(No Model.) 4 Sheets—Sheet 1.

# C. LORENZ.

## CALCULATING MACHINE.

No. 393,478. Patented Nov. 27, 1888.

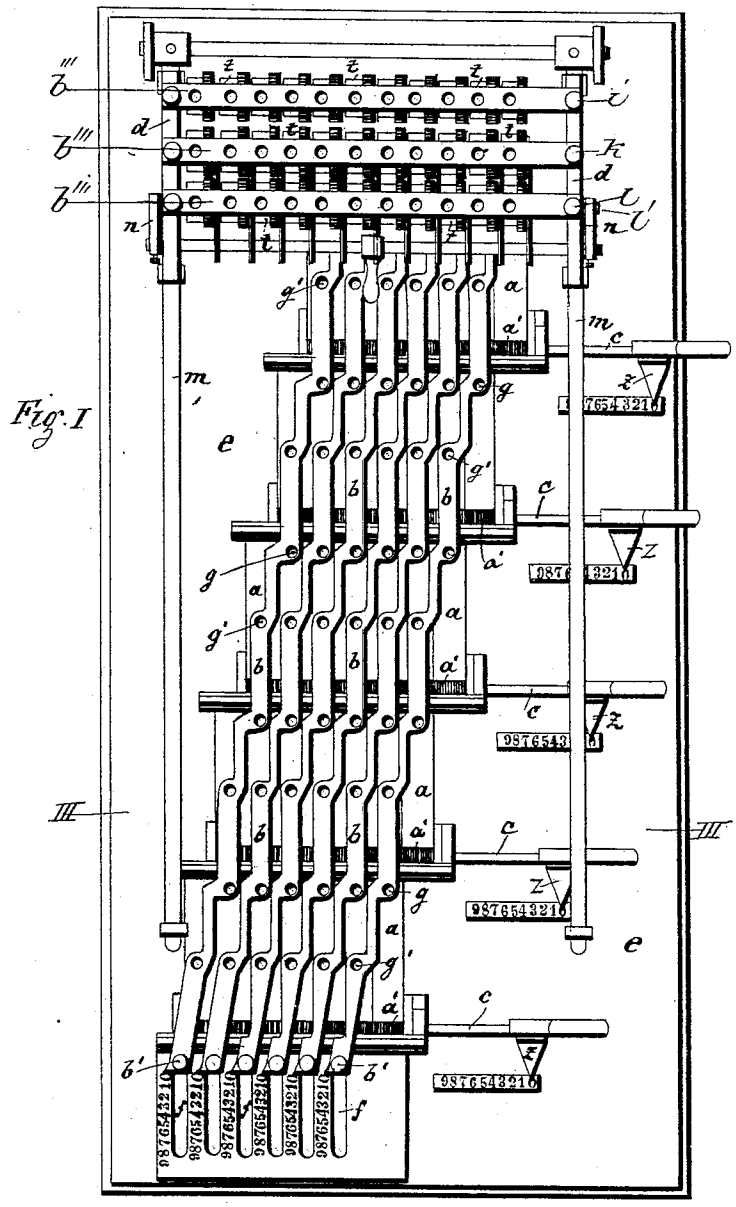


Fig. I

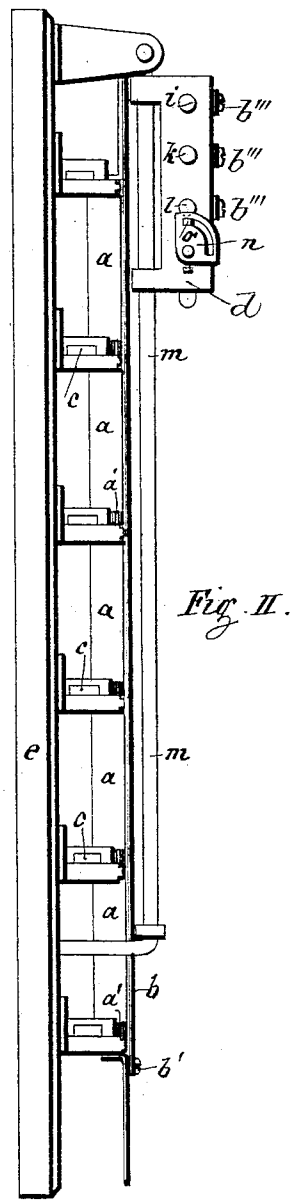


Fig. II.

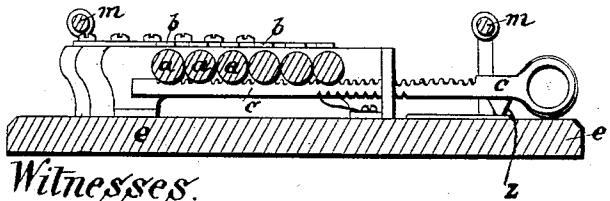


Fig. III.

Witnesses.
Alfred Jonghmans
Walter E. Morris.

Inventor.
Carl Lorenz
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Attorneys

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(No Model.)

4 Sheets—Sheet 2.

# C. LORENZ.

## CALCULATING MACHINE.

No. 393,478. Patented Nov. 27, 1888.

Fig. IV.

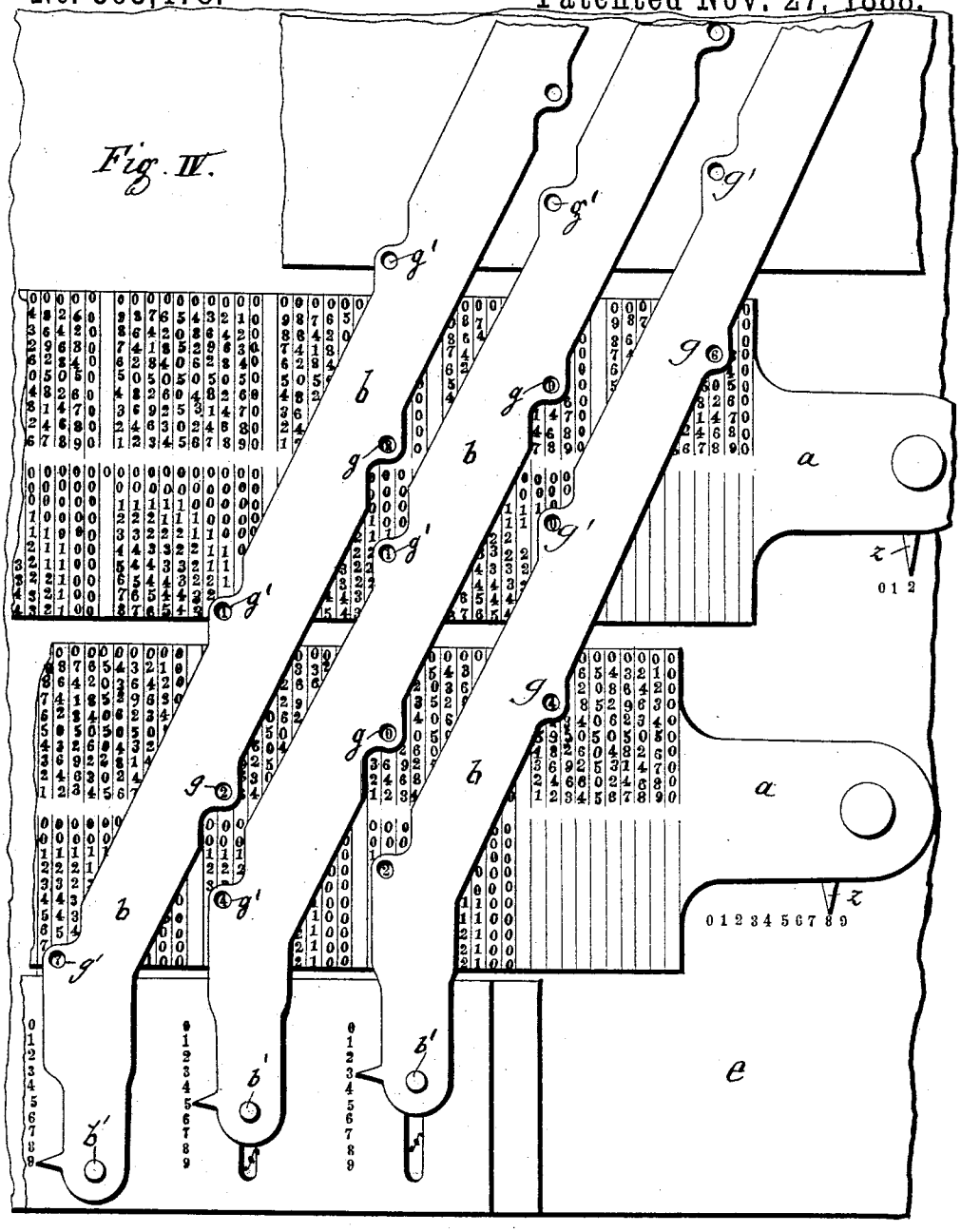
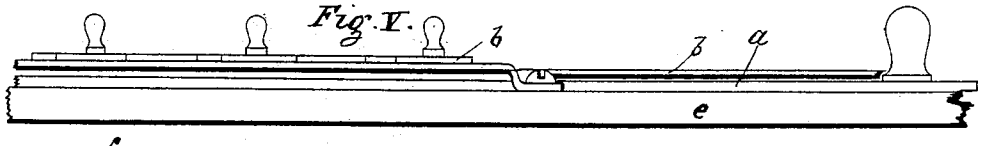



Fig. V.




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4 Sheets—Sheet 3.

# C. LORENZ.

## CALCULATING MACHINE.

No. 393,478. Patented Nov. 27, 1888.

FIG. VIII.

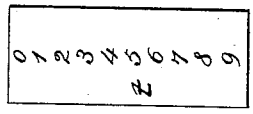
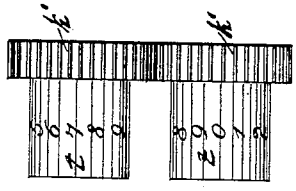


FIG. VII.



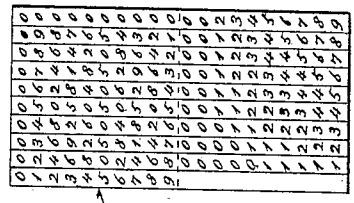
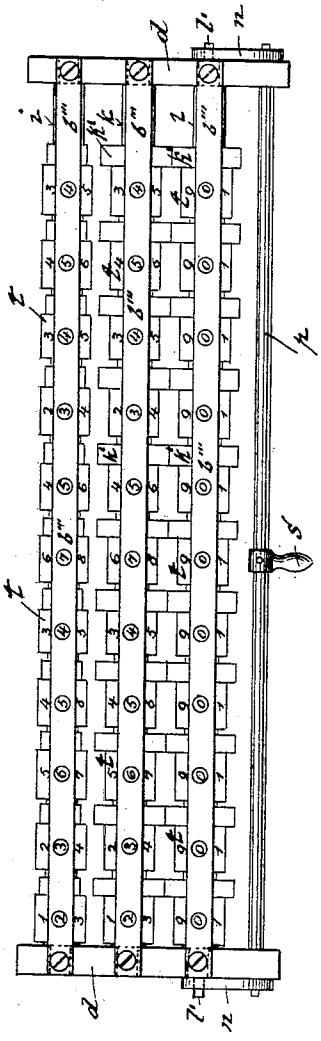


FIG. X.

FIG. VI.



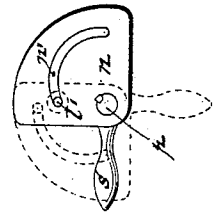


FIG. IX.

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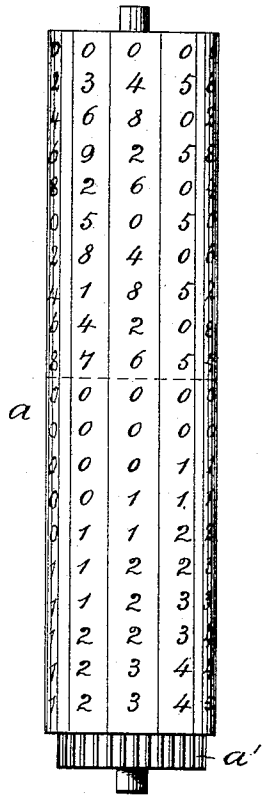
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# C. LORENZ.

## CALCULATING MACHINE.

No. 393,478. Patented Nov. 27, 1888.

FIG. II.




WITNESSES.
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# UNITED STATES PATENT OFFICE.

CARL LORENZ, OF DUISBURG, GERMANY.

## CALCULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 393,478, dated November 27, 1888.

Application filed September 7, 1887. Serial No. 249,055. (No model.) Patented in Germany August 25, 1887, No. 44,138; in Italy August 26, 1887, No. 22,234; in Luxemburg August 27, 1887, No. 882; in Austria-Hungary August 29, 1887, No. 34,106 and No. 66,103; in Denmark August 30, 1887, No. 407; in England August 31, 1887, No. 11,807; in France August 31, 1887, No. 185,584; in Belgium August 31, 1887, No. 78,714, and in Norway September 1, 1887 No. 612.

*To all whom it may concern:*

Be it known that I, CARL LORENZ, a subject of the German Emperor, residing at Duisburg, in the German Empire, have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification.

This invention relates to a simple machine for performing multiplication and division.

It consists in the various features of improvement, more fully pointed out in the claims.

This invention has been patented in the following countries: in Germany August 25, 1887, No. 44,138; Austria-Hungary, August 29, 1887, No. 34,106 and No. 66.103; Luxemburg, August 27, 1887, No. 882; Italy, August 26, 1887, No. 22,234; Great Britain, August 31, 1887, No. 11,807; France, August 31, 1887, No. 185,584; Belgium, August 31, 1887, No. 78,714; Denmark, August 30, 1887, No. 407; and Norway, September 1, 1887, No. 612.

In the accompanying drawings, Figure I is a face view of my improved calculating-machine. Fig. II is a side view of the same. Fig. III is a transverse section on the line III III, Fig. I. Fig. IV is a face view of a modification on an enlarged scale. Fig. V is an end view of the same. Fig. VI is a top view of the shafts *i k l*, with their disks *t*, on an enlarged scale. Fig. VII represents two of the disks *t* enlarged. Fig. VIII shows the numbers placed around the disks *t* in a plane. Fig. IX shows an end view of the disk *n*. Fig. X represents the arrangement of the figures around the rollers *a*, shown on a plane. Fig. XI represents, on an enlarged scale, a roller, *a*, showing the numerals on the same.

With particular reference to Figs. I to III, the letter *e* represents the back plate provided with a series or rows of rollers, *a*, hung in bearings projecting forwardly from the plate *e*. The rollers *a* carry a number of numerals all arranged in like manner. Each roller is encircled by twenty rows of figures, with ten figures to the row, as shown in Fig. X. The upper ten rows represent units, while the lower ten rows represent corresponding tens. So, for example, in the column for the multiplication of four the following figures are in view: Units, 0, 4, 8, 2, 6, 0, 4, 8, 2, 6; tens, 0, 0, 0, 1, 1, 2, 2, 2, 3, 3. The rollers are provided with pinions *a'*, that are engaged by a rack, *c*. The rollers are so placed that the same numbers will appear upon the top of the rollers in the same row. The racks *c* carry index-fingers or pointers *z*, running along a scale marked 0 to 9. If the rack is moved until the pointer indicates 3, the numbers 0, 3, 6, 9, 2, 5, 8, 1, 4, 7 (units) and 0, 0, 0, 0, 1, 1, 1, 2, 2, 2 (tens) appear on top of the rollers located in the same row and operated by the same rack. Above the rollers *a* are placed the oblique slides *b*, moving in a vertical direction and guided by means of pins *b'*, engaging grooves *f*. The number of these slides *b* correspond with the number of sets of rollers *a* made in a plate or frame attached to the main plate *e*. Each slide *b* is provided with openings *g* and *g'*. The openings *g* expose the units of the roller located to the right of the slide and the openings *g'* expose the tens of the roller located to the left of the slide. The openings *g g'* are so far distant from each other that the lower opening always exposes the ten belonging to the unit exposed by the upper opening. If the rack *c* is placed, for example, with its pointer *z* at 3 and a slide, *b*, is placed opposite the number 4 of a scale, near the bottom of the slide on the plate *e*, the unit-opening will show a 2 and the corresponding ten-opening will show a 1, thus making 12.

If the slide is entirely drawn down so that the scale indicates 9, the figure 27 will similarly be formed. In multiplying numbers of several figures the different figures of each vertical column are to be added up.

For performing divisions there are provided three shafts or axles, *i k l*, (see Figs. II and VI,) carrying a number of disks *t*, which show the figures 0 to 9. (See Figs. VII and VIII.) Above the disks *t* bars *b'''* are placed, attached to the slides *d*, and provided with openings through which the numerals on the disks *t* can be seen. The shafts *i k l* are journaled in slides *d*, movable upon the tracks *m*. The disks *t* of the upper and middle shafts are so turned as to show on top, through openings in the bars *b'''*, figures forming the dividend,

while the divisor is formed by placing the slide *b* corresponding with the series of rollers *a* opposite a corresponding figure on the scale near the foot of said slide on the plate *e*. The disks *t* upon the lowermost shaft, *l*, are all placed at 0, and all the disks not in use and upon the left of the other shafts are also placed at 0.

For multiplying it is well to utilize all the rollers from the top and the slides at the right, while for dividing it is more handy to place these rollers and slides opposite 0. Directly above each vertical row of rollers there is one of the disks *t* upon axles *i k l*. After the divisor and dividend have been formed, as described, the slide *d* is drawn down, so as to expose only the lowermost row of rollers.

If the divisor is contained, say, twice in the first two figures of the dividend, the lowest rack is placed with its pointer opposite 2. The result can now be obtained by multiplying the divisor by two. This result must be subtracted from the dividend. This is done by so turning the disks upon the lowermost axle, *l*, (and which had been placed at 0) that they indicate the multiplicative divisor just obtained. By disks *n*, having eccentric slots *n'*, (see Fig. IX,) the lower axle, *l*, is, through projecting ends *l'* of the shaft *l*, working in said slots *n'*, so moved toward axle *k* that cog-wheels *k'* on the axles are caused to intergear. If, now, the lower disks are turned from 0 to 1, the disks on the axle *k* are revolved in an opposite direction, and if a 9 has been displayed it will be displaced by an 8.

If a subtraction is to be performed by the same disk, the disk on the axle *l* is revolved for as many figures as the number to be subtracted contains units. If figures are carried over in subtraction, the disk to the left on the axle *l* is revolved for one figure. The remainder, which is to be added, will appear after subtraction upon the disks of the middle axle. Next, the second quotient-figure is found by moving the second rack to the second figure of the quotient to be found. The slide *d* must be moved over the second row of rollers, *a*, to expose the result of the multiplicative divisor of the second figure of the quotient upon this row of rollers. By again revolving the corresponding disks the result is found, and so on until all the figures of the quotient are found, and the remainder is reduced to a decimal. If the figure of the quotient has been taken too large or small, this will appear by looking upon the figures on the roller, and it is only necessary to draw the rack backward or forward to correct the mistake. The dividend on the upper axle, *i*, remains unaltered during the calculation, it serving only as a check. By adding the figures on the lower and middle axle at any time during or after the calculation it can be ascertained if a mistake has been made, as the sum of the numbers on both axles must always be equal to the dividend. If to form the highest place of the quotient one figure more is required of the dividend than the divisor contains figures, the slide is, after finding of the first figure of the quotient, moved to the second multiplication row. The lowermost row remains at 0; but, if desired, each axle may contain at its left an additional disk, so as to utilize the lowermost row of rollers; or the rollers may be made sliding.

In Figs. IV and V the rollers *a* are supplanted by disks provided with numbers that are arranged as described. These may be moved directly beneath the slides *b*. In lieu of the shafts *i k l*, tapes may be used.

What I claim is—

1. The combination of the plate *e* with rollers *a a*, slides *b*, having openings *g g'*, and the racks *c*, engaging pinions *a'* on the rollers *a* and having pointers *z*, substantially as specified.

2. The combination of the rollers *a* and the racks *c* with the shafts *i k l*, carrying disks *t* and slides *d*, substantially as specified.

3. The combination of rollers *a* and racks *c* with the shafts *i k l*, slides *d*, and with the disk *n*, having the eccentric slots *n'*, engaging the ends *l'* of the shaft *l*, substantially as and for the purpose described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CARL LORENZ.

Witnesses:
HAUR FRIEDRICH,
GUSTAVE ALBERT OELRICHS.