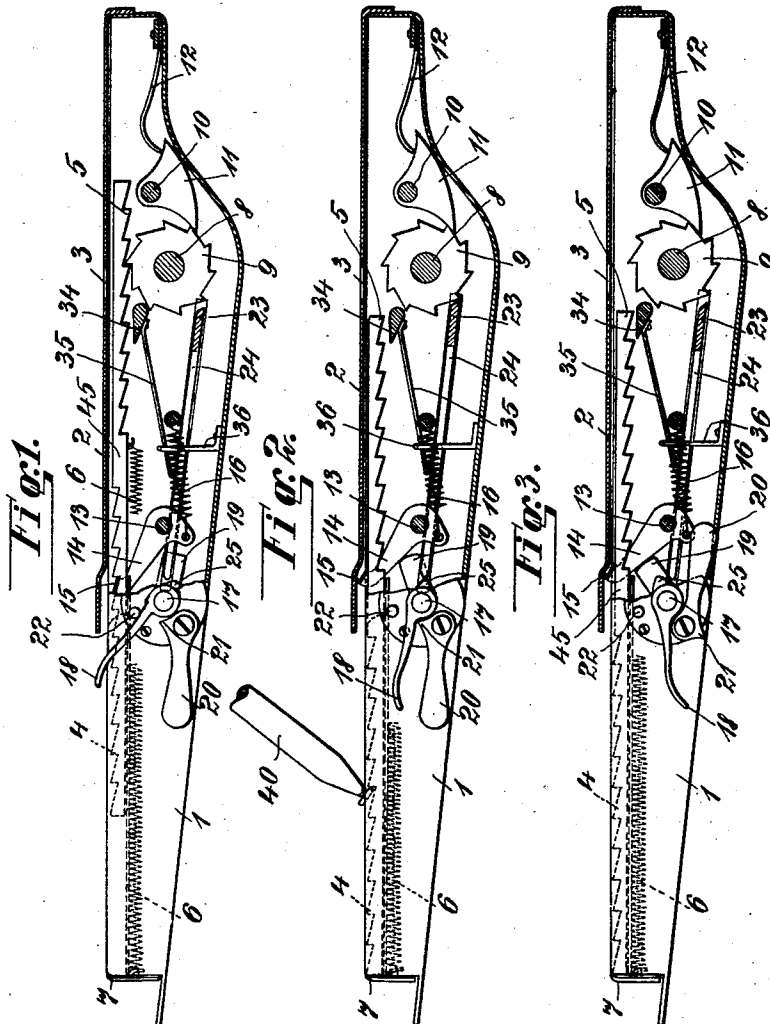


W. R. HEINITZ.
 CALCULATING MACHINE.
 APPLICATION FILED JAN. 10, 1910.

1,020,200.

Patented Mar. 12, 1912.

3 SHEETS—SHEET 1.



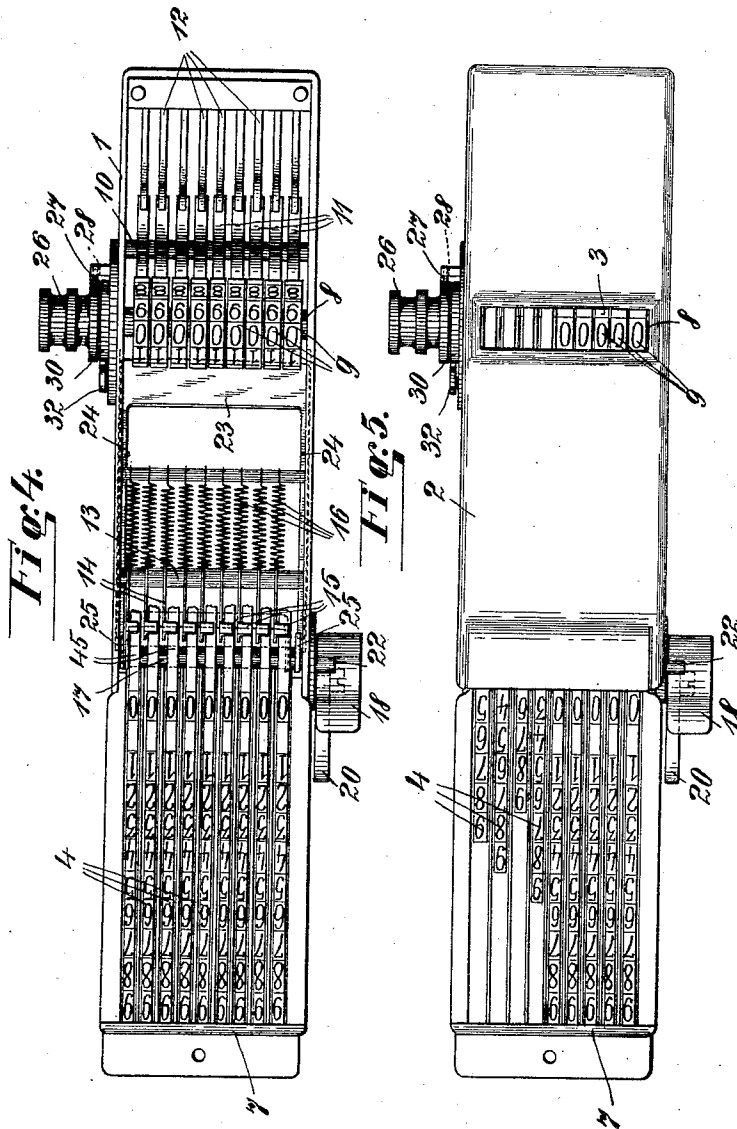
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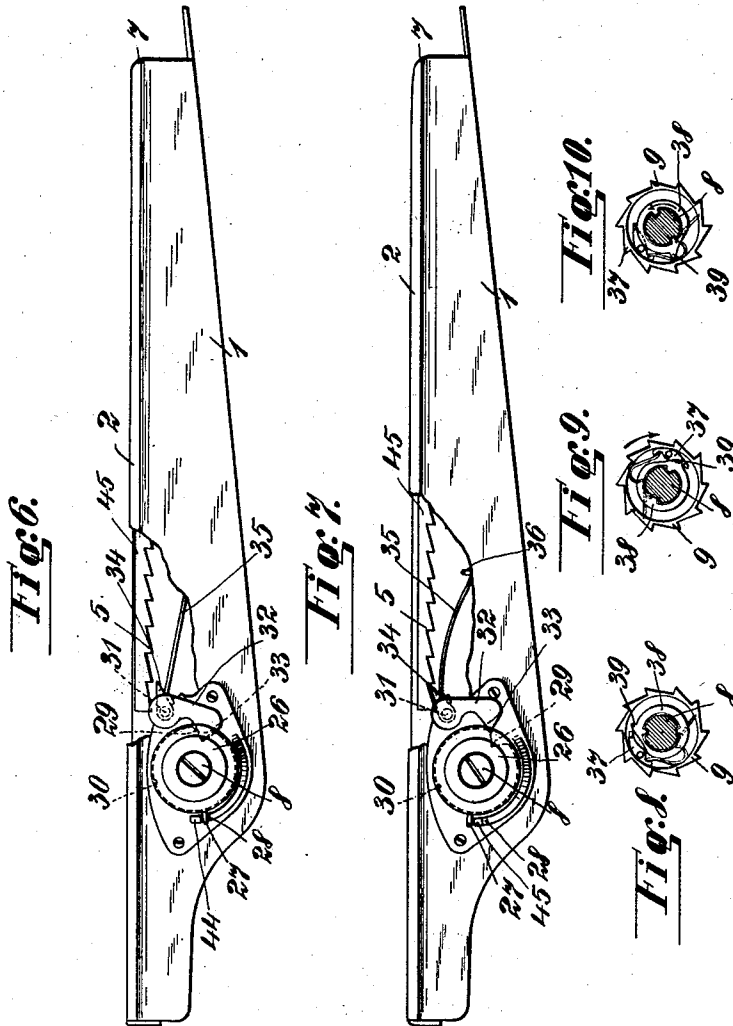
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UNITED STATES PATENT OFFICE.

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CALCULATING-MACHINE.

1,020,200.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WOLDEMAR REINHOLD HEINITZ, a citizen of the German Empire, residing at Chemnitz, in the State of Saxony, in the German Empire, have invented certain new and useful Improvements in Calculating-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in calculating machines which are particularly designed for performing additions and subtractions, but which may also be used for performing other calculations.

The improvements are particularly designed for embodiment in calculating machines of that class in which the values are transmitted to the registering mechanism by means of shiftable toothed racks, chains, or the like. And one of the objects of the improvements is to provide a machine of this class in which the setting elements may either be separately retracted into their normal positions, or simultaneously and after setting thereon the whole number to be registered, so that the said number can be examined by the operator.

A further object of the improvements is to provide locking means for the numeral wheels which are automatically thrown into action, as soon as the previously locked setting elements are retracted into their zero or normal positions, so that a second registration by the setting elements caused by the recoil of the latter is avoided. And finally my invention consists in so constructing the resetting mechanism, that the latter must be regularly operated before further calculations can be performed.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawings in which the same letters of references have been used in all the views to indicate corresponding parts.

In said drawings—Figure 1, is a side view partly in section of the machine showing the elements of the calculating mechanism in the position in which a number has been registered on the numeral wheels, the setting ele-

ments being in their locked positions, Fig. 2, is a similar side view partly in section of the machine the setting elements being shown in their unlocked positions and after having returned to their zero or normal positions, Fig. 3, is a similar side view partly in section, the elements of the calculating mechanism being shown in the position for performing multiplications. Fig. 4, is a top view of the machine with the cover removed, the elements of the calculating mechanism being shown in their zero or normal positions, Fig. 5, is a similar top view of the machine with the cover in its position, some of the setting elements of the calculating mechanism being shown in their zero positions and others in their set positions, Fig. 6, is a side view of the machine, partly in section and illustrating the mechanism for enforcing a resetting of the machine after each operation, the said mechanism being shown in its inoperative position, Fig. 7, is a similar side view showing the mechanism shown in Fig. 6 in its operative position, and Figs. 8 to 10, are side views of a detail of the machine, and illustrating the resetting mechanism.

Referring to the example illustrated in the drawings, the calculating mechanism is inclosed within a casing 1 the open top of which is about half closed by a cover or lid 2. The latter is provided with a transverse slit 3 which is preferably covered by a plate of transparent material. Within the casing and cover the whole breadth of the same longitudinally slidable setting racks 45 are located one beside the other. At their upper sides the said racks are formed with nine ratchet teeth 4 successively provided with numerical characters from "1" to "9". The teeth 4 are located within the uncovered part of the casing. At the parts which extend below the cover of the casing the said racks are formed at their under sides with nine ratchet teeth 5 which are similar in construction to the teeth 4. The racks are connected to springs 6 which with their opposite ends are secured to the upper part of the transverse front wall 7 of the casing 1, so that the racks bear with their forward ends against the wall 7. Below the slit 3 a shaft 8 is located upon which a plurality of numeral

wheels 9 are loosely located which are constructed in the form of ratchet disks. The ratchet teeth of said wheels are provided with the numerical characters from "1" to "9" and the "0" sign. At the rear of the shaft 8 there is a transverse shaft 10 carrying pawls 11 one for each of the wheels 9. Springs 12 have the tendency to force the said pawls into engagement with the ratchet teeth of the disks 9.

Extending transversely of the machine a shaft 13 is mounted in the side walls of the casing which provides a support for a plurality of pawls 14 extending to a part of the casing above the racks 45. Springs 16 have the tendency to force laterally projecting fingers 15 of the said pawls into engagement with the ratchet teeth 4. Near the shaft 13 a transverse shaft 17 is located which at its end projecting outside the casing has a lever 18 secured thereto. Within the casing levers 19 are secured to the shaft 17 and the number of the said levers corresponds to that of the racks 45 and pawls 14. Below the lever 18 a second lever 20 is located the hub of which is formed with a nose 21. The lever 20 has the function to limit the downward rocking movement of the lever 18. The upward rocking movement is limited by a pin 22 providing an abutment for the said lever.

Between the shafts 8 and 17 a U-shaped slide is located within the casing. The cross bar 23 of the side slide extends in front of the ratchet disks 9, and its side members 24 are located in suitable guideways formed on the side walls of the casing 1, and they extend into the path of lugs 25 secured to or integral with the shaft 17.

At one of its ends the shaft 8 extends through the side wall of the casing 1 and to the outside of the same, and it is provided at this end with a laterally movable nut 26 whereby it may be turned. From the said nut a pin 27 projects laterally which engages on a cam face 28 providing a support for the same. The said cam is sloping in one direction toward the wall of the casing, and at its opposite end it provides an abutment for the pin 27.

Outside the casing 1 a disk 30 is keyed to the shaft 8 which is formed with a notch 29. To a shaft 31 a rocker 32 is secured the nose 33 of which is normally in engagement with the notch 29. Within the casing and adjacent to the ratchet teeth 5 the shaft 31 is provided with a plurality of pawls 34 having springs 35 secured thereto. The ends of the said springs project below a bridge 36. While the nose 33 of the rocker 32 engages in the notch 29, the pawls 34 are out of the path of the ratchet teeth 5.

The numeral wheels 9 are formed with annular grooves and within the said grooves spring actuated pawls 37 are located. Be-

tween the numeral wheels, disks 38 are situated which are formed with noses 39. The disks take part in the rotation of the shaft 8.

For moving the racks 45 any edged or pointed tool 40, such for example as a pencil, may be used. Preferably a suitably shaped pin, sleeve, or the like is supplied with the machine.

The operation of the machine is as follows: Figs. 1 and 2 show the parts in the position in which additions are being performed. In my improved machine means are provided whereby the racks are locked in their set positions, so that when adding numbers of a plurality of figures the number set on the racks can be examined before the setting elements are retracted into their zero positions. In the position of the lever 20 shown in Figs. 1 and 2, in which the nose 21 is directed upward, the downward rocking movement of the lever 18 is limited by the said nose. If now a pencil 40 or the like is set in engagement with the ratchet tooth 4 representing the number to be set, and shifted until it is arrested by the cover 2, the pawls 14 are rocked by the ratchet teeth 4. When the rack has thus been shifted and the pencil is removed, the pawl remains in engagement with the tooth which has now arrived in position below the same, because the ratchet teeth are formed with abrupt front faces, and the pawl is held in engagement with the said tooth by the spring 12. The spring 6 of the rack is held under tension. While the rack 45 is thus being shifted, the lower ratchet teeth 5 engage in the ratchet teeth of the numeral wheel 9, whereby the latter is turned so many units as correspond to the desired number. In the same way, all the figures of a number desired to be registered are set on the racks 45, and at the end of such setting operation the whole number appears in front of the margin of the cover 2, so that it can be examined, as appears from Fig. 5, where the number 3645 has been set. As shown in Fig. 1, in this position of the lever 18 the lugs 25 are out of the path of the side members 24 of the slide, so that the cross bar 23 of the latter does not interfere with the movement of the wheels 9. In order to reset the setting elements into their normal positions, the lever 18 is pressed upon, so as to rock the same into the position shown in Fig. 2. By the said movement the arms 19 rock the levers 14 upward and lift the fingers 15 out of engagement with the ratchet teeth 4, so that the springs 6 can retract the racks into their normal positions. The levers 14 are under the influence of the springs 16. When therefore the lever 18 is released, the said springs rock the arms 19 downward and thereby move the lever 18 into its normal position shown in Fig. 1, so that when setting the

next number the racks are first locked and afterward released by means of the said lever.

Particularly when setting numbers of high values which cause the springs 6 to be considerably extended, the racks are thrown by the said springs against the transverse wall of the casing with considerable force, and they are sometimes thrown backward by their recoil to such an extent, that the ratchet teeth 5 act on the cooperating numeral wheel 9 a second time. To render this impossible, the following means are provided. As soon as the lever 18 arrives in the position shown in Fig. 2 in which the racks are about to be released, the noses 25 are rocked in front of the ends of the lateral members of the slide and force the cross bar 23 into engagement with the teeth of the wheels 9. Thereby the said wheels are locked, so that they can not be shifted when again engaged by the ratchet teeth 5. Therefore the recoil of the racks 45 causes no displacement of the numeral wheels 9. When performing additions all the racks 45 which have previously been set are retracted into their zero positions when the lever 18 is depressed. As soon as the lever 18 is released and rocked into its elevated position, the finger 15 of the locking pawl 14 for the setting elements is again in operative position, and the slide 23, 24 is again released, so that the wheels 9 can be set. Obviously it is immaterial whether the stroke of the slide is limited directly or indirectly by levers. But it is of importance, that the wheels 9 are locked when the racks are thrown against the front wall of the casing.

In Fig. 3 I have shown the parts in the positions for performing multiplications. As shown the lever 20 is turned at an angle of about 180 degrees. Thereby the lever 18 can be rocked at a larger angle, and it can therefore be set in the position shown in which the arms 19 provide abutments for the levers 14 to prevent the latter from being retracted by the springs 16. Thereby the fingers 15 of the pawls 14 are rocked out of engagement with the ratchet teeth 4, so that the racks 45 have an unobstructed reciprocating movement. As in performing multiplications each number must usually be set several times in a single calculation, the locking and releasing operations would cause an objectionable delay. However, it is not of importance to examine each number set by the racks 40. The calculation is performed in such a way, that when performing for example the calculation 34×9568 the figure 8 is first set four times on the first rack 45 from the right, thereupon the decimal 6 on the second rack, etc., whereupon the same figures are set three times on the racks 45 beginning with the rack representing the decimals, that is the

second rack from the right. When in performing a multiplication a number is set, the pencil 41 remains in engagement with its tooth 4 to enable the setting operation to be easily repeated, as required. Thereby the setting racks are also held by the pencil when being retracted by the springs 6, so that they can not be thrown backward by recoil and thereby cause erroneous calculations. By rocking the lever 18 in the manner described the lugs 25 are rocked out of the path of the slide members 24, and they are located above the said members.

In order to reset the numeral wheels 9 at the end of a calculation the shaft 8 is turned by its nut 26. As the pin 27 rests within the notch 28, the nut 26 must first be shifted laterally, whereupon the shaft can be rotated until the pin 27 strikes against the abutment 44 provided at the end of the cam face 28. By such rotation the numeral wheels which are not in their zero positions are carried along by the noses 39 of the disks 38, because the said noses engage at the rear of the pawls 37.

In Fig. 8 I have shown the parts in their zero positions. Upon rotation of a numeral wheel the pawl 37 is rocked by the cooperating nose 39. If the shaft 8 is afterward rotated together with the disk 38, the noses 39 carry along the pawls 37 and through the latter the numeral wheels, until the rotation is completed by the pin 27 striking against its abutment 44. In order to effect a new resetting operation at the end of a calculation, the shaft 8 must be turned backward, until the pin 27 falls into the notch 28. Thereby the nose 39 is moved into its normal position.

In order to render a second calculating operation impossible before first resetting the machine, I provide mechanism as follows: When the shaft 8 is in its correct position, that is, when the pin 27 engages in the notch 28, the nose 33 of the rocker 32 engages in the notch 29 of the disk 30. In this position of the parts the noses 34 are out of the paths of the ratchet teeth 5. If for the purpose of resetting the numeral wheels, the shaft 8 is rotated, the disk 30 is carried along, so that the nose 33 is forced out of the notch 29. Thereby the pawls 34 are free to engage the ratchet teeth 5. When after turning the shaft 8 into the position in which the pin 27 strikes against the abutment 44, the operator should forget to turn the shaft backward, the racks 45 can not be shifted. Thereby the attention of the operator is called to the fact that he has omitted to turn the shaft 8 backward. After the pin 27 has fallen into the notch 28 the nose 33 of the rocker 32 engages again in the notch 29, so that the pawls 34 are again retracted out of the path of the ratchet teeth 5, and the racks 45 can be shifted longitudinally.

The springs 35 secured to the pawls 34 are set under tension when the rocker 32 is rocked out of engagement with the notch 29, so that they can afterward push the said
5 rocker into its normal position.

I claim:

1. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the
10 setting operation of the setting elements, of automatic means to lock the setting elements in set position, and hand actuated means adapted upon operation by the hand of the operator to throw said locking means out of
15 operation.

2. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the setting operation of the setting elements, of
20 spring actuated members adapted to lock the setting elements in set position, a rock shaft, arms on said rock shaft adapted to throw said members out of locking position, and a hand piece secured to said rock shaft and
25 adapted when operated by the hand of the operator to rock said rock shaft and arms into position for throwing the locking members out of locking position.

3. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the setting operation of the setting elements, of
30 automatic means to lock the setting elements in set position, and means adapted to be operated before setting said setting elements to lock said locking means in inoperative position.

4. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the setting operation of the setting elements, of
40 automatic means to lock the setting elements in set position, means to throw said locking means out of operation, and normally inoperative means to lock said throwing means in operative position.

5. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the
50 setting operation of the setting elements, of rocking levers one for each of said setting elements adapted to lock said setting elements in set position, means to normally hold said levers in locking position, and
55 means adapted to be operated before setting said setting elements set to said rocking levers in non-locking position.

6. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the setting operation of the setting elements, of
60 rocking levers one for each of said setting elements adapted to lock said setting elements in set position, means to normally

hold said levers in locking position, a rock
shaft, and cams on said rock shaft adapted when rocking said shaft to throw said locking levers in non-locking position.

7. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the setting operation of the setting elements, of rocking levers one for each of
70 said setting elements adapted to lock said setting elements in set position, means to normally hold said levers in locking position, a rock shaft having two rocked positions, cams on said rock shaft adapted when rocking said rock shaft to throw said locking levers into inoperative position, and
80 means operative when said rock shaft has been rocked into one of its rocked positions to lock the rock shaft.

8. In a calculating machine, the combination with the setting elements, and registering elements adapted to be operated by the setting operation of the setting elements, of rocking levers one for each of
85 said setting elements adapted to lock said setting elements in set position, means to normally hold said levers in locking position, a rock shaft provided with a handle, a rocking lever having a cam shaped hub adapted to stop said handle in different
90 positions, cams on said rock shaft adapted when rocking said shaft to throw said locking levers out of operation, and means operative when the rock shaft has been rocked into one of its rocked positions to lock the
95 rock shaft.

9. In a calculating machine, the combination with the setting elements, and the registering elements adapted to be operated by the setting operation of the setting elements, of locking means for the registering
100 elements and means to throw said locking means into locking position.

10. In a calculating machine, the combination with the setting elements, and the registering elements adapted to be operated
110 by the setting operation of the setting elements, of locking means for the setting elements, means to throw said locking means out of operation, locking means for the registering elements, and automatic means to
115 throw said locking means for the registering elements into locking position upon the release of the locking means of the setting elements.

11. In a calculating machine, the combination with the setting elements, and the registering elements adapted to be operated by the setting operation of the setting elements, of locking means for the setting elements, a slide adapted to be shifted into
120 locking engagement with said registering elements, a rock shaft, and simultaneously acting means on said rock shaft to throw

said locking means for the setting elements out of operation and to shift said slide into locking position.

12. In a calculating machine the combination with the setting elements, the registering elements adapted to be operated by the setting operation of the setting elements, and resetting mechanism for said registering elements, of normally inoperative locking means adapted to prevent the operation of said setting elements, and means actuated by and inoperative at the end of the resetting operation to render said locking means operative.

13. In a calculating machine the combination with the setting elements, and the registering elements adapted to be operated by the setting operation of the setting ele-

ments, of normally inoperative locking means adapted to prevent the operation of said setting elements, a resetting shaft carrying said registering elements, resetting devices on said shaft operated by rotation of said shaft, a disk secured to said shaft and having a notch at its circumference, a rocker engaging said notch in the normal position of said resetting shaft and adapted when rocked to throw said locking means into locking position.

The foregoing specification signed at Chemnitz this 24th day of December 1909.

WOLDEMAR REINHOLD HEINITZ.

In presence of—

WILLIAM J. KOUJETKNY,
W. W. BRUNSWICK.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."