(No Model.)

E. E. MATSSON.

ARITHMETICAL APPARATUS.

No. 555,218. Patented Feb. 25, 1896.

Fig. 3

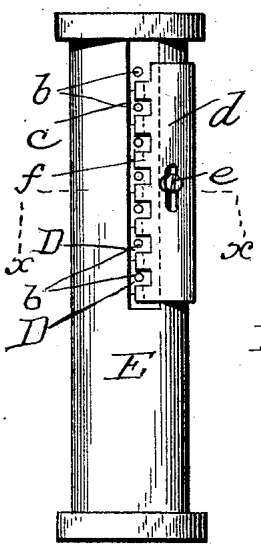


Fig. 1.

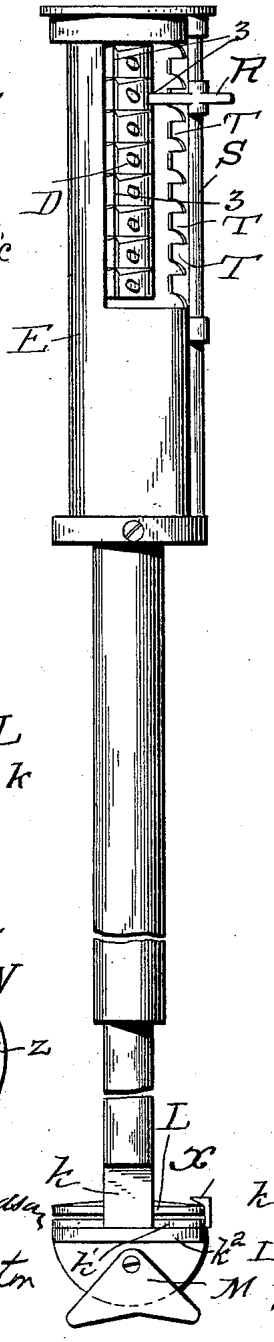


Fig. 2.

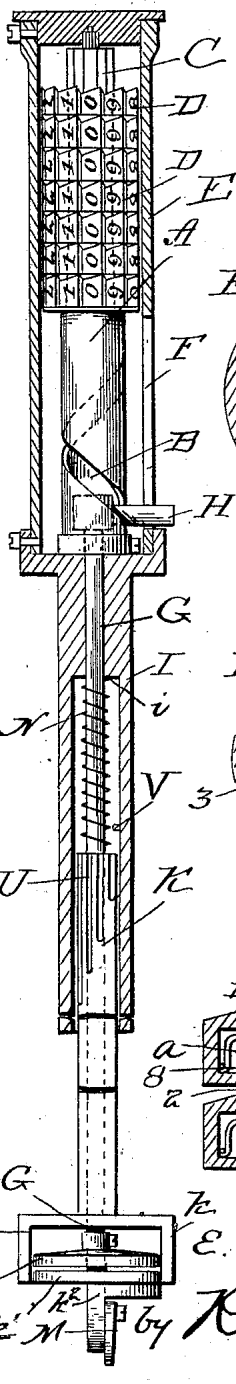


Fig. 4

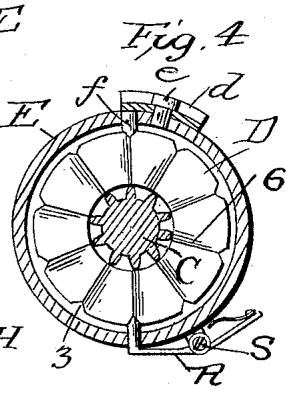


Fig. 5.

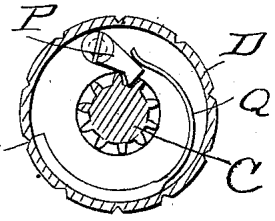


Fig. 7

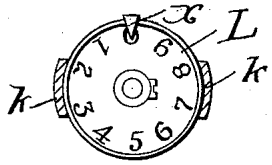


Fig. 8.

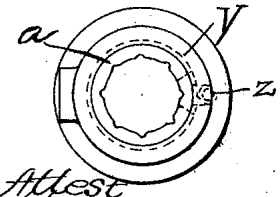
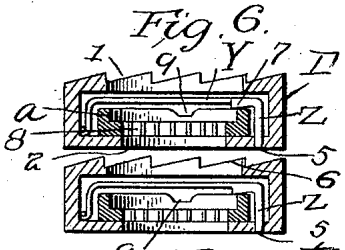


Fig. 6.



Attest

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UNITED STATES PATENT OFFICE.

ERKES ERIK MATSSON, OF SILJANSNAS, SWEDEN.

ARITHMETICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 555,218, dated February 25, 1896.

Application filed May 15, 1891. Serial No. 392,919. (No model.) Patented in Sweden February 10, 1891, No. 3,249; in England April 28, 1891, No. 7,346; in France April 29, 1891, No. 213,129, and in Germany May 1, 1891, No. 59,799.

To all whom it may concern.

Be it known that I, ERKES ERIK MATSSON, tradesman, a subject of the King of Sweden and Norway, residing at Siljansnas, in the Kingdom of Sweden, have invented certain new and useful Improvements in Arithmetical Apparatus, of which I do hereby declare the following to be a full, clear, and exact description.

The invention has been patented in the following countries: Sweden, No. 3,249, dated February 10, 1891; France, No. 213,129, dated April 29, 1891; Great Britain, No. 7,346, dated April 28, 1891; Germany, No. 59,799, dated May 1, 1891.

This invention relates to a calculating apparatus for addition and multiplication, and is particularly intended to be used when summing up figures in long columns. The apparatus is therefore so arranged that it may be handled as a pen. By moving in turns the lower end of the pen-shaped apparatus to every figure in the column and actuating the apparatus in a certain manner the sum, when all the figures in the column are taken up, can be read in an opening in the casing of the apparatus.

On the annexed drawings, Figure 1 represents the exterior of the apparatus. Fig. 2 is a longitudinal section of the casing with the interior parts in elevation. Fig. 3 is a detail side elevation of the upper casing, showing an adjustable plate used for setting the device to zero. Fig. 4 is a sectional view on line $x\ x$ of Fig. 3. Fig. 5 is a sectional view through the casing, showing the pawl on the calculating-wheel and the fluted roller engaging the same. Fig. 6 is a sectional detail view of a pair of numbering-wheels. Fig. 7 is a plan view, partly in section, showing the lower graduated disk. Fig. 8 shows in detail plan view the spring-arm and pawl carried by the number-wheels.

The apparatus consists of a cylinder A, in the wall of which is cut a spiral slot B. This cylinder is at the top firmly united with a fluted roller C, upon which wheels D are sleeved close one to another. Each of these wheels, also called "registering-wheels," is at its circumference divided in ten parts, and each part is in succession provided with the figures from 0 to 9. On these wheels the sums or the products are to be read when using the apparatus. The parts of the apparatus now described are surrounded by a cylinder E, in the wall of which an opening F is made in the longitudinal direction of the cylinder. Through this opening only one figure at a time is visible on each registering-wheel D, and the slit or opening is therefore not made wider than a good tenth part of the circumference of the registering-wheel.

It is evident that the different sums or products appearing in the opening F depend upon the different turnings of the registering-wheels. These turnings are effected in the following manner: Through the bottom of the cylinder A passes a rod G, which is movable with relation to the cylinder, and at the end passing into the cylinder is provided with an arm H projecting through the said spiral slot B in the wall of the cylinder A as well as a straight slot in the cylinder E. This latter cylinder is continued some distance downward by the smaller tube I, into the lower end of which to the greater part of its length another tube, K, is passed. Through this latter tube the rod G descends, and on its lower end projecting out of the lower end of the tube K it is provided with a circular disk L, which is at its circumference divided in ten parts provided with the figures from 0 to 9. (See Fig. 7.) The tube K is provided with two arms k having a connecting-plate k' passing under the disk L, forming in this way a bearing and a support to the lower end of the rod G. Further, there is fixed under these arms, in the manner shown by the drawings, a pivoted foot-piece M. This foot-piece is pivoted to a bracket k^2, and on this foot-piece the apparatus is supported when put down near the figure which is to be taken up in the apparatus. By this movable piece the apparatus may evidently be inclined in any direction whatever.

It will be easily understood that if the apparatus is seized by the fingers of one hand clasping the tube I while the foot-piece M is put down against a stationary object and the tube I is pushed down on the tube K the cylinder A must be turned around, and therewith also the registering-wheels.

The arm H will at its outer end be supported by the cylinder E, because the latter is prevented from turning, since the tube I is retained between the fingers. Consequently the cylinder A must turn, because the arm H projects through the spiral slot in its wall. After being pressed down a spiral spring N causes the tube I and the cylinder E to go upward. The top of the spiral spring rests, as shown by the drawings, against a stop *i* in the tube I, and the lower end rests against the end of the tube K.

Each calculating-wheel consists of a hollow cylinder having openings at 1 2, Fig. 6, in its top and bottom communicating with each other through the interior of the wheel to receive the fluted roller C. Each hollow cylinder or calculating-wheel has pivoted thereto a pawl P under tension of the spring Q and engaging the fluted roller, so that when the roller is turned one-tenth, two-tenths, or any part of a revolution the wheels will be carried forward a corresponding part of a revolution.

On the return movement of the roller, when the tube I reascends, the wheels which are not retained in their moved position will be turned back to their former position of rest by means of the frictional contact between the spring-pawls and the fluted roller; but any one of the wheels may be retained in its moved position by means of a detent R, pivoted on a rod S on the outside of the casing and adapted to be slid up or down along said rod, so that it will engage the depressions 3 in any one of the wheels. The notches or depressions are made a distance apart equal to the tenth part of the circumference of the wheel. The edge of the opening in the cylinder or outer casing E has a series of projections T, and these serve to retain the detent in any position along the rod S. It will be understood that the amount of rotation imparted to the number disks or wheels corresponds to the amount of longitudinal movement of the tube I with outer casing and slotted cylinder A in relation to the tube K and the bar G, which carries the pin H. This longitudinal movement is regulated by turning the tube K about the bar G and within the tube I, so that any one of the grooves U at the top of the tube K will align with the stop V on the inner side of the tube I, and then by pushing the tube I down the cylinder A with the fluted roller and number-wheels will turn until the stop V strikes the lower end of the groove U, when the movement will cease. The grooves, as shown, are of different length, so that when the shorter one aligns with the stop the movement of the tube I will be only sufficient to rotate the slotted-cylinder fluted roller and number-wheels one-tenth of a revolution. The next groove is long enough to allow two-tenths of a revolution, and so on up to the longest groove corresponding to a full revolution. The amount of rotary adjustment of the tubes I and K with relation to each other, so as to bring the proper groove in alignment with the stop V, is determined by the pointer X, carried by the yoke *k k* at the lower end of the tube K, which is brought opposite the desired number on the disk L by turning the tubes I K in relation to each other, the disk L turning with the tube I because the pin H, connected to the bar G carrying the wheels, projects through the outer slotted case E which is connected to the outer tube.

Supposing all the wheels to be at zero, as shown, and it is desired to add five and three, the apparatus is made to rest on the piece M and the tube I is turned, so that 5 on the disk L comes opposite the pointer X. The pin V is now opposite the groove U, which is long enough to permit five-tenths of a revolution. On pressing down the tube I all the number-wheels are turned five-tenths of a revolution by the fluted roller engaging the several pawls of the wheels; but only one wheel will be held in this position, as the detent R is only adapted to engage the notches in one wheel. The others will be returned to normal position by the friction between their pawls and the fluted roller. The retained wheel will display the figure 5. The next step is to turn the tube I so that the figure 3 on the disk L comes opposite the pointer, and then when the tube I is depressed the action above described will take place, excepting that the stop V will arrest the movement when three-tenths of a revolution has taken place, thus bringing the figure 8 on the retained wheel opposite the display-opening, all the other wheels returning to normal position, as before.

When the sum of the numbers added exceeds ten, a transfer of tens must take place from the wheel retained by the detent R to the next wheel below it, and when this wheel has made a comple revolution the wheel next below is brought into action, and the movement is thus carried from wheel to wheel throughout the series. This carrying mechanism consists of a spur Z, Fig. 6, adapted to work in and out of the opening 5 in the bottom of the upper wheel to engage at the proper moment one of a series of radial notches or grooves 6, formed in the upper face of the wheel next below. This spur is carried by a spring-arm Y, secured to the casing of the wheel and tending constantly to force the spur out to engage the radial notches in the wheel below. This tendency is resisted normally, however, by the ring *a*, which is arranged within the hollow numbering-ring, and the shoulder 7 on the spur rides on the edge of this ring, and thus the spur is held up against the spring-tension.

The ring has teeth 8 on its inner edge engaging the teeth of the fluted roller, and when the fluted roller turns forward the number-wheel and toothed ring all turn together, the ring and number-wheel maintaining their positions relative to each other; but if the number-wheel is held by the detent R the return of the fluted roller to normal position will

turn the toothed ring within the wheel and independently thereof, and thus the notch 9 in the edge of the ring will be brought nearer to the shoulder on the spur, which remains in a fixed circumferential position with its number-wheel, and if the movement is sufficient the notch will come beneath the shoulder of the spur and then the spur will fly out from the upper wheel to engage the notches in the next wheel below, thus forming a carrying device between the two wheels. Each wheel, excepting the last one of the series, has this carrying device.

When the fluted roller is returning to normal position and the upper number-wheel is held against return movement by the detent, the notched ring, as before stated, turns, and finally the spur of the upper wheel flies out and engages the upper radial notches of the wheel next below, and if this action takes place before the fluted roller with all of the unretained number-wheels have returned to normal position the engagement of the spur of the retained wheel with the wheel next below will act to stop its return to normal position and to hold it with the proper digit displayed, which, in combination with the numeral on the retained disk, will show the sum of the numbers added.

Supposing the figures five and seven are to be added, the tubes are adjusted so that depression of the tube I will cause the number-wheels to be turned five-tenths of a revolution to display the numeral 5. Only the upper number-wheel will be retained, however, as the detent-pawl has been adjusted to engage this. In the present instance the upper wheel of the series to be operated is the second one from the top, and Fig. 2 shows the pawl R in engagement therewith.

All the other number-wheels will return with the fluted roller, and the notched ring *a* of the upper retained number-wheel will be moved only part-way around to make its notch engage the shoulder on the spur, and consequently the spur will be held up and the number-wheel next below the retained wheel will return to normal or zero position with the fluted roller. When now the tubes are adjusted for adding seven to the five already displayed the seven-tenths revolution of the fluted roller will carry the upper wheel past the tens place and bring the numeral 2 to view. This wheel will be retained by the pawl R to display the numeral 2, and on the return of the fluted roller the ring *a* of this upper retained wheel will be again moved, and its revolution will now be completed, so that the spur will fly out the moment this revolution is completed and engage the wheel next below before it fully returns to zero, or, in other words, the spur of the retained wheel will engage the notch for the numeral 1 on the wheel next below, and the wheel will be retained in this position, displaying the numeral 1, thus displaying, in conjunction with the upper wheel, the numeral 12, representing the sum of the numbers added.

In order to set the device to zero each wheel has a pin *b* projecting from its circumference, as shown in Fig. 3. The cylinder E has a longitudinal slot *c* to receive a series of studs or shoulders *f* projecting from the plate *d* adjustable up and down on the outside of the cylinder by a screw *e* passing through a slot in the plate. When calculating with the apparatus the plate is pushed down so that the pins pass freely between the shoulders *f;* but when the apparatus is to be adjusted to zero the plate is pushed up so that the shoulders *f* will strike the pins, and thus serve to arrest the movement of the wheels. The disk L is now turned so that the index will point to zero. The detent R is then released from the number-wheel, and the cylinder L and tube I are pushed downward. The pins *b* and the stop-shoulders *f* will cause all the wheels to stop at the zero-point.

When the apparatus is to be employed for multiplication it must be proceeded in the following way: If, for instance, the multiplication of twenty-eight by thirty-four is to be performed, the disk L is adjusted to eight, whereafter the apparatus is pressed down four times. Then the hook R is moved to the next subjacent registering-wheel and the figure 2 is adjusted to the disk L, whereafter the apparatus is pressed down three times.

I claim—

1. A calculating apparatus comprising a series of registering-wheels, a roller carrying the same side by side, a cylinder having a spiral groove and extending axially in line with the axis of the wheels and forming an extension of the roller carrying the wheels and a rod extending axially of the cylinder and having movement longitudinally in relation thereto, said rod having an arm projecting therefrom into the spiral groove of the cylinder to rotate the same when the parts are displaced longitudinally in relation to each other, substantially as described.

2. In combination, the registering-wheels placed side by side, a roller extending axially through the disks and fluted, means between the fluted roller and the registering-wheels for operating them, a spirally-grooved cylinder connected with the fluted roller and means for operating the spirally-grooved cylinder consisting of the rod G movable longitudinally in relation to the cylinder and having an arm engaging the spiral groove of the same, substantially as described.

3. In combination in a calculating apparatus, a casing a fluted roller journaled therein, the means for turning said fluted roller, the series of registering-wheels D arranged on said fluted roller, the pawls pivoted within the wheels to engage the fluted roller to impart the movement thereof to the registering-wheels and to allow said roller to move back while the wheels may be stationary and the

detent-pawl R for holding any of the registering-wheels stationary while the fluted roller is retracting, substantially as described.

4. In combination in a calculating apparatus the fluted roller, the means for rotating the same, the series of registering-wheels on the roller, the pawls P pivoted to the wheels and engaging the fluted roller to be moved thereby, the detent for holding one wheel stationary, and the carrying mechanism from one wheel to the next comprising a spring-spur on each wheel arranged to engage the next wheel and the notched ring in each wheel arranged to control the spur, said ring having teeth to engage the fluted roller, substantially as described.

5. In combination in a calculating apparatus, the casing the fluted roller therein with means for moving it, the series of registering-wheels carried by the fluted roller and each having a pawl to engage the same, carrying or transfer mechanism between the wheels, a detent-pawl R and the guide-rod S therefor along which the detent-pawl may be adjusted to engage any desired registering-wheel, substantially as described.

6. In combination, the casing the fluted roller therein, the spirally-slotted cylinder A connected with the fluted roller, the registering-wheels on the fluted roller having pawls engaging the same, the rod G having a pin engaging the slot in the cylinder A, the tube K surrounding the rod G and having a series of grooves of different lengths, the stop V on the case to engage said grooves, said tube being arranged to be turned axially and the index device, substantially as described.

7. In combination, the casing, the registering-wheels therein, the means for moving the same including a rod G movable through the casing, the tube surrounding the rod and having grooves of different lengths, the stop on the casing for engaging said grooves and the dial and index to determine the desired amount of rotation of the grooved tube, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ERKES ERIK MATSSON.

Witnesses:
BAEK M. PERSSON,
ALM MATS ERSSON.