

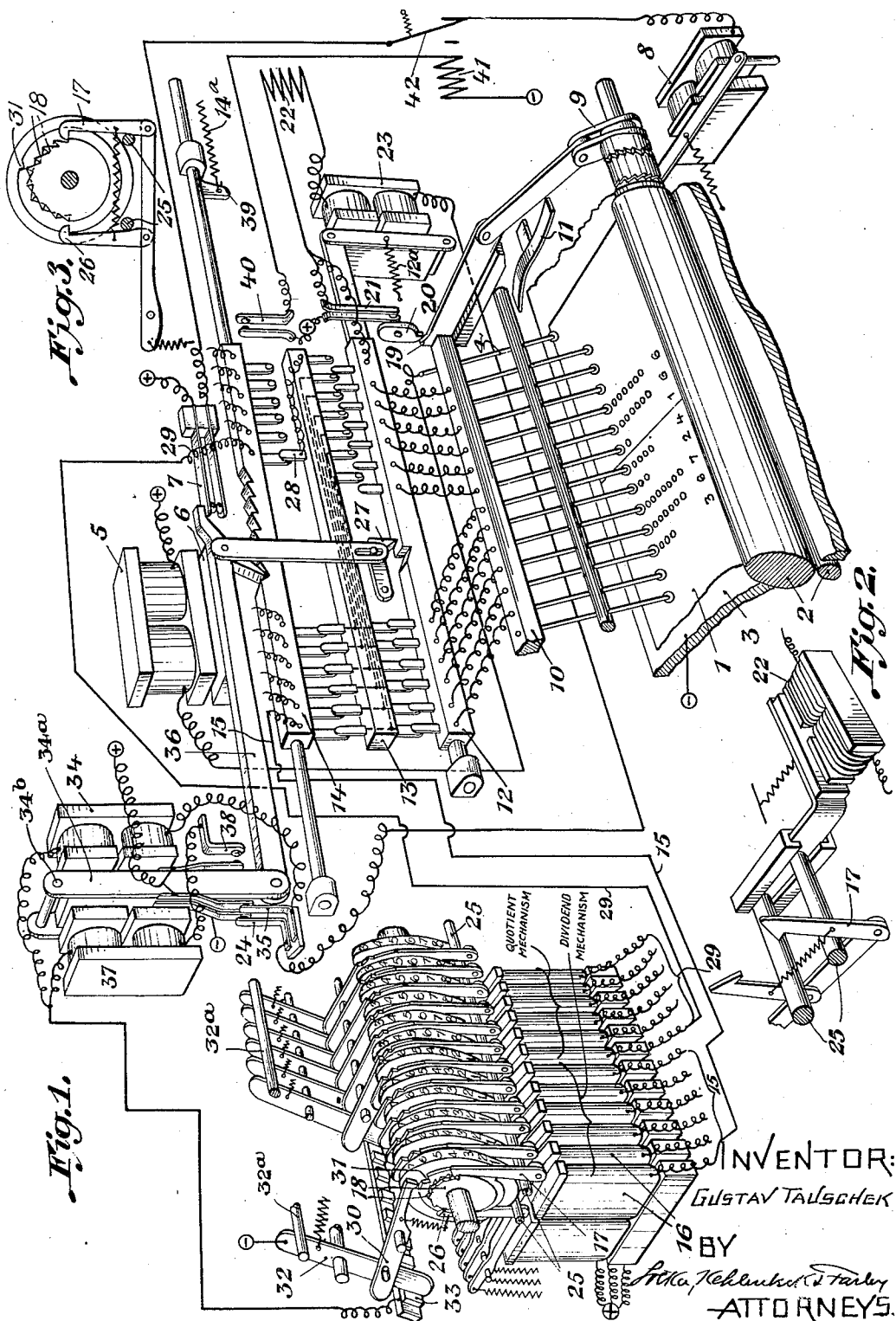
Oct. 31, 1933.

G. TAUSCHEK

1,933,352

MACHINE FOR CALCULATIVELY INTERPRETING PERFORATED CARDS

Original Filed March 1, 1928



UNITED STATES PATENT OFFICE

1,933,352

MACHINE FOR CALCULATIVELY INTER-
PRETING PERFORATED CARDS

Gustav Tauschek, Vienna, Austria, assignor, by
mesne assignments, to International Business
Machines Corporation, New York, N. Y., a cor-
poration of New York

Application March 1, 1928, Serial No. 258,240, and
in Austria May 18, 1927. Renewed May 13,
1931

27 Claims. (Cl. 235—92)

My invention relates to machines for calcula-
tively interpreting perforated cards and has in
particular reference to a device adapted to be
used in connection with such machines by which
it is possible, for instance, to use the interpret-
ing machines, employed at present only for tabu-
lating the statements contained in the perfor-
ated cards with simultaneous addition and sub-
traction of the number values, for carrying out
a division without altering the counting mecha-
nisms. For the device forming the subject mat-
ter of the invention it does not matter whether
the statements are arranged in the card in such
a manner that the number of holes following
each other in a vertical row corresponds to the
digit value of the number to be represented, or
whether the number is represented by a single
hole or a plurality of holes provided at a cer-
tain place of the line to be sensed.

The practical value of the invention is at once
evident if it is considered, that in many book-
keeping and account statements represented in
perforated cards items for division are contained
which, up to now, were to be calculated not by
the interpreting machine, but by human agency,
if necessary by means of a calculating machine
operated by hand. These disadvantages are over-
come by the present invention.

The present invention is of utility for exam-
ple, in those instances in which a card is de-
signed for representing the purchase of values
or devices in banking transactions by which the
purchaser wants for a certain amount, for in-
stance, for 1000 marks, a corresponding amount
in Austrian shillings, and if the exchange of the
shilling is 0.59 mark, the division 1000:0.59 gives
the shilling amount of 1695. Also other busi-
ness affairs, particularly, however, statistical
statements of uniform or average capacities,
necessitate divisions based upon the statements
represented in the perforated cards. Certain
features of the present invention are claimed in
the copending application of applicant Serial
No. 267,730, filed April 5, 1928.

In the accompanying drawing, a machine ac-
cording to the invention is shown diagramma-
tically by way of example, Fig. 1 showing dia-
grammatically a perspective view of the machine,
Fig. 2 being a view of a detail also in perspec-
tive and Fig. 3 is a view of a detail in side eleva-
tion. In the example selected the holes in the
perforated card represent a number 36724 which
is to be divided by 166.

The operation of the device is as follows:

By means of feeding rollers 2 the perforated

card 1 is brought upon an electrically conduct-
ing surface 3 and advanced until a feeler 4 abuts
against the edge of the card. Hereby the con-
tact between the feeler 4 and the surface 3 is
interrupted and a circuit across the magnet 5 is
opened. The armature 6 of the magnet 5 drops
and closes a circuit across the contact 7 to a
magnet 8 which switches the drive of the feed
rollers 2 upon a crank 9, so that the card comes
to rest, whereas the feelers arranged upon a
common yoke 10 start to oscillate. A resilient
guide 11 controls the movement of the feelers
in such a manner that they are lifted from the
card during the forward movement, but slide
upon the card during the return movement.

The feelers are arranged in two groups one of
which serves for sensing the dividend and the
other for sensing the divisor represented in the
card. Both groups of feelers may be connected,
by way of contact pieces arranged upon three
bars 12, 13 and 14, to the junction cables 15
which lead to the corresponding magnets 16 of
the counting mechanisms.

The bar 13 is fixed, whereas the bars 12 and 14
are movable. The position of the contact pieces
upon the bar 12 is such that, according to the
position of the bar, the feelers of the dividend
group only or the feelers of the divisor group
only are connected to the counting mechanism.

The original position of the bar 12 is shown in
the drawing. In this position the dividend group
is connected to the counting mechanism. If now
the feelers during their return oscillation slide
upon the card they will contact with the surface
3 at the points at which holes are present and
cause current impulses which energize the cor-
responding magnets 16. These magnets in turn
feed, by means of pawls 17 and ratchet wheels
18, the corresponding number wheels one unit
for every perforation present in the correspond-
ing column in the card, so that, when the feelers
have completed their oscillation, the dividend
represented in the card is registered in the count-
ing mechanism. Any suitable means such as a
brake may be utilized to hold the number wheels
in their position of adjustment.

In the last phase, before completion of the
oscillation, a nose 19 of the feeler yoke strikes
against a stop 20 and temporarily closes a con-
tact 21 and thereby a circuit across the magnet
22, (shown diagrammatically in Fig. 1 and in per-
spective in Fig. 2) the magnet 23 and the contact
24. By means of the mechanism shown in Fig. 2,
including the system of rods 25, the magnet 22
causes disengagement of the pawls 17 and en-

5
10
15
20
25
30
35
40
45
50
55

60
65
70
75
80
85
90
95
100
105
110

gagement of the pawls 26 which operate in opposite sense. The magnet 23 causes a displacement of the bar 12 in such a manner that the contacts of the dividend group are opened and those of the divisor group are closed. In this position the bar 12 is held by a pawl 27. This displacement of the bar 12 also closes a circuit around the contacts 21 and through the contact spring 28 to the connecting cable 29 of the highest denomination of the magnets of the quotient counting mechanism. After the next oscillation of the feeler group, the dividend registered in the counting mechanism is reduced as follows:

15 36724
 -166

 20124

During the next oscillation the process is repeated:

20 20124
 -166

 3524

25 At the next following oscillation the amount to be subtracted will exceed the registered value:

 3524
 -166

30 86924

Therefore in the highest denomination the number 8 will be shown in the counting mechanism, the number wheel has turned from 1 through 0 and 9 to 8, whereupon the pawl 30, usually serving for the tens transfer, drops temporarily into the depression 31 of the number wheel and releases a lever 32 which now in contact with the contact plate 33 closes a circuit for a short current impulse across the magnet 34 and the contact 35. The pawl 30 may be connected with its lever 32 by a pin and cam slot connection, the slot being so formed that when the rear end of the pawl is raised as its forward end enters the depression 31, the lever 32 oscillates in clockwise fashion as viewed in Fig. 1 under the action of the spring connected to the lever 32. When the forward end of the pawl 30 rises, the lever 32 is returned by a bar 32a whereupon the pin is shifted to the end of the cam slot it normally occupies. Instead of the above described mechanism the transfer mechanism disclosed in detail in the British Patent 289,055 may be used for the dividend counter. Upon closure of the circuit by the lever 32 as just described, the magnet 34, through its armature 34a which is pivoted at its upper end at 34b, shifts the pawl bar 36, so that it drops behind the next following tooth of the bar 14. Simultaneously the contacts 24 and 35 are opened. As on account of the opening of the contact 24 the circuit of the magnet 22 cannot be closed, the rods 25 will at the next oscillation of the feeler group be in the position of addition and the amount of the divisor is added again.

 86924
 +166

70 03524

Hereby the tens transfer pawl 30 is engaged again and the lever 32 now closes a circuit across the magnet 37 and the contact 38, whereby the pawl-bar 36 is so actuated, that it feeds the bar

14 for one tooth. Now the contact springs of the bar 13 engage with the contact springs of the bar 14 belonging to the corresponding next lower denominations of the counting mechanism. Any suitable means, such as a pawl, may be provided for holding the bar 14 in successively shifted position whereby when disengaged at the end of machine operation bar 14 may be restored by spring 14a. The operation of subtraction starts again until at the highest denomination the tens transfer is effected, whereupon an addition is again carried out and so on.

For each oscillation of the divisor feeler group occurring after the setting up of the dividend, or after the magnet 23 has shifted the bar 12 to secure a succeeding quotient digit, contacts 21 are closed, so that an electrical impulse is directed by the contact spring 28 and a wire 29 to the related magnet of the quotient digit representing mechanism.

The operating mechanisms for the dividend counter wheels and the quotient counter wheels are alike but it should be noted that the numerals on the quotient counter wheels and the dividend counter wheels are reversed.

The adding pawls 17 of the dividend counter wheels turn said wheels clockwise to represent at the reading line the amount of the dividend.

When successive negative registrations are effected pawls 26 turn the wheels of the dividend counter counterclockwise so as to reduce the amount of the dividend. At this time the pawls 26 of the quotient counter are also active but in view of the reverse numbering of the wheels of the quotient counter, with respect to the dividend counter wheels, the selected quotient digit representing wheel is turned one or more steps from zero counterclockwise to indicate the number of successive registrations necessary to secure an overdraft.

When pawls 17 are subsequently active to restore the dividend counter to a positive condition the pawl 17 of the quotient digit representing wheel previously operated will turn the related wheel clockwise or backwardly one step thereby reducing the previous reading by a unit, so as to indicate the true quotient digit.

Obviously, if the first negative registration produces an overdraft the selected quotient wheel will represent "1", and then be turned backwardly to represent the initial reading or "0" when the dividend counter is restored to a positive condition. Hence a zero is exhibited by the quotient wheel under such circumstances.

If all denominations are sensed, the nose 39 on the bar 14 closes, upon the now occurring lifting movement of the pawl 36, a contact 40 and thereby a circuit across a diagrammatically shown magnet 41 which in turn deenergizes the magnet 8 by opening a contact 42. The drive is switched over again to the feed rollers 2, so that the card starts to move forward; whereas the oscillation of the feelers is stopped. If the edge of the card has passed the feeler 4, the circuit of the magnet 5 is closed and the pawls 36 and 27 are lifted, whereby the bars 12 and 14 return under the action of springs 12a and 14a into the original position.

What I claim is:

1. In a machine for calculatively interpreting perforated cards, in combination, feelers for sensing the holes in the perforated cards, actuating mechanism for oscillating said feelers over a card, and means operable during the repeated oscillations of said feelers for carrying

out a division of the number values registered in the cards.

2. In a machine for calculatively interpreting perforated cards, in combination, feelers for sensing the holes in the perforated cards, means for carrying out a division of the number values registered in the cards and means for holding the perforated card to be interpreted in co-operation with the feelers during the time the division is carried out.

3. In a machine for calculatively interpreting perforated cards and including a counting mechanism, in combination, feelers for sensing the holes in the perforated cards, magnets associated with the number wheels of the counting mechanism, and means for carrying out a division of the number values registered in the cards, said means comprising contact points electrically connected to said feelers, other contact points electrically connected to said magnets, and means for mutually shifting the contact points connected to the feelers and to the magnets respectively in a manner corresponding to the nature of the division.

4. In a machine for calculatively interpreting perforated cards and including a counting mechanism, in combination, feelers for sensing the holes in the perforated cards, magnets associated with the number wheels of the counting mechanism, means for carrying out a division of the number values registered in the cards, said means comprising contact points electrically connected to said feelers, other contact points electrically connected to said magnets, and means for mutually shifting the contact points connected to the feelers and to the magnets respectively in a manner corresponding to the nature of the division; card feeding mechanism and feeler oscillating mechanism associated with said feelers, and a feeler contact operative, when abutting against the edge of a card, to cause the card feeding device to come to rest and the feeler oscillating mechanism to be set into motion to sweep the feelers over the perforated card.

5. In a machine for calculatively interpreting perforated cards and including a counting mechanism, in combination, feelers for sensing the holes in the perforated cards, magnets associated with the number wheels of the counting mechanism, means for carrying out a division of the number values registered in the cards, said means comprising contact points electrically connected to said feelers, other contact points electrically connected to said magnets, and means for mutually shifting the contact points connected to the feelers and to the magnets respectively in a manner corresponding to the nature of the division; card feeding mechanism and feeler oscillating mechanism associated with said feelers, a feeler contact operative, when abutting against the edge of a card, to cause the card feeding device to come to rest and the feeler oscillating mechanism to be set into motion to sweep the feelers over the perforated card, and a guiding device for said feelers to cause the same to slide over the card in one direction only and to be lifted during the return oscillation.

6. In a machine for calculatively interpreting perforated cards and including a counting mechanism, in combination, feelers for sensing the holes in the perforated cards, magnets associated with the number wheels of the counting mechanism, means for carrying out a division of

the number values registered in the cards, said means comprising contact points electrically connected to said feelers, other contact points electrically connected to said magnets, and means for mutually shifting the contact points connected to the feelers and to the magnets respectively in a manner corresponding to the nature of the division; card feeding mechanism and feeler oscillating mechanism associated with said feelers, a feeler contact operative, when abutting against the edge of a card, to cause the card feeding device to come to rest and the feeler oscillating mechanism to be set into motion to sweep the feelers over the perforated card, means for introducing the dividend into the counting mechanism during the first oscillation of the feelers, and means for switching over to subtraction of the divisor, when the oscillation of the feelers is completed.

7. In a machine for calculatively interpreting perforated cards and including a counting mechanism, in combination, feelers for sensing the holes in the perforated cards, magnets associated with the number wheels of the counting mechanism, means for carrying out a division of the number values registered in the cards, said means comprising contact points electrically connected to said feelers, other contact points electrically connected to said magnets, and means for mutually shifting the contact points connected to the feelers and to the magnets respectively in a manner corresponding to the nature of the division; card feeding mechanism and feeler oscillating mechanism associated with said feelers, a feeler contact operative, when abutting against the edge of a card, to cause the card feeding device to come to rest and the feeler oscillating mechanism to be set into motion to sweep the feelers over the perforated card, means for introducing the dividend into the counting mechanism during the first oscillation of the feelers, means for switching over to subtraction of the divisor when the oscillation of the feelers is completed, means for closing a contact, when a wheel of the counting mechanism turns from 1 through 0 to 9, said contact operative to switch the counting mechanism to addition, and means for switching again to subtraction and for simultaneously switching the next lower denomination of the quotient counting mechanism, when the wheel of the counting mechanism turns from 9 through 0 to 1.

8. The combination in a record controlled machine, of record controlled devices for setting up a dividend, devices for analyzing designations of a record representing a divisor, and means effective upon setting up a dividend for carrying out the operation of division of said dividend and divisor and indicating the quotient.

9. The combination in an accounting machine, of devices settable to represent a dividend, devices for analyzing designations of a record representing a divisor, and means adapted when once put into operation to automatically carry out under control of both of said devices the operation of division and register the result thereof whether the quotient comprises one or more digits.

10. In a record controlled dividing machine, devices for initially analyzing designations of a record to enter a dividend in a totalizer, devices for analyzing designations of a record representing a divisor, and means adapted when once placed in operation for automatically effecting under control of the divisor analyzing devices the operation of division regulated by the condition

of the dividend totalizer, and to register the quotient.

11. In a record controlled machine, the combination of record controlled means for setting up a dividend, devices for analyzing designations of a record representing a divisor, and means automatically effective upon setting up the dividend for effecting under control of said devices the operation of division and indicating the quotient.

12. In a record controlled machine, the combination of record controlled means for setting up a dividend, a quotient indicator, and means under control of a record representing a divisor for automatically effecting the operation of division and operating said indicator to indicate the quotient.

13. In a record controlled machine, the combination of record controlled devices for setting up a dividend in a totalizer, a quotient counter, and means adapted upon setting up of the dividend to automatically effect under control of a record representing a divisor the operation of division and to indicate the result on said counter.

14. In a record controlled machine, the combination of record controlled devices for setting up a dividend in a totalizer, and a dividing mechanism operated when said dividend is set up and including mechanism for effecting successive analysis of a record representing a divisor to effect the operation of division of the dividend and the divisor.

15. In a record controlled machine, means for effecting a positive registration in a dividend totalizer under control of a perforated record, means for effecting one or more negative registrations of a divisor under control of a perforated card, and a quotient indicator for representing the number of negative registrations effected prior to the negative registration that effects a negative condition of said totalizer.

16. In a record controlled machine, means for analyzing a record to effect an entry in a dividend totalizer, means for successively analyzing the divisor factor perforations of a record and effecting one or more subtractions from said dividend of said divisor so that a negative condition of said totalizer occurs, and a quotient indicator operable to represent the number of subtraction operations effected prior to the subtraction operation that causes a negative condition of said totalizer.

17. In a record controlled machine, means for analyzing a perforated record for effecting a positive registration in a dividend totalizer, means automatically set in operation as a sequence to said positive registration to effect one or more negative registrations of the divisor represented by a perforated record, and a quotient indicator operable to represent in one order the number of negative registrations effected prior to the negative registration that effects a negative condition of the totalizer.

18. In a record controlled machine, means for analyzing a record for effecting a registration in an additive sense in a totalizer to represent a dividend, means automatically set in operation for effecting one or more negative registrations of a value represented by a perforated record, and a quotient representing device operable in a positive direction to count the number of negative registrations and in a negative direction when said totalizer is operated to represent a positive condition, to thereby indicate a digit of the true quotient.

19. In a record controlled machine, means for

analyzing a record for entering a dividend amount in a dividend totalizer, devices for effecting division by reducing one or more times the amount on said totalizer by the value of a divisor prior to changing the denominational relationship between said devices and said dividend totalizer, a quotient indicator for indicating the number of times reduction is effected to bring the totalizer to an overdraft condition, and means for thereafter correcting said indicator to indicate a true quotient digit.

20. In a record controlled machine, a dividend totalizer, a record controlled overdraft determining device for designating an overdraft condition of the totalizer effected by one or repeated record controlled subtractions of a divisor from the dividend, means operated as a result of each subtraction operation for deriving a quotient figure, and means for correcting the result to indicate a true quotient figure.

21. In a record controlled machine, means for analyzing a record to effect by subtraction operations the division of the value represented by a dividend totalizer by a divisor represented by the record, a quotient indicator for indicating the number of complete subtraction operations, and a totalizer overdraft determining device for automatically causing the changing of the denominational relationship between the dividend totalizer and said analyzing means when the indicator indicates a true quotient figure.

22. In an accounting machine, means for analyzing a record to enter a dividend in a totalizer, an ordinarily shiftable carriage, and means including electrical controlling circuits operable through said carriages for effecting the division of said dividend by a divisor until a negative followed by a positive condition of the totalizer obtains to thereby secure the first quotient digit, and thereafter shifting said carriage to the next arithmetical order for the securing of the successive quotient digit.

23. In an accounting machine, record controlled means for operating a totalizer in an additive direction to represent a dividend designated by a perforated record, a quotient indicator operated in accordance with the number of times a dividend is completely divisible by a divisor represented by a perforated record, and means for successively analyzing a record to effect the division operations.

24. In an accounting machine, record controlled means for entering in a dividend totalizer the representation on a perforated record, analyzing means for analyzing a record representing a divisor to determine the complete division operations of the dividend by the divisor, a quotient indicator, and means for automatically selecting the elements of the quotient indicator for operation in accordance with the complete division operations for successive arithmetical orders.

25. In an accounting machine, a totalizer, record controlled means for initially entering the dividend represented by perforations of a record in said totalizer, means controlled by the perforations of a record representing a divisor for subtracting one or more times the divisor from said dividend, means for determining when said dividend indicates an overdraft, and a quotient indicator corrected under control of the overdraft determining means to indicate the true quotient.

26. In a record controlled machine, record controlled means whereby an entry represented by perforations of a record is effected in a dividend totalizer, record controlled means for reducing

the entry represented by the dividend totalizer one or more times by an amount represented by a divisor designated by perforations on a record, and an overdraft determining means operable to indicate when the remainder exceeds the value of the dividend. 5

27. In a record controlled machine, a totalizer containing an entry representing a dividend, means under control of a perforated record for successively reducing said dividend one or more times by the value of a divisor, a quotient indicator and means for representing on said indicator the number of reductions necessary to effect a negative condition of the totalizer and corrected during the addition operation that effects a positive condition of the totalizer. 80

GUSTAV TAUSCHEK.

10	85
15	90
20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150