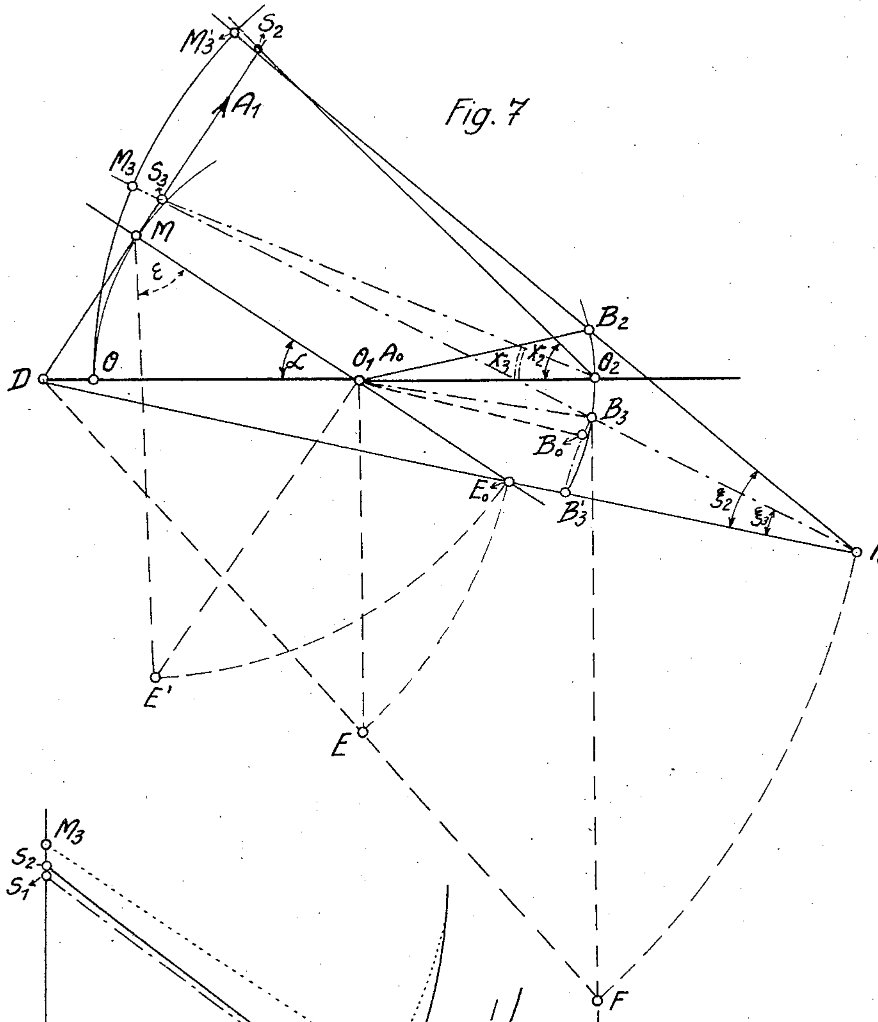

Fig. 7

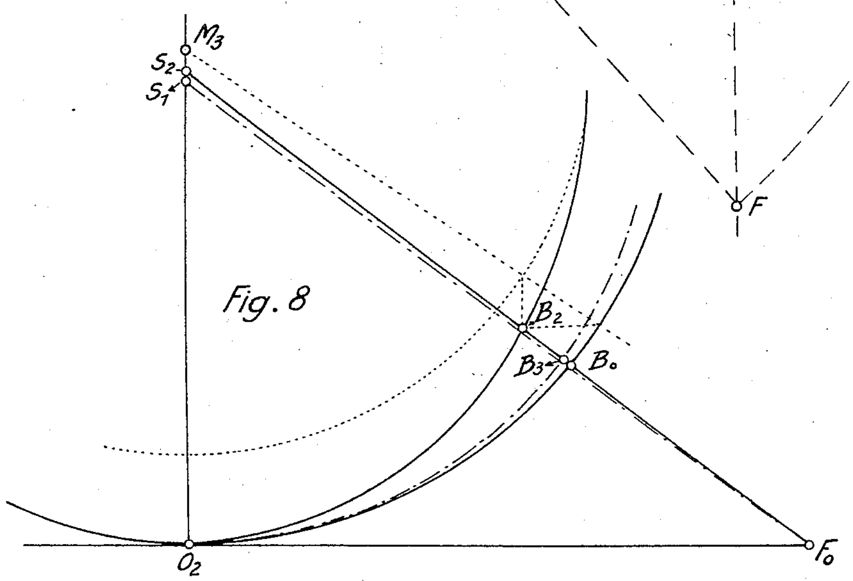

Fig. 8

Inventor:
Otto Haas

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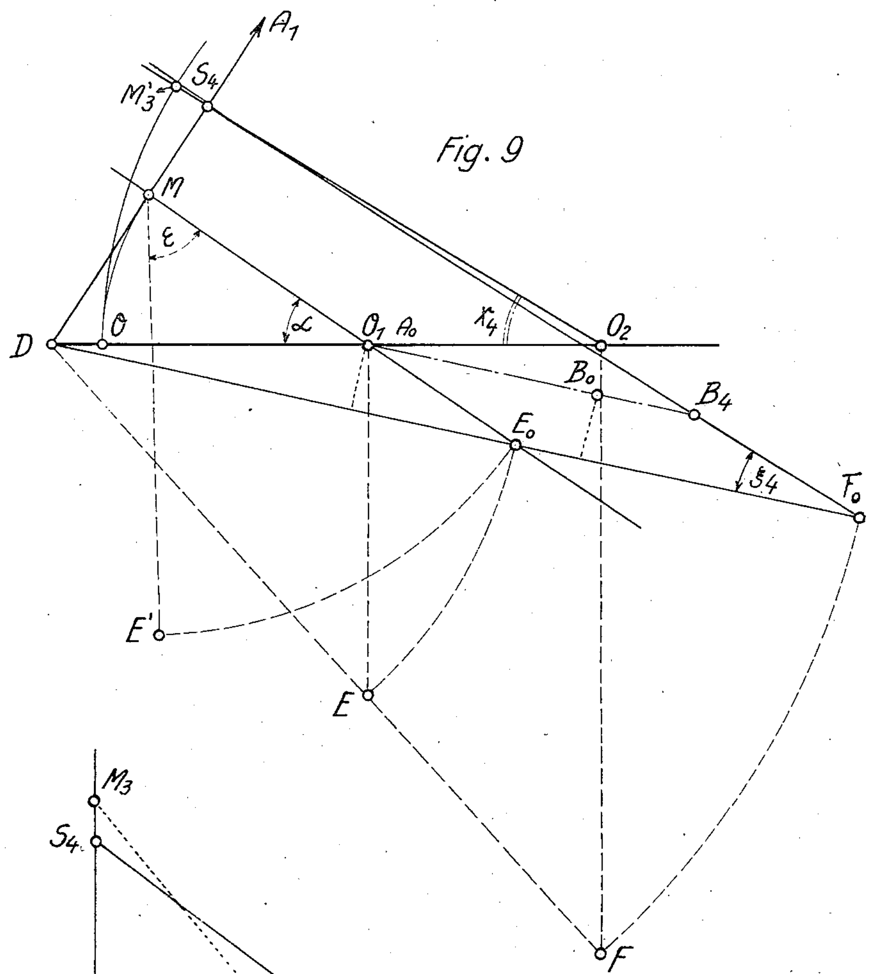

Fig. 9

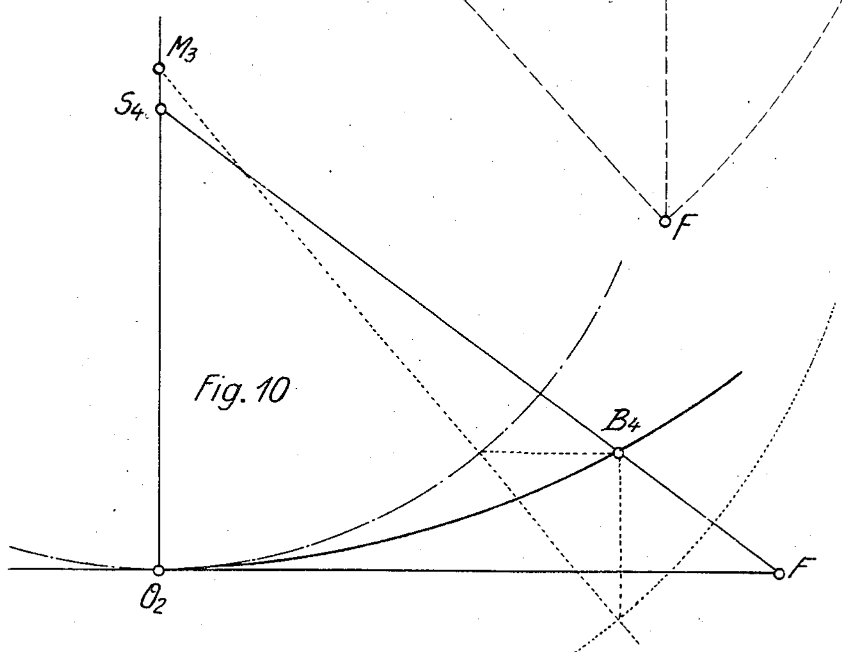

Fig. 10

Inventor:
Otto Haas

May 5, 1936.

O. HAAS

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Fig. 11

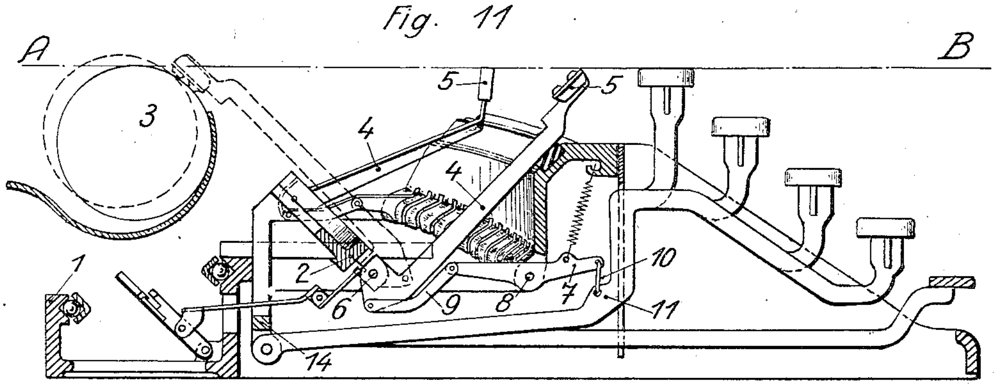
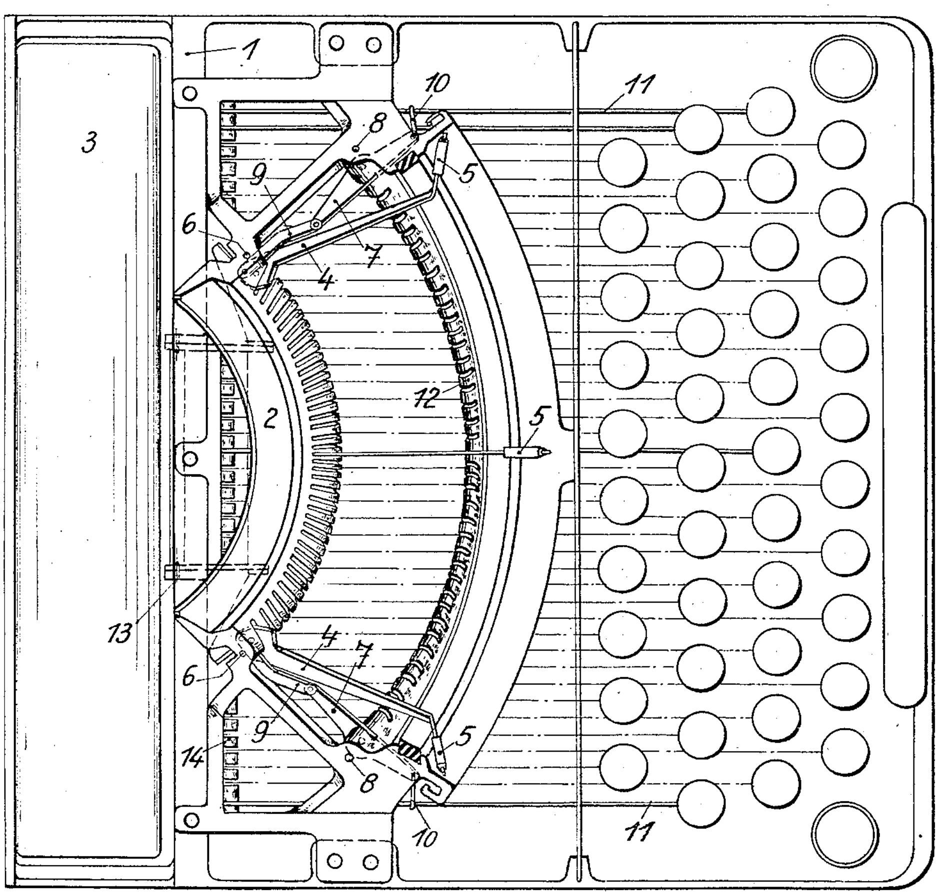


Fig. 12



Inventor:
Otto Haas

UNITED STATES PATENT OFFICE

2,039,991

TYPEWRITER

Otto Haas, Pieterlen, Switzerland

Application March 3, 1934, Serial No. 713,895
In Germany March 9, 1933

4 Claims. (Cl. 197—22)

This invention relates to typewriters and more especially to small, so-called portable typewriters, and has for its general object to devise a portable typewriter of smallest height and most compact construction. This is accomplished according to my invention, firstly by specific cooperation of the type actuating members and secondly, by supplementing the construction to operate according to novel principles.

The small or portable typewriters so far on the market are too heavy for travelling purposes, both as regards their general construction as well as regards their size and weight; in addition to this, the known portable typewriters must be carried in a container specifically designed for this purpose.

In order to more fully meet the requirements connected with the construction of an easily portable or travelling typewriter it is necessary to pay regard to the aforementioned conditions in a far greater measure than has heretofore been done in practice

For the purpose in view the dimensions of the typewriter and its parts must be kept so small, that it may conveniently be carried in a small travelling bag, portfolio or the like and, accordingly, the weight of the typewriter must be quite considerably reduced, as compared with heretofore constructed portable typewriters. If it is desired, for instance, to construct a portable typewriter for use in schools, the construction must be of extreme compactness permitting the school-children to conveniently carry the typewriter with them in a school-knapsack or the like, without imposing on the child an excessive strain due to the weight of the typewriter.

The efforts which have so far been made by manufacturers with a view of constructing portable typewriters have more and more lost sight of the underlying principles that ensure proper portability and in fact have rather followed the opposite way in attempts of accommodating the several parts to the requirements present in the operation and attendance of large office typewriters. Regarding its very quality and propriety as a portable machine, especially for travelling purposes, the typewriter has thus essentially lost its value, and its weight as well as its price has been steadily increased, so that the "portables" of the present day do no more serve the purpose for which they had originally been intended, with the result that they have failed to find their way just to those classes of purchasers primarily coming into question.

As far as novel principles of construction are used according to my invention, I have attempted to purposely avoid any excess or surplusage in the equipment, and additionally endeavored to make use of all devices necessary for the proper operation of the typewriter in a form which is as simple as possible. By this I attain greatest safety of operation without weakening any of the parts of the typewriter.

According to my invention the bearings for the type-levers are arranged in the known manner inclined towards the rear, while the type-levers are so mounted in their bearings that the outermost tips of said levers in condition of rest are positioned about flush with the upper edge of the platen. In the present case the angular position of the middle type-lever in condition of rest, measured towards the rear from a line passing perpendicularly through the bearing point of the type-lever, is approximately the same as in operative condition of said lever after forward motion thereof. The several parts properly cooperate furthermore in such a manner that the upper edge of the platen and the types in condition of rest are positioned underneath a plane parallel to the base plane and passing through the uppermost rows of keys, the height of the four-row keyboard being thus kept smaller than had heretofore been possible in known construction of typewriters.

In order to attain this, the keys, the intermediary levers and the type-levers are arranged and constructed in such a compact manner that after operating the keys and imparting motion to the type-levers, the intermediary levers will partly move into that space, or at least into proximity of that space, which had just been left by the type-levers. For this purpose it is further necessary to arrange the intermediary levers in the plane of the swing of the type-levers or in a plane closely parallel thereto. In consequence of the special arrangement of the bearings for the intermediary levers within a plane which is inclined at a quite definite critical angle as well as by reason of the clear and simple construction all forces tending to displace or distort any of the members of the type-lever operating mechanism are only very little different from the pressure exerted upon the middle keys. This pressure is from 30 to 40% smaller than in all heretofore constructed typewriters and, accordingly, the wear of all parts of the type-lever operating mechanism will likewise be from 30 to 40% smaller than in known constructions; in addition to this, said mechanism evidently may be more easily operated. Due to the co-operation of the aforementioned novel features it will further be possible to construct the typewriter in an extremely compact manner and of a size which is as small as possible.

My invention is more fully explained in the accompanying drawings, Figs. 1 to 10 being explanatory diagrams and Figs. 11 and 12 a section and top-view, respectively, of a typewriter constructed according to my present invention.

Referring first to Figs. 11 and 12, within the casing 1 is mounted the bearing 2 for the type-levers, said bearing being inclined in known manner to the platen 3. The type-lever 4 with the type 5 thereon is mounted swingably round the axle 6 for said type-lever. An intermediary lever 7 mounted swingably round the axle 8 is in operative connection with the type-lever and the key-lever 11 appertaining thereto by way of the connecting rod 10. Owing to the inclined arrangement of the bearing 2 for the type-levers the point of rest of the outer type-levers 4 is positioned higher than that of the middle type-lever. The types on said outer type-levers must be positioned underneath the line A—B, as the total height of the typewriter shall not exceed a definite value; these levers are therefore inclined towards the rear somewhat more than the middle type-levers and, accordingly, when depressing the key-lever, must be moved a greater distance than the middle levers. All other individual type-lever operating members forming part of the type-writer are not specifically designated as they are not necessary for explaining the gist of my invention.

In general, the intermediary levers of the typewriter are also mounted on an horizontal axle, if the bearing for the type-levers, as in the present case, is inclined to the platen, the outer type-levers thus coming into a more elevated position.

As all individual type-lever operating members according to my invention must comply with the requirement of a flat and compact construction of typewriter, the intermediary levers 7 are also mounted in a bearing which, similarly to the type-lever bearing 2, is inclined towards the platen 3 at a definite critical angle, a mathematical calculation being given hereinbelow for determining this angle. The slots in which the type-levers and intermediary levers move are preferably positioned within the same or a parallel plane for each pair of levers, so that the middle pair of levers will be moved within vertical planes, while the outer pairs of levers move within inclined planes.

It is further necessary to arrange the intermediary levers in such a way that like applied moments will result in every case for all levers. This is attained, firstly, by positioning two respective bearing points, of the bearings for the type-levers as well as of the bearings for the intermediary levers, at an even height above the base plane, and secondly, by placing said bearing points at an even distance from each other.

The arrangement of the type-lever operating mechanism permits an extremely simple construction and the provision of a most advantageous bearing. It will therefore be possible to combine all bearing points for the type-lever operating mechanism into a unitary structure made by casting, preferably by pressure casting, as may be seen from Fig. 11. In this manner I further attain that all forces which may cause torsions or other displacements within the general bearing arrangement will be positively avoided and the stability of the entire structure in no way impaired.

In order to permit easy assembling, the completed type-lever and key-lever mechanism may be put together separately and outside of the typewriter frame. An example of an arrangement of this kind is shown in Fig. 12, according to which the bearing 2 for the type-levers, the bearing 12 for the intermediary levers and the bearing 14 for the key-levers is combined into a unitary structure. In this unitary bearing structure all individual parts of the type-lever operating mechanism, such as the type-levers 4, the connecting member 9, the intermediary levers 7, the connecting rods or wires 10, the key-levers 11 and, for instance, also the feed-bridge 13 may be fully assembled outside of the usual frame. By inserting the separately assembled type-lever operating mechanism into the typewriter frame which had likewise been separately equipped with the remaining operating mechanisms, the typewriter will now be completely assembled and in condition ready for use. By constructing the typewriter in the above indicated manner the time necessary for the assembling will be quite considerably shortened as compared with typewriters of ordinary construction. In this manner the type-lever and key-lever mechanism may be conveniently exchanged at any time and furthermore a low-priced and extremely compact construction is obtained with a fully normal high-grade typewriter, the construction being, in addition, of the greatest possible mechanical strength and stability.

Regarding the mathematical calculation of the bearings for the intermediary levers in relation to the segment bearing for the type-levers the following may serve as an explanation.

Referring to Fig. 1 it may be assumed that the two axle-bearings for the movable type-levers and the intermediary levers are concentrical circular arcs with their center-point at O and radii $OO_1=r$ and $OO_2=r+d$. The plane in which the bearing for the type-levers is positioned is now raised through the line O_1E which is perpendicular to OO_1, through the angle α. The center-point M of the bearing for the type-levers will now be that point of the plane above which all types hit against the platen. The greater the angle α and the greater $MO_1=OO_1=r$, the greater will be the height of the typewriter.

With the sectional plane MO_1O_2D the slots in the segment bearing at O_1 and in the bearing for the intermediary levers will exactly fit each other. However, if now the sectional plane along which the movable levers (segment levers and intermediary levers) are moving is rotated about the axis A_1—which is perpendicular to MO_1 and to all straight lines of the plane of the segment bearing through M—through an angle ϵ, the segment bearing will be intersected perpendicularly at A and the bearing for the intermediary levers obliquely at B. On the other hand the sectional plane, when rotated about the axis A_2 perpendicularly to OO_2 through C would meet the bearing for the intermediary levers at B_2. The greater the angle ϵ, the greater will be the distance BB_2. Practically this means that upon motion of the intermediary lever about B there will arise displacing forces which would result in greater friction and greater wear of the intermediary lever. Depressing the outer key-levers would require considerably greater forces than are necessary for depressing the middle key-levers. Besides, the distance A—B and therewith the length of the intermediary levers would steadily increase with increasing angle ϵ. If the intermediary levers shall remain of even length, it will be necessary to give up the form of circular arc at the bearing for the intermediary lever. The distance A—B, however, is in this case heavily inclined.

In order to avoid the aforementioned forces tending to bring about displacement in the bearing for the intermediary levers at B the following should be considered, reference being had to Fig. 2:

B_2 will co-incide with B at every value of the angle ϵ, if the plane of the bearing for the intermediary levers is raised through the line O_2F through an angle x_1, so that the center-point M_2 of the bearing for the intermediary levers will come to lie on the line MD.

If now the sectional plane MDEFAB is rotated about the axis

$$A_1 \equiv MD$$

through the angle ϵ, said axis will intersect the segment bearing at A and the bearing of the intermediary levers at B. Since M_2 is on the line MD, now the sectional plane MDEF will intersect the plane of the bearing for the intermediary levers along M_2CF and pass also through B. The sectional plane, although now intersecting the bearing for the intermediary levers no more perpendicularly at B, will now be somewhat inclined towards the center a distance M_2CF. This inclination, however, is insignificant, as the levers now may move, without forces tending to produce displacement acting thereon, within the same plane, both, with respect to M and with respect to M_2.

In calculating the angle x, from the triangle DO_2M_2 with the aid of the triangle DO_1M the following equations are obtained: (see also Fig. 5):

$$M_2O_2 = r + d$$

$$DO_2 = DO_1 + O_1O_2 = \frac{r}{\cos \alpha} + d$$

$$\text{angle } M_2DO_2 = 90° - \alpha$$

$$\text{angle } DM_2O_2 = 180° - (90° - \alpha + x_1) = 90° + \alpha - x_1$$

According to the theorem of the sine the following equation holds true:

$$\sin (90° + \alpha - x_1) : \sin (90° - \alpha) = DO_2 : M_2O_2.$$

$$\sin (90° + \alpha - x_1) = \frac{\left(\frac{r}{\cos \alpha} + d\right) . \cos \alpha}{r + d} = \frac{r + d . \cos \alpha}{r + d}$$

In Fig. 2 the angle x_1 is in agreement with the angle x_1 in Fig. 5. In a typewriter constructed according to this principle, therefore, no forces tending to produce displacement would arise at B, and the intermediary levers move without friction in B, as M_2B is perpendicular to the circular arc. However, as with increasing angles ϵ the distance AB becomes greater than $O_1O_2 = d$, the outer intermediary levers would have to be made longer than the middle ones, the distance AB, besides, being inclined towards the horizontal plane, so that the connecting members which transmit motion of the intermediary lever to the type-lever are all of a different size. The differences, however, are no more as great as with the arrangement according to Fig. 1. Thus the question arises, whether by further increase of the angle x_1 it will be possible that the equation $AB = O_1O = d$ remains to be true and that AB at the same time is positioned horizontally.

From the point of manufacture, therefore, it is required that not only all type-levers but also all intermediary levers and all members operating therebetween must be alike, while the bearings for the type-levers and the bearings for the intermediary levers should, if possible, be retained in the form of concentrical circular arcs, reference being made to Figs. 3, 4*a*, 4*b*, 5 and 6. Compliance with these requirements in connection with a serial manufacture of the several parts and an assembling thereof into the complete typewriter will result in an incredible simplification and extremely small price of the typewriter.

In connection with this the question arises, through which angle x the plane of the bearing of the intermediary levers must be rotated in order to have any desired sectional plane around

$$A_1 \equiv MD,$$

with given r, d and α, intersect the two bearings so that the equation: $AB = O_1O_2 = d$ holds true and that AB remains always parallel to the horizontal plane. This means further that the height h_1 of A above the horizontal base plane is equal to the height h_2 of B above said plane; AB, furthermore, will be parallel to EF and therewith again

$$h'_1 \equiv AJ = h'_2 \equiv BK.$$

(See Fig. 3.) The graphical solution follows from Fig. 5.

The critical angle x, for given values of r, d and α, is constructed as follows: Make $O_1O_2 = d$, protract the angle α at O_1 and measure $O_1M = r$. A line drawn at M perpendicularly to MO_1 will intersect the line O_1O_2 at D.

$$MD \equiv A_1$$

is the axis of rotation for the present sectional plane within which the movable levers move. Protract the angle of rotation ϵ at M. In the drawing at first the greatest angle of rotation

$$\epsilon = \frac{\omega}{2}$$

of the respective model is used. Draw a perpendicular to O_1M at O_1 furnishing the point E'. $O_1E = O_1E'$ is perpendicular to DO_1 in the horizontal plane. The connecting line DE is the line of intersection between the sectional plane and the horizontal plane; on this line F must lie; F likewise lies on the line erected perpendicularly to O_1O_2 at O_2.

The sectional plane is now rotated backward through the angle ϵ. As

$$A_1 \equiv MD$$

is perpendicular to the plane of the segment bearing, MD is likewise perpendicular to all straight lines of the segment plane through M, that is not only perpendicular to MO_1 but also perpendicular to MAE. Upon backward rotation of the sectional plane through the line MD now MA will come to lie on MO_1,

$$ME' \equiv ME_0$$

($DE_0 = DE$ giving the point E_0 as a control), MDE_0 being the true shape of the triangle. The perpendicular

$$A_0J_0 \equiv h'_1$$

is now displaced a distance D parallelly to $h'_2 = h'_1$; $J_0K_0 = d$. By this we find B, so that AB is equal to d and parallel to the base plane. If now F_0D is made equal to DF, F_0B will furnish the intersecting line of the sectional plane with the plane of the bearing for the intermediary levers.

This intersecting line F_0B meets

$$MD \equiv A_1$$

at S. The connecting line SO_2 is now at the desired angle x with O_1O_2. On SO_2 lies the point M_3 (so that $O_2M_3=d+r$) as well as the point T through which passes the intersecting line of the two bearing planes.

We now further draw in Fig. 6 the plane of the bearing for the intermediary levers which plane is raised through the angle x. From Fig. 5 we find the finite lines: $M_3O_2=d+r$, O_2F perpendicularly thereto, and O_2S and $F_0S \equiv FS$. Now we lay off $FB=F_0B$ on FS and thus obtain B. Fortunately, the circular arc round M_3 with the radius $M_3O_2=r+d$ also passes through B, that is the bearing for the intermediary levers may be retained in the form of the concentrical circular arc.

As M_3S has a length of only a few millimeters, the intersecting line SBF is only little different from M_3B, that is SB is nearly perpendicular to the bearing for the intermediary levers and the displacing forces shown in the first part (Fig. 1) are only very small.

If the construction is repeated for smaller angles ϵ the same point S is obtained on MD and therewith the same angle x and again B on the circular arc round M_3 with the radius $(r+d)$.

The principles followed in the drawings will also furnish, with the aid of Figs. 5, 3 and 4*a* and 4*b*, the calculation of the critical angle x.

At first we calculate some auxiliary finite lines and angles:

(1) $$DO_1=\frac{r}{\cos\alpha}$$

(2) $$ME'=\frac{r}{\cos\epsilon}$$

(3) $$MD=r.tg\alpha$$

(4) $$tg\varphi=\frac{MD}{ME_0}=\frac{r.tg\alpha.\cos\epsilon}{r}=tg\alpha.\cos\epsilon$$

The same relation follows from the rectangular three-dimensional corner at D, reference being made to Figs. 4*a* and 4*b*.

$$\cos\epsilon=\cot g(90^\circ-\varphi).\cot g\alpha \text{(Neper's rule)}$$

$$tg\varphi=tg\alpha.\cos\epsilon$$

(5) $$O_1E=rtg\epsilon$$

(6) $$tg\delta=\frac{O_1E}{DO_1}=\frac{r.tg\epsilon}{\frac{r}{\cos\alpha}}=tg\,\epsilon.\cos\alpha=\frac{\cos\alpha}{\cot g\epsilon}$$

The same relation follows from Figs. 4*a* and 4*b*.

$$\cos\alpha=\cot g\epsilon.\cot g(90^\circ-\delta)$$

$$tg\delta=\frac{\cos\alpha}{\cot g\epsilon}$$

(7) $$O_2F=DO_2.tg\delta=\left(\frac{r}{\cos\alpha}+d\right).tg\delta$$

(8) $$DE=\frac{DO_1}{\cos\delta}=\frac{r}{\cos\alpha.\cos\delta}$$

(9) $$DF=\frac{DO_2}{\cos\delta}=\frac{\left(\frac{r}{\cos\alpha}+d\right)}{\cos\delta}$$

(10) $$AE=ME-MA=\frac{r}{\cos\epsilon}-r$$

(11) $$EJ=AE.\cos\varphi=(ME-MA).\cos\varphi=\left(\frac{r}{\cos\epsilon}-r\right).\cos\varphi$$

(12) $$h'_1 \equiv AJ=AE.\sin\varphi;\quad h'_2 \equiv BK=h'_1$$

(13) $$FK=DF-DK=DF-(DJ-JK)=DF-(DE-EJ-JK)=DF-DE-EJ-JK$$

Generally the following equations hold true:

$$FK=\frac{\frac{r}{\cos\alpha}+d}{\cos\delta}-\frac{r}{\cos\alpha.\cos\delta}+\left(\frac{r}{\cos\epsilon}-r\right).\cos\varphi-d=\frac{r}{\cos\alpha.\cos\delta}+\frac{d}{\cos\delta}-\frac{r}{\cos\alpha.\cos\delta}+\left(\frac{r}{\cos\epsilon}-r\right).\cos\varphi-d=\frac{d}{\cos\delta}-d+\left(\frac{r}{\cos\epsilon}-r\right).\cos\varphi$$

(14) $$tg\xi=\frac{h'_2}{FK}=\frac{\left(\frac{r}{\cos\epsilon}-r\right).\sin\varphi}{\frac{d}{\cos\delta}-d+\left(\frac{r}{\cos\epsilon}-r\right).\cos\varphi}$$

(15) Calculation of DS from the triangle DSF in which DF (Equation 9), ξ and $90^\circ-\varphi$, and therewith the third angle $\sigma=180^\circ-(\xi+90^\circ-\varphi)$ may be found.

$(DS:DF=\sin\xi:\sin\sigma$ (theorem of the sine)

$$DS=\frac{DF.\sin\xi}{\sin\delta}$$

(16) Calculation of the critical angle from the triangle DSO_2 in which now DS, DO_2 and the angle $SDO_2=90^\circ-\alpha$ are given.

(*a*) Calculation from the opposite side $SO_2=s$ according to the theorem of the cosine:

$$s^2=DS^2+DO^2_2-2DS.DO.\cos(90^\circ-\alpha)$$

(*b*) Calculation of x according to the theorem of the sine:

$$\sin x:\sin(90^\circ-\alpha)=DS:O_2S$$

$$\sin x=\frac{DS\cdot\sin(90^\circ-\alpha)}{O_2S}$$

If it be assumed that in a certain model the dimensions for r, d and α be $r=50$ mm., $d=44.5$ mm., and $\alpha=34^\circ$, the numerical calculation for $\epsilon=54^\circ$ will give an angle $x=19^\circ41'$, and for $\epsilon=27^\circ$ an angle $x=20^\circ36'$; the mean value obtained by calculation for the critical angle of inclination x is therefore in agreement with the construction according to Figs. 5 and 6 and amounts to approximately 20°.

It is also possible to calculate the angle x from the corner at F (acute or obtuse angled spherical triangle). To find a general expression for $\sin x$ which shows the independence from ϵ is not simple on account of the insertion of the metrical values $d=AB$; such an expression, however, is not necessary after having ascertained that the construction according to Fig. 5 and the above given calculation for different angles ϵ will furnish the same DS and the same angle x.

The plane for the intermediary levers must therefore be inclined by this critical angle x against the base plane, if from the point of manufacture the maximum requirement is made viz: to have all type-levers, all intermediary levers and all intermediary operating members of even size and the bearing points (A and B, Fig. 5) always positioned at an even height above the base plane, and in addition to obtain like torques for each aggregate of the type-lever operating members and uniform composition of each of said aggregates.

Reference is now made to Figs. 7, 8, 9 and 10.

If one of the aforementioned maximum requirements can be neglected, there may be maintained, for instance, the requirement of all intermediary levers being of like length in which case, however, the bearing point B_2 in Fig. 7 can no more lie at the same height above the base plane and the bearing for the intermediary lever will now have to be of an elliptical form and the plane of the bearing for the intermediary levers be raised through an angle x_2 against the base plane. This construction is carried out in Figs. 7 and 8. As far as to finding the point F_0 the construction is the same as in Fig. 5. If for the bearing for the intermediary levers, for instance, the form of an elliptical arc O_2B_2, Fig. 8, is prescribed, the point B_2 is found as point of intersection between the circular arc round F_0 with the radius F_0B_2 and the circle round O_1 with the radius $d=O_1O_2$ and upon the prolongation FOB_2 the point S_2 on the axis of rotation M_1D and therewith S_2O_2 and the angle of inclination x_2 appertaining thereto. In the opposite way, for a given angle of inclination, for instance x_3 in Fig. 7, there may be found the point S_3, thereupon B_3 and the form of the elliptical arc in which the bearing point for the intermediary levers must be positioned.

If, therefore, the above requirement of even height of corresponding bearing points A and B be dispensed with, the angle between the intermediary lever and the type-lever for the outer key-levers will be a different one and the torques likewise essentially different. If, on the other hand, the requirement of even height of corresponding bearing points A and B be maintained, like distances between said bearing points and therewith like lengths of all intermediary levers can no more be attained if the critical angle of the circular arc of the bearing for the intermediary levers is no more maintained.

Assuming that the bearing for the intermediary levers have the form of an elliptical arc, as shown in Fig. 10, with a view of obtaining small height and compact construction of the typewriter, from Fig. 9, similar to Fig. 5, the point F may be obtained. The circle round F_0 with the radius FB intersects the parallel line A_0B_0 at the point B_4. F_0B_4 meets the axis of rotation M_1D at the point S_4. S_4O_2 will now furnish the respective angle of inclination of the plane of the bearing for the intermediary levers. In the opposite way, for a given angle of inclination the respective elliptical arc may be found from Figs. 9 and 10. This solution has the disadvantage that the intermediary levers will be of increasing length in outward direction with the result that the torques will become less favorable. Fig. 10 shows in addition that the forces tending to produce displacements as shown in Fig. 1 will increase. With greatest compactness of the type-lever operating members a maximum of simplicity in the general construction of the typewriter and regarding compensation of the torques will be obtained, if for a given inclination of the plane of the type-lever bearing, and for given lengths of the type-levers and of the intermediary levers the inclination of the plane of the intermediary levers (critical angle x in Fig. 5) is calculated and constructed in accordance with Figs. 5 and 6 and the explanations given in connection therewith. In this case the bearing for the intermediary levers will be a concentrical circular arc. If the aforementioned maximum requirement can be neglected, the form of said bearing will be changed to follow an elliptical arc, simultaneously therewith changing the angles of inclination.

I claim:

1. In a typewriter, in combination with intermediary levers and type levers, bearings for the intermediary levers, circular segment bearings for the type levers in a plane at an agle with the base plane of the typewriter, said bearings for the intermediary levers being positioned on a curve which is geometric with respect to the circle of the bearings for the type levers, said curve being in a plane at an angle between the same and the base plane smaller than the angle between the plane of the circular segment bearings for the type levers and the base plane, said smaller angle bearing such relation to the first angle that the bearings for the intermediary levers are substantially equidistant from the bearings of the type levers and are positioned at substantially the same heights above the base plane as the corresponding bearings for the type levers.

2. In a typewriter, the combination of intermediary levers with key levers and type levers, bearings for said intermediary levers, a type lever segment for pivotally mounting said type levers, said type lever segments being arranged in a plane at an angle with the base plane of the typewriter, the bearings of said intermediary levers being arranged at predetermined distances from the coordinate pivots of the type lever segment and being positioned on a curve in a plane at an angle between the same and the base plane smaller than the angle between the plane of the type lever segment and the base plane.

3. In a typewriter, the combination as set forth in claim 2, in which the curve on which the bearings of said intermediary levers are positioned has the form of a circular arc.

4. In a typewriter, the combination of pivotally mounted type levers, with pivotally mounted intermediary levers adapted to actuate said type levers, the pivots of said type levers being arranged on a circular curve in a plane at an angle α between the same and the base plane of the typewriter the pivots of said intermediary levers being arranged on a circular curve in a second plane which is also positioned at an angle to the base plane of the typewriter, this last named angle x being calculated in accordance with the following formular

$$\sin x = \frac{DS. \sin (90^\circ - \alpha)}{O_2S}$$

in which DS is the distance between the center of the intermediary levers curve in said second plane and the point of intersection of the axis (A_1, Fig. 3) in the center of the type lever's curve with the plane of the intermediary lever's curve, said axis extending vertically to the plane of the type lever's curve, while O_2S is the length of the radius of the intermediary lever's curve.

OTTO HAAS.