May 23, 1933. H. CORDT 1,910,201

CALCULATING MACHINE

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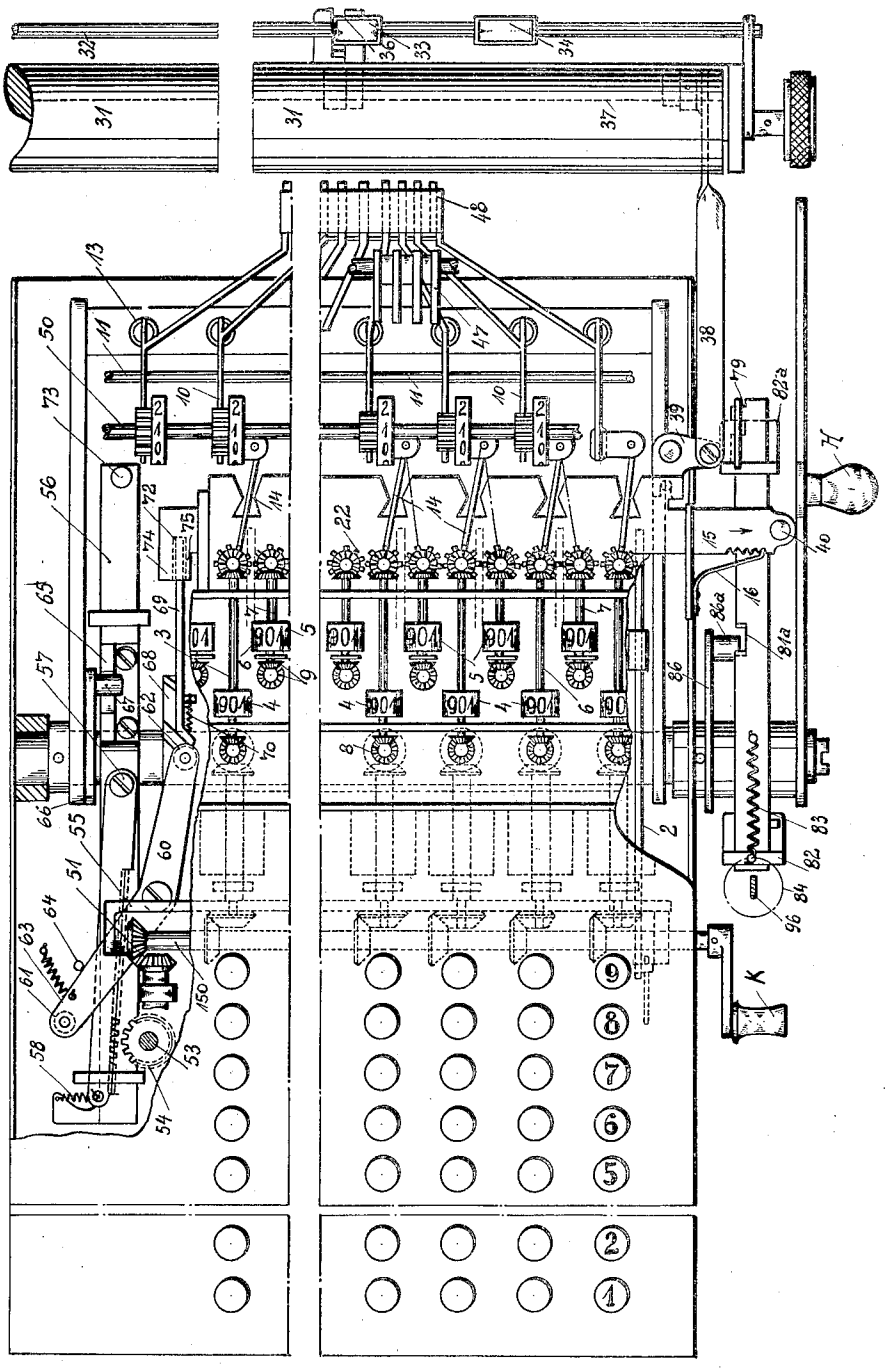


Fig. 1

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May 23, 1933. H. CORDT 1,910,201

CALCULATING MACHINE

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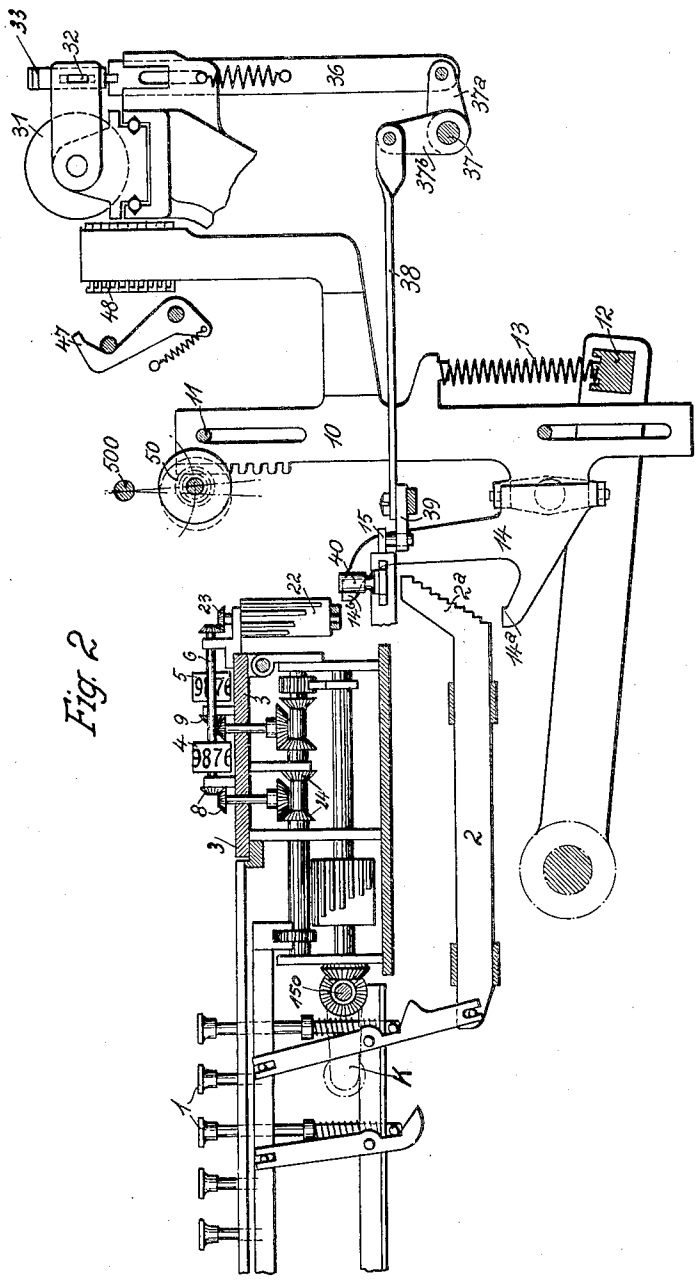


Fig. 2

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CALCULATING MACHINE

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Fig. 3.

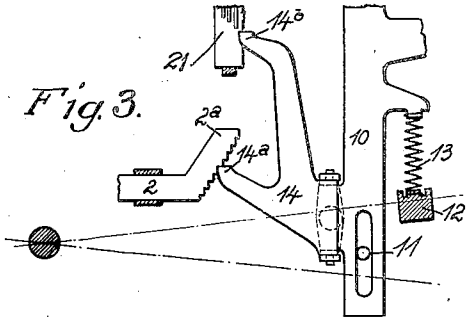


Fig. 4

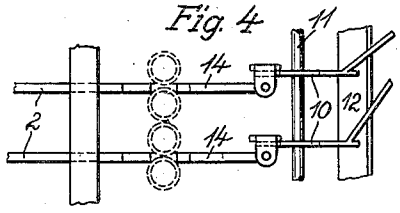


Fig. 8.

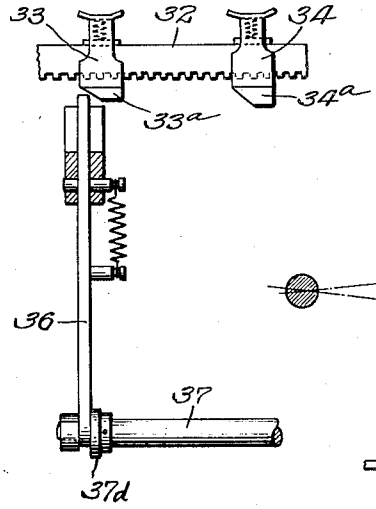


Fig. 5

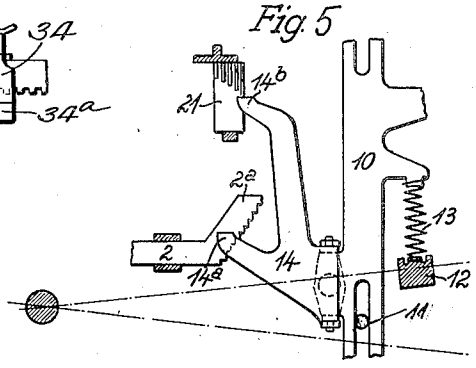


Fig. 6

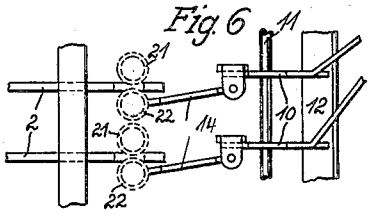
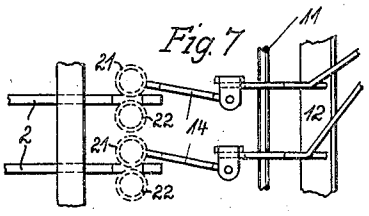


Fig. 7



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CALCULATING MACHINE

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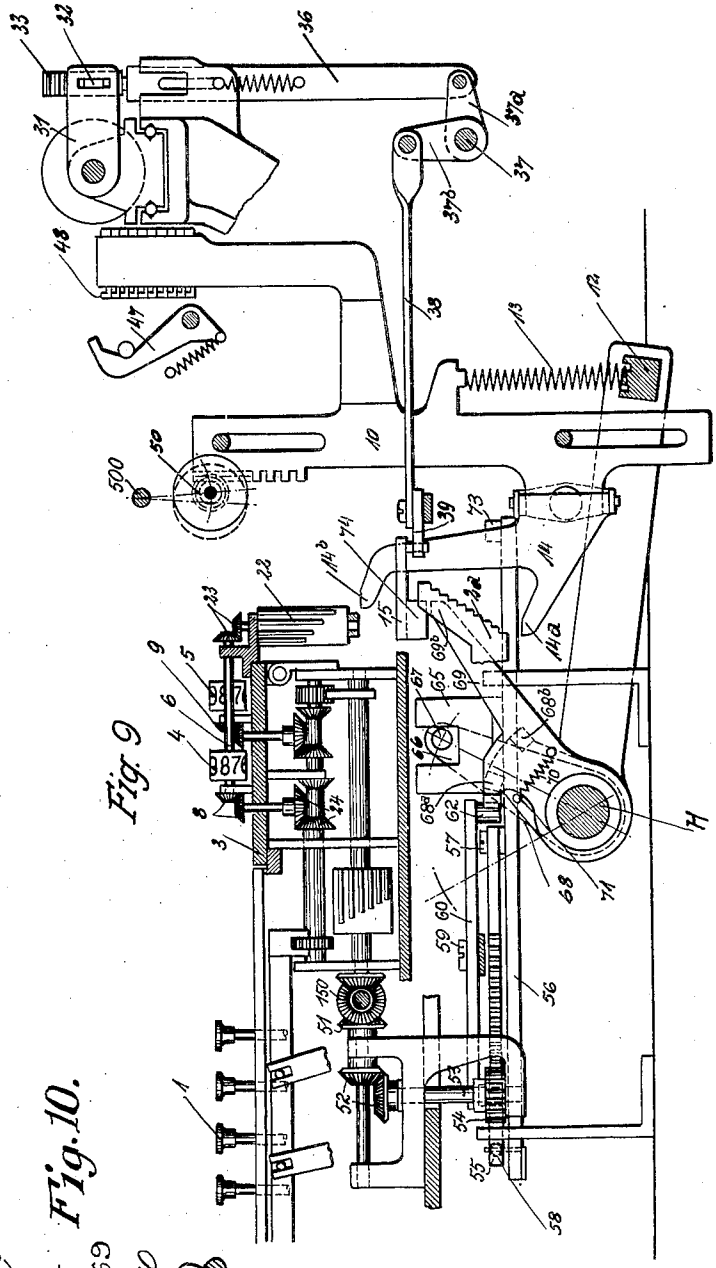


Fig. 9

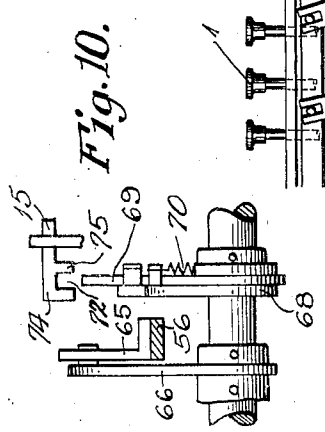


Fig. 10.

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Fig. 11

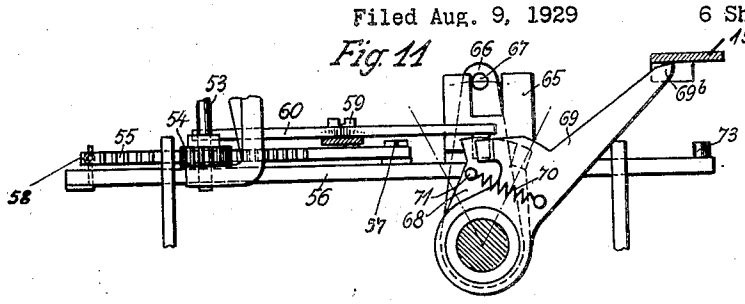


Fig. 12

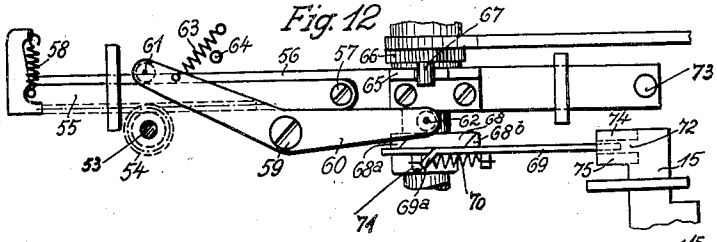


Fig. 13

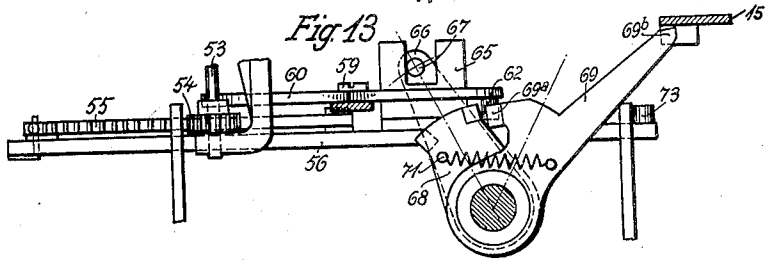


Fig. 14

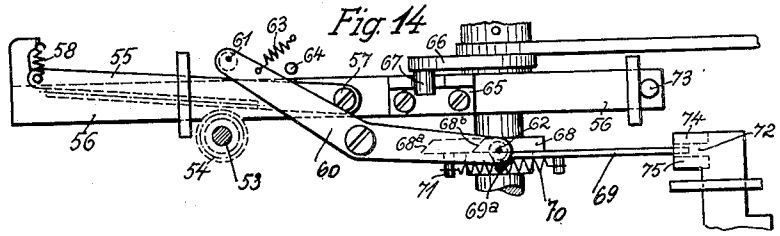


Fig. 15

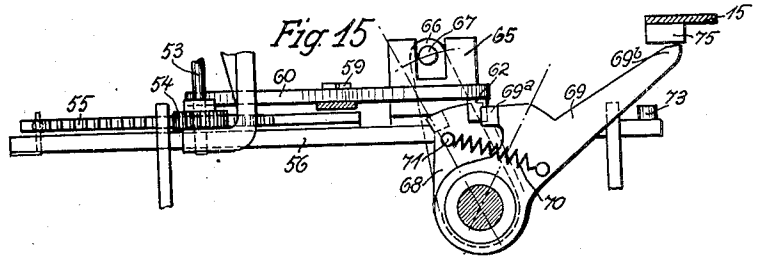
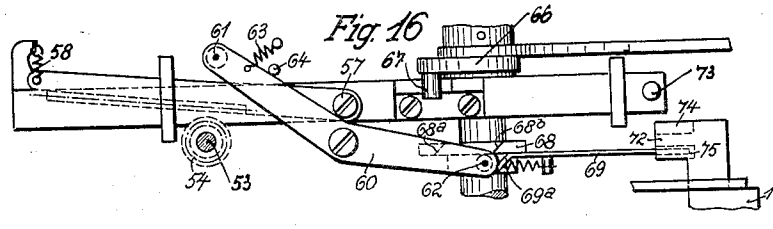


Fig. 16



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CALCULATING MACHINE

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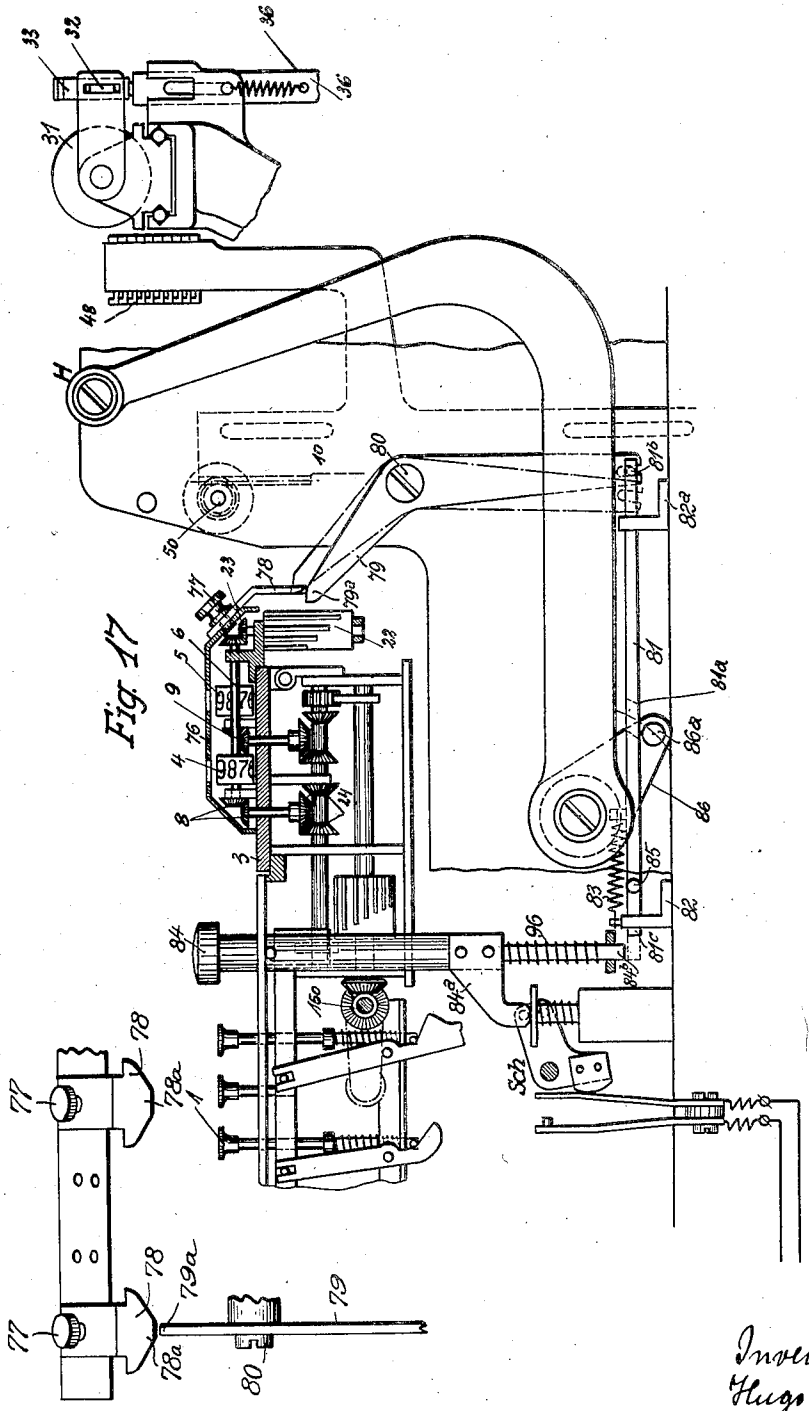


Fig. 17

Fig. 18.

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Patented May 23, 1933 1,910,201

UNITED STATES PATENT OFFICE

HUGO CORDT, OF LEIPZIG, GERMANY

CALCULATING MACHINE

Application filed August 9, 1929, Serial No. 384,576, and in Germany August 17, 1928.

In the employment of multiplying machines or calculating machines for performing all four kinds of calculation, i. e. for performing addition, subtraction, multiplication and division, it is frequently desired during multiplying operations either to print the resulting products or the multiplicands or multipliers employed and to add them, or further to print all three numbers and to add one or all of them, the same applying in the reverse sense when dividing in the case of quotients, dividends and divisors. The fulfillment of this requirement does not offer any difficulty theoretically, inasmuch as it is only necessary to add to the multiplying machine or the machine for all four kinds of calculation, the corresponding printing and adding mechanisms. In practice, however, considerable difficulties arise as is proved by all the hitherto known proposals. In these proposed constructions a separate printing mechanism having its own transmission device is provided for the multiplicand, the multiplier and the result. In consequence of this the machine is, however, rendered so complicated and is so expensive in manufacture that for this reason alone it is not competitive. Apart from this the machines constructed according to these known proposals cannot possibly work reliably inasmuch as the numbers shown in the calculating machine for all four kinds of calculation and the printing mechanism are located so far apart from one another and are so arranged that the connection between the two necessitates a large number of linkages, shafts and racks, which must of necessity have a certain amount of play at their connecting points, which play adds itself together and at the end of the transmission gives rise to false indications.

It is the principal object of the calculating machine forming the subject of the present invention to remove these drawbacks. The invention consists essentially in the combination of a calculating machine for performing four kinds of calculation i. e. addition, subtraction, multiplication and division, or a multiplying machine having individual hand or motor drive and a printing, adding and subtracting machine with one or more counting mechanisms and its own hand or motor drive, which latter is not provided with a keyboard and on the operation of its drive takes off the values to be printed or to be calculated from number members which set themselves up correspondingly on the operation of the calculating machine for four kinds of calculation, or the multiplying machine as the case may be. In this manner transmission devices in which the unavoidable play between the parts adds itself up are especially avoided.

In the accompanying drawings the essential parts of a calculating machine for four kinds of calculation and an adding machine arranged behind the former are shown by way of example, according to the invention.

Referring to the drawings:

Fig. 1 is a plan,

Fig. 2 is an elevation,

Figs. 3 to 7 show various positions of the feeling members of the adding machine in elevation and plan,

Fig. 8 shows a setting device for the setting up of the feeling members through the agency of the paper carriage,

Fig. 9 is an elevation of the machine showing the coupling of the drive of the adding and subtracting machine with the drive of the calculating machine for four kinds of calculation.

Fig. 10 shows a detail of Fig. 9 in front view,

Figs. 11 to 16 show different positions of the coupling mechanism in elevation and plan,

Fig. 17 is an elevation of the locking device of the drive of the adding machine,

Fig. 18 is a detail of the locking device in plan, and

The reference numeral 1 denotes the keyboard of the calculating machine for four kinds of calculation. Under each of the keys located behind one another in a row, a bar 2 is arranged which on depression of a key is displaced in known manner such as that disclosed in the U. S. A. Patent Specification No. 1,489,547, the displacement being

of different length in the case of each key. The rear end of the bar 2 is constructed in known manner in the form of steps as shown at 2*a*. The reference numeral 3 denotes the counting mechanism plate of the calculating machine for four kinds of calculation. On this latter shafts 6, 7 carrying number rollers 4, 5 as usual are mounted, which can be rotated by means of bevel wheels 8, 9. The number rollers 4 indicate the product or the dividend respectively and the number rollers 5 indicate the multiplier and quotient. The actuation of the shafts 6, 7 is effected in the known manner (as shown for example in the U. S. A. Patent Specification No. 1,489,547) universally employed in calculating machines for all four kinds of calculation by means of a crank K.

The adding machine employed in the combination is provided with its own drive by means of the lever H and is not in any direct connection whatever with the calculating machine for all four kinds of calculation. The said adding machine differs from known adding machines only in the fact that its keyboard is replaced by taking-off devices which serve the purpose of transmitting the value set up in the calculating machine for four calculations to the adding machine. The taking-off devices may be per se of any desired construction. In the construction illustrated for instance on each of the racks 10 connected with the adding mechanism 50, (and otherwise controlled by the keyboard), said racks being guided so as to be movable in a vertical direction on rods 11 and carried by compression springs 13 mounted on the driving bar 12, a double armed lever 14 is pivotally attached so as to be capable of swinging laterally, which arm according to its position serves for the taking off of the multiplicand, of the multiplier, or of the product. The lower arm of the double armed lever 14 terminates in a take-off member 14*a* and serves exclusively for the taking off of the multiplicand on the stepped end 2*a* of the bar 2 of the calculating machine for all four calculations, whilst the upper arm is employed as desired for the taking-off of the multiplier or of the product. The double arms 14 each engage in a recess of a bar 15 (Fig. 2) of cone form, by the displacement of which all the said double arms are simultaneously swung to and fro. The bar 15 is held in the position given to it from time to time by means of a fixing spring 16. In the middle position of the bar 15 double arms 14 are so swung into position that they are located exactly in the prolongation of the bars 2 of the calculating machine for the four kinds of calculation (Figs. 1 and 4). During the raising of the racks 10 resulting from the actuation of the hand lever H of the adding machine by the common printing bar 12, the projections 14*a* of the arms 14 strike against the stepped ends 2*a* of the bars 2 (Fig. 3) which prevent a further movement. The moment when this occurs will, however, be different in respect of the individual feeling bars 10, inasmuch as the bars 2 of the calculating machine for four kinds of calculation have different positions, in accordance with the setting up of the keyboard 1. In correspondence with the varying stroke of the feeling bars 10 a different setting up in the adding mechanism 50 is effected by the said feeling bars 10.

If the setting bar 15 is brought into the position of adjustment for the quotient or multiplier respectively (position shown in Fig. 6), then on the raising of the feeling bars 10 the lower projecting parts 14*a* no longer come within the range of the bars 2. The upper projections 14*b* now strike upon the stepped rollers 22, which are adjusted on the shafts 7 by means of bevel wheel gear 23, 24 (Figs. 5 and 6). On the periphery of the stepped rollers 22 ten axial ribs of different lengths are provided which are uniformly distributed, and each of which corresponds to the number value of the corresponding number roller represented as a length. These ribs all begin at the one, namely, the upper end of the vertical stepped roller 22. On the lower end of these longitudinal ribs the projections 14*b* will strike sooner or later whereby the movement of the feeling bars 10 will be interrupted and the adjustment of the latter corresponding to the position of the number rollers 5 will be effected.

If an adjustment of the setting bar 15 to the position of rest or a setting of the result mechanism (position shown in Fig. 2) is effected, then the double arms 14 are swung into position in such manner that on the raising of the feeling bars 10 the upper projections 14*b* of the arms 14 strike on stepped rollers 21, whereby an adjustment of the feeling bars corresponding to the position of the number rollers 4 takes place (Fig. 7).

As is already known, the paper carriage 31 of the adding machine is longitudinally slidable in order to be able to print the results, multiplicand and multipliers in rows located adjacent to one another by means of the impression hammer 47 and the type carrier 48. This movement of the paper carriage may be employed for the automatic adjustment of the setting bar 15. For this purpose a guide or carrier bar 32 (Figs. 1 and 8) is fixed to the paper carriage 31, on which riders 33 and 34 can be placed in position in any desired order of succession, just according to which values are required to be printed first. The riders 33 and 34 are provided with projecting portions 33*a* and 34*a* of different heights adapted to strike during the movement of the paper carriage against

a slidably mounted rod 36, which thereby is pressed downward according to the height of the projection against the action of a spring. The lower end of the rod 36 is pivotally mounted on an arm 37*a* of a shaft 37, a further arm 37*b* is connected by means of a pull rod 38 with one arm of a bell crank lever 39. The other arm of this bell crank lever 39 is constructed in the form of a fork and encloses a pin mounted on the lower side of the setting bar 15. By means of this linkage the movement imparted to the rod 36 transmits itself to the setting bar 15, which thus after the printing of a particular denomination of numbers is automatically brought into the position for taking off another denomination of numbers.

The adding mechanism 50 shown in the drawings naturally adds only the items of one individual denomination of numbers, for example, only the multiplicands or dividends, the multipliers or divisors, or the products or quotients. For this reason, the adding mechanism 50 is mounted pivotally on a shaft 500 and can be brought in and out of engagement with the racks 10. It would, of course, also be possible to employ one of the known adding machines having a plurality of counting mechanisms so that the numbers of all the denominations could be added. The adding mechanism could moreover be connected with a printing mechanism in order to print the totals.

Moreover, it is desirable, for instance, in the calculations of electricity works regarding the current consumption of the individual consumers to print the number impressed on the keyboard and also to let it appear on the number roller 4 indicating the product, in order to be further employed for the calculation in the calculating machine for all four calculations. It is desirable to be able to effect this adjustment by the actuation of a single hand lever. This result can be attained by arranging that in the middle position of the setting bar 15 the hand lever H of the adding machine is so coupled with the shaft carrying the crank K of the calculating machine for all four calculations, that the latter carries out a complete revolution when the hand lever H is operated. A suitable mechanism of this kind is shown in Figs. 9 and 17. In this construction the shaft 150 carrying the crank K of the calculating machine for all four operations is connected by means of pairs of bevel wheels 51 and 52 positively to a vertical shaft 53 on which a spur wheel 54 is fixed. Opposite to the spur wheel 54 a rack 55 is located. This latter rests on a slide 56 and swings around a holding screw 57. A spring 58 maintains the rack 55 in the position of rest outside of the range of the spur wheel 54. Above the rack 55 fixedly or pivotally mounted on a screw 59 a lever 60 is located which carries at its two ends rollers 61 and 62 and is normally drawn by means of a spring 63 (Fig. 1) against a stop 64. On the slide 56 a forked bearing block 65 is fixed. In the fork of this bearing block a carrier pin 67 mounted on a lever arm 66 of the shaft of the printing lever H engages, which has ample play in the said recessed portion and transmits the movement of the printing lever H to the slide 56 with a retardation which is determined by the play. For the control of the roller lever 60 a control disc 68 which is likewise fixed on the shaft of the lever H serves, which is provided with two inclined surfaces 68*a*, 68*b*. On the hub of the said control disc a feeling lever 69 is mounted so as to be loosely rotatable, which feeling lever is coupled with the control disc 68 by means of the tension spring 70, which draws the lever 69 against a pin 71 of the control disc 68 (Fig. 9). On the feeling lever 69 an inclined surface 69*a* is provided which when the lever 69 rests on the pin 71, forms the extension of the inclined surface 68*a* on the control disc 68. When the hand lever H moves towards the left in Fig. 9 the control disc 68 is carried with it and through the medium of the spring 70 likewise carries the feeling lever 69 with it. During this movement the front end 69*b* of the feeling lever strikes from below against the setting bar 15. The point at which the feeling lever 69 strikes against the setting bar 15 naturally differs according to the position taken up by it. Corresponding to the three given positions of the setting bar 15 there will be three points of contact lying adjacent to one another. In the two outer points of contact the setting bars 15 each carry a projection 74 and 75 which are so high that they hardly allow the feeling lever 69 any possibility of rotation. If, however, the setting bar 15 is in the middle position, then the feeling lever 69, the front end of which on moving into the recess 72 engages between the projections 74 and 75, can effect such a large movement that its inclined surface 69*a* imparts a rotatory movement to the roller lever 60 through the medium of the roller 62. Consequently, the roller 62 slides upon the inclined surface 68*a* of the control disc 68, which latter inasmuch as it participates in the forward movement of the printing lever H positively imparts to the roller lever 60 a still greater rotatory movement. Consequently, the roller 61 comes into contact with the back of the rack 55 and presses this latter into engagement with the spur wheel 54 against the action of the spring 58 (Fig. 12). At this moment the carrier pin 67 has completed its idle path, engages in the slide 65 and moves the slide 56 and consequently the rack 55 forwards. The roller 61 maintains the rack constantly in engagement with the

spur wheel 54 whilst the roller 62 slides along the rear surface of the control disc 68 (Fig. 12). During the forward movement of the slide 56 the shaft 53 and consequently the crank shaft 150 is rotated by means of the rack 55 and the spur wheel 54. At the end of the forward movement of the printing lever H (Fig. 13) the crank shaft will have carried out the desired single rotation. The stop 73 arranged on the slide 56 limits the path of the said slide 56 and prevents the movement of the crank shaft 150 for more than one rotation. At this moment the roller 62 of the control lever 60 is located at the end of the inclined surface 68*b* of the control disc 68 and slides now under the action of the tension spring 63 off the control disc 68 and applies itself to the inclined surface 69*a* of the feeling lever 69 (Fig. 14). During this operation the roller 61 releases the rack 55 which under the action of the spring 58 snaps out of engagement with the spur wheel 54. During the succeeding backward movement of the printing lever H the slide 56 together with the rack 55 returns into the position of rest without rotating the spur wheel 54. The roller 62 of the roller lever 60 is thereby pressed by the inclined surface 68*b* of the control disc 68 still further towards the inclined surface 69*a* of the feeling lever 69 and slides along the front surface of the control disc 68. The roller lever 60 thus returns to its position of rest so that after the printing lever H has been completely passed back, the position shown in Fig. 9 is again established. On a further working stroke of the printing lever H and with the same position of the setting bar 15 the above described operation would repeat itself and the calculating crank K would execute a further rotation. On the other hand, if the setting bar 15 is so set by the paper carriage 31 that the projection 69*b* of the feeling lever 69 rests below the projection 74 (Figs. 10 and 16) or 75, then the coupling does not enter into operation, since as already mentioned in this case the feeling lever 69 cannot execute any substantial rotatory movement and in this case only the spring 70 would be tensioned (Fig. 15). The slide 56 and the rack 55 will execute their movements during the forward and backward movement of the printing lever H, but these latter do not exert any effect on the machine inasmuch as the coupling is inoperative.

In the carrying out of the multiplication and division operations in the calculating machine for all four kinds of calculation the counting mechanism plate 3 is, as is well known, pushed transversely into the machine. After the conclusion of the calculation for the determination of the individual result, the counting mechanism plate 3 must be brought back into its initial position in order to take up the adjustment for the decimal point. The adjustment to the decimal position will be hereinafter described as the decimal position. When calculating quickly, it happens, however, that the calculator inadvertently neglects to bring the result mechanism 3 into the decimal position before operating the lever H. He will thus transmit the result in the false position of the result mechanism and consequently will obtain at the end of the calculation a false result. In order to render this impossible a separate locking device is provided which is illustrated in Figs. 17 and 18. In this locking device riders 78 are fixed on one of the side surfaces of the cover 76 of the result mechanism 3 (Fig. 17) by means of milled screws 77, which riders are provided on both sides with inclined surfaces. These riders 78 control during the movement of the result mechanism 3 a two-armed lever 79 which is pivotally mounted on the machine frame at 80 and is provided with a lower forked end which encloses a pin 81*b* fixed to a locking slide 81. The locking slide 81 is mounted in bearings 82, 82*a* so as to be horizontally slidable therein and is controlled by the action of a tension spring 83.

If one of the riders 78 runs over the upper end of the lever 79, then this latter will be pressed down and the lever will be swung about its pivot so that it withdraws the locking slide 81 against the action of the spring 83. During this operation, a lateral recess 81*a* provided in the slide 81 comes into position in the course of motion of a pin 86*a*, which is carried by an arm 86 of the shaft turned by the hand lever H and which projects a short distance over the locking slide 81. In this initial position of the locking slide 81, this latter prevents the rotation of the hand lever shaft, inasmuch as the pin 86*a* strikes upon it. The free movement of the hand lever shaft is only possible when the pin 86*a* can enter into the recess 81*a*. The hand lever H can thus only be operated when the counting mechanism plate 3 occupies such a position that one of the riders 78 displaces (i. e. swings) the lever 79. By suitable setting up of the riders 78 on the cover 76 of the counting mechanism, operation of the hand lever H is only possible in the decimal position, so that a false result can never be printed. It is necessary to provide several riders 78, inasmuch as several rows of numbers have to be written one beside the other, each of which possesses a separate decimal position. If, in addition to the hand lever H, the machine is also provided with an electric drive upon actuation of which the hand lever remains at rest, the locking bar 81 can also be employed for locking the motor key 84. The motor key 84, generally pressed upwards by means of a spring 96, is provided as usual with an arm 84*a* by means of which

a time switch 8 is operated on depressing the key. If the locking slide 81 is in the position of rest determined by the spring 83 and the pin 85, then its left hand end (Fig. 17) will be located directly below the lower end of the motor key 84, so that the latter cannot be operated. The path of motion of the motor key will, however, be clear when the locking bar is drawn back by the passage of a rider 78 on to a lever 79.

It is to be understood that the invention is not restricted to the constructional form described and illustrated, but that the individual constructional parts can be modified within wide limits.

I claim:

1. In a calculating machine for performing addition, subtraction, multiplication and division, key controlled set up means and sets of members set in accordance with the factors or products of computation, a printing mechanism and a totalizer co-operating therewith to accumulate items printed, said printing mechanism having its own actuating means and controlled by adjustable feelers selectively positioned to set up the printing mechanism in accordance with either the setting of the key controlled set up means, or one of said sets of members set in accordance with factors or products.

2. In a calculating machine for performing addition, subtraction, multiplication and division, key controlled set up means including feeler bars and sets of members set in accordance with the factors or products of computation, a printing mechanism and a totalizer co-operating therewith to accumulate items printed, said printing mechanism having its own actuating means and controlled by means comprising setting-up bars co-operating with said printing mechanism and totalizer, adjustable swinging feelers mounted on said setting-up bars, the said feelers being selectively positioned to set up the printing mechanism in accordance with either the setting of the key controlled set up means, or one of said sets of members set in accordance with the factors or products.

3. In a calculating machine for performing addition, subtraction, multiplication and division, key controlled set up means including feeler bars and sets of members set in accordance with the factors or products of computation, a printing mechanism and a totalizer co-operating therewith to accumulate items printed, said printing mechanism having its own actuating means and controlled by means comprising setting-up bars co-operating with said printing mechanism and totalizer, adjustable swinging feelers mounted on said setting-up bars, the said feelers being selectively positioned to set up the printing mechanism in accordance with either the setting of the key controlled set up means, or one of said sets of members set in accordance with the factors or products, and a comb-like slide member through recesses in which said swinging feelers pass so that by displacement of said slide member in an axial direction said feelers are simultaneously displaced.

4. In a calculating machine for performing addition, subtraction, multiplication and division, key controlled set up means and sets of members set in accordance with the factors or products of computation, a printing mechanism and a totalizer co-operating therewith to accumulate items printed, said printing mechanism having its own actuating means and controlled by adjustable feelers selectively positioned to set up the printing mechanism in accordance with either the setting of the key controlled set up means, or one of said sets of members set in accordance with factors or products, and a slide controlling said feelers.

5. In a calculating machine for performing addition, subtraction, multiplication and division, key controlled set up means and sets of members set in accordance with the factors or products of computation, a printing mechanism and a totalizer co-operating therewith to accumulate items printed, said printing mechanism comprising printing members and a movable paper carriage, controlling means for said printing members comprising setting-up bars, adjustable swinging feelers mounted on said setting-up bars, key-actuated feeler bars, the said feelers being selectively positioned to set up the printing mechanism in accordance with either the setting of the key controlled set up means, or one of said sets of members set in accordance with the factors or products; a comb-like slide member through recesses in which said swinging feelers pass so that by displacement of said slide member in an axial direction said feelers are simultaneously displaced, and means co-operating with said carriage to control said comb-like slide, comprising a guide bar fixed to said carriage, riders on said guide bar, a vertical rod positioned so as to be moved downwards by said riders during the motion of said carriage, a horizontal shaft operatively connected to said rod so as to be rotated by the movement of said rod, and a bell crank lever co-operating with said shaft and said comb-like slide to control the latter.

Signed at Leipzig, Germany, this 31st day of July, 1929.

HUGO CORDT.