

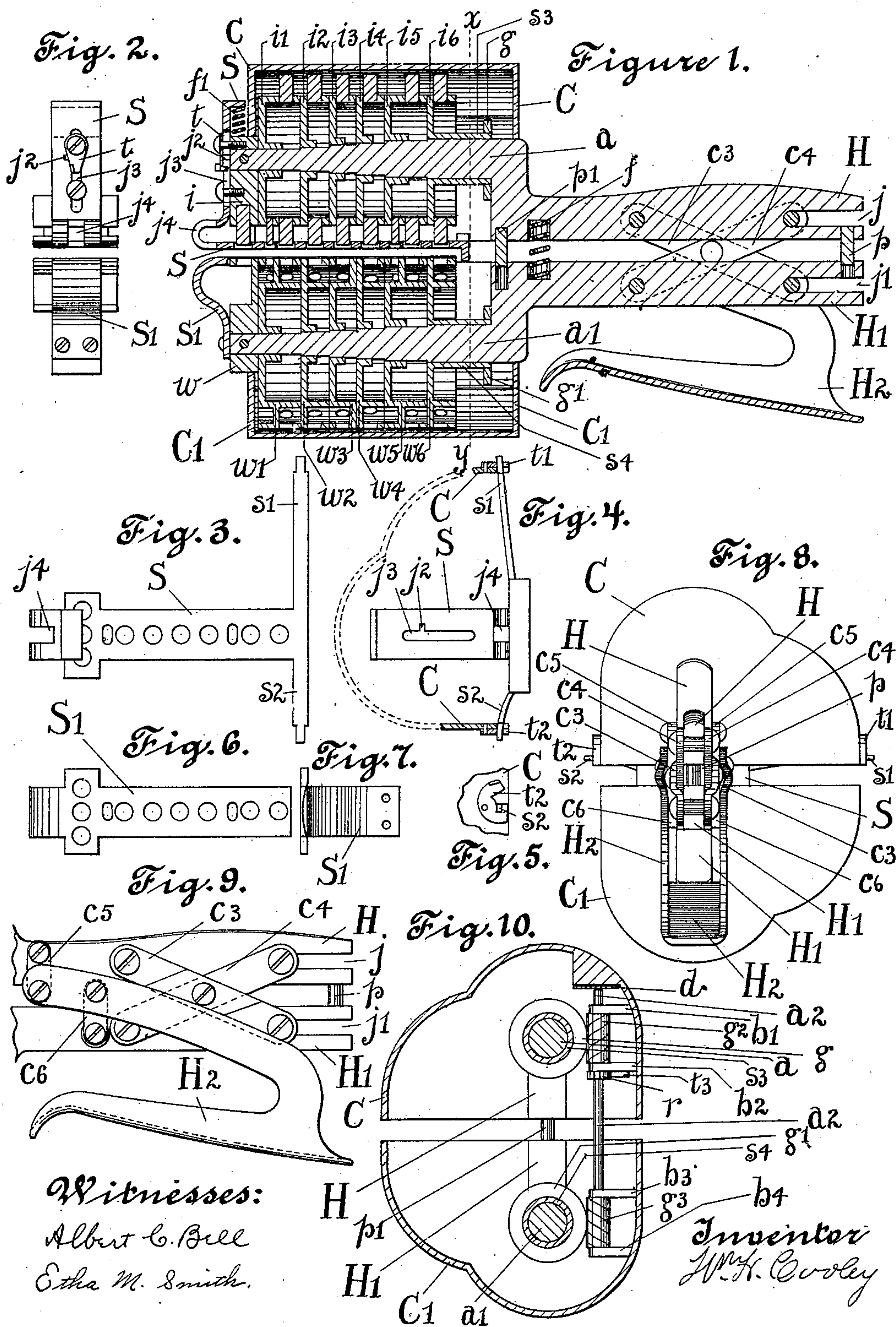
**W. H. COOLEY.**

**MEANS FOR LIMITING TRANSFER PRIVILEGES.**

(Application filed May 10, 1900.)

(No Model.)

**5 Sheets—Sheet 1.**



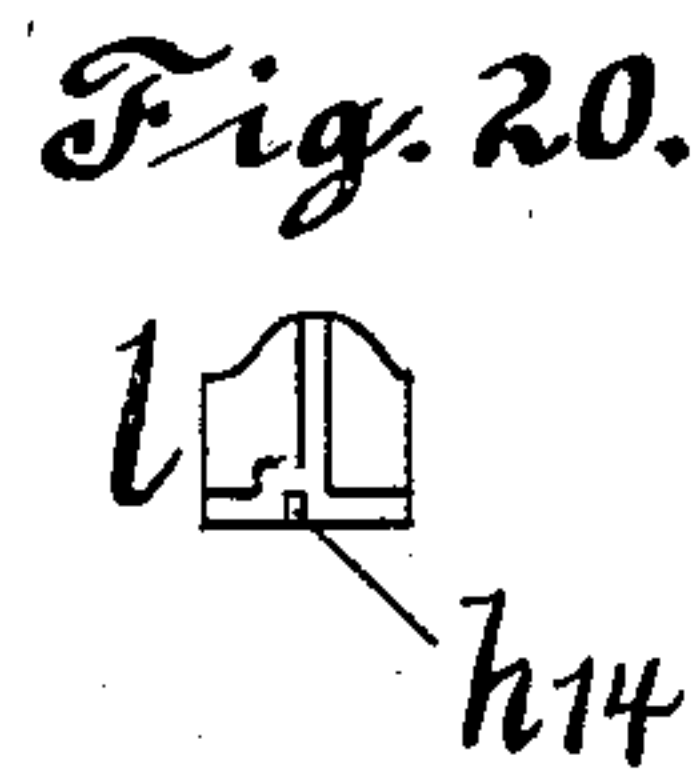
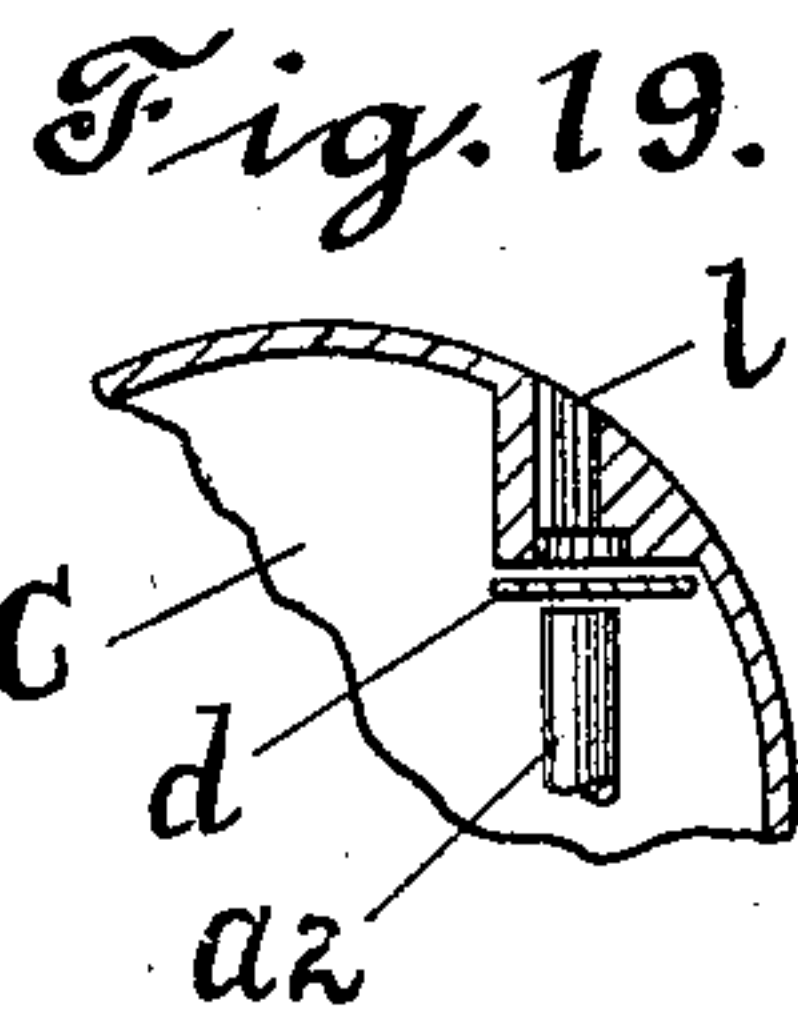
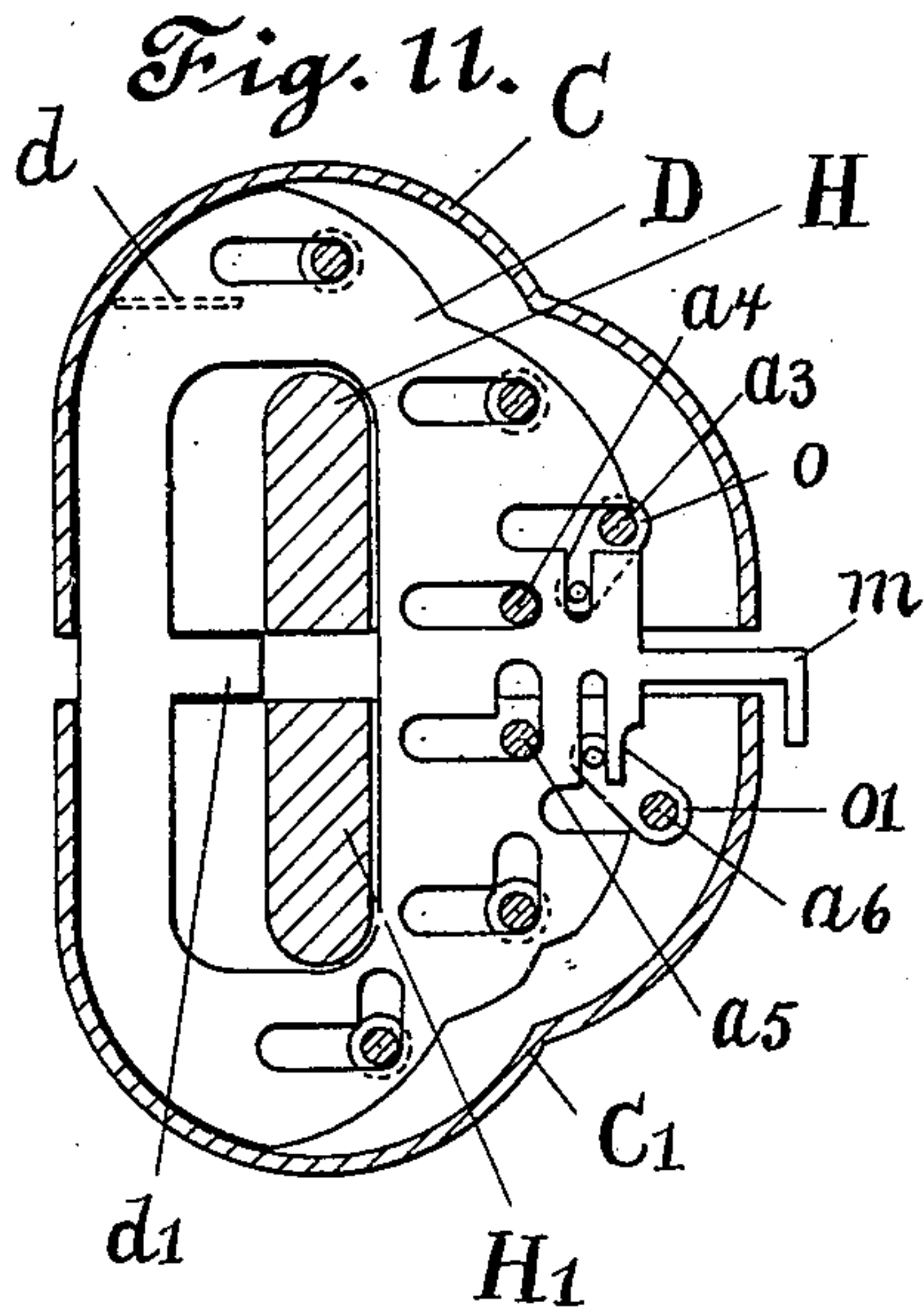
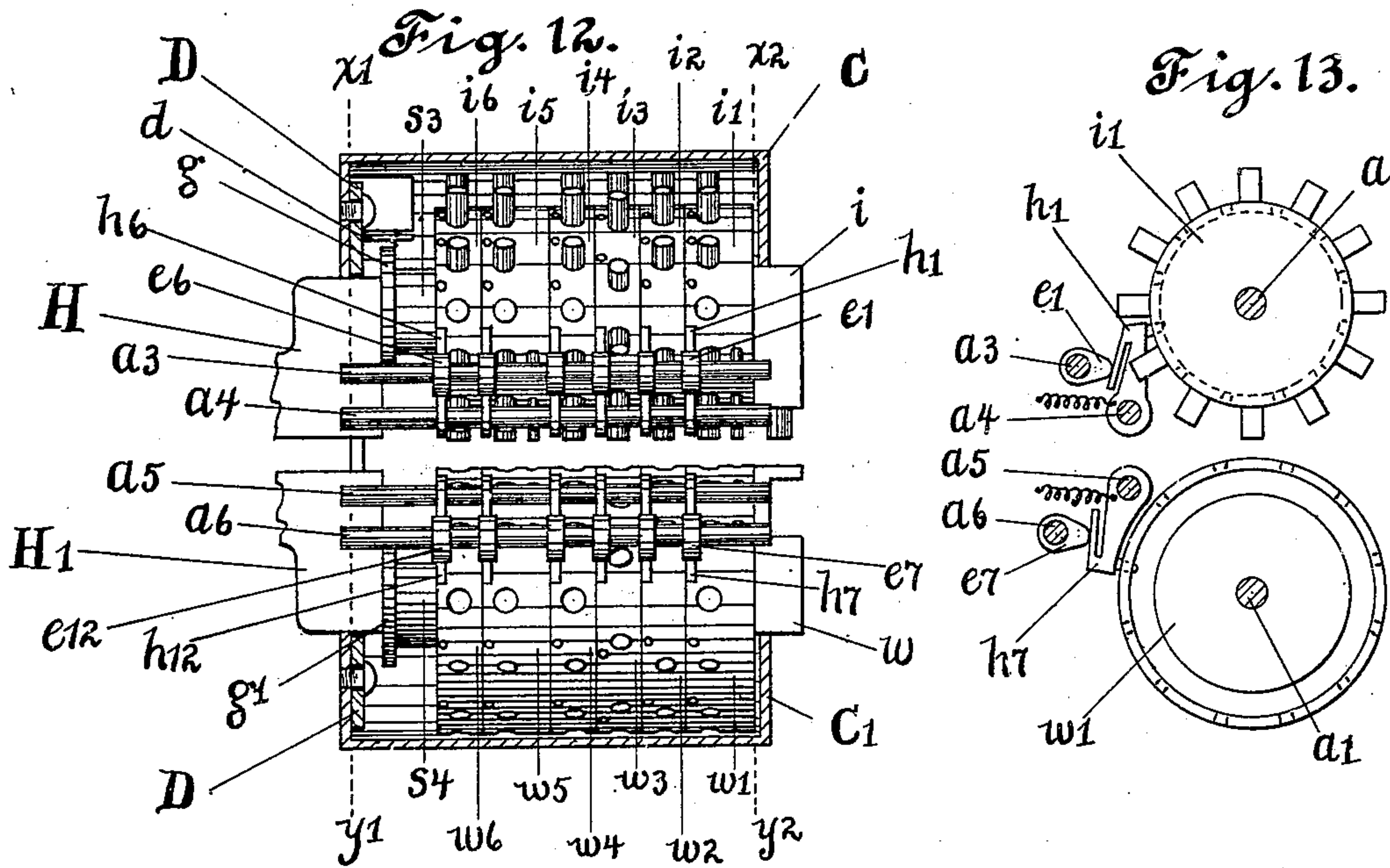
W. H. COOLEY.

MEANS FOR LIMITING TRANSFER PRIVILEGES.

(Application filed May 10, 1900.)

(No Model.)

5 Sheets—Sheet 2.



Witnesses:  
*W. E. Eaton*  
*Albert C. Bell.*

Inventor  
*W. H. Cooley.*



No. 680,645.

Patented Aug. 13, 1901.

W. H. COOLEY.

MEANS FOR LIMITING TRANSFER PRIVILEGES.

(Application filed May 10, 1900.)

(No Model.)

5 Sheets—Sheet 3.

Fig. 14.

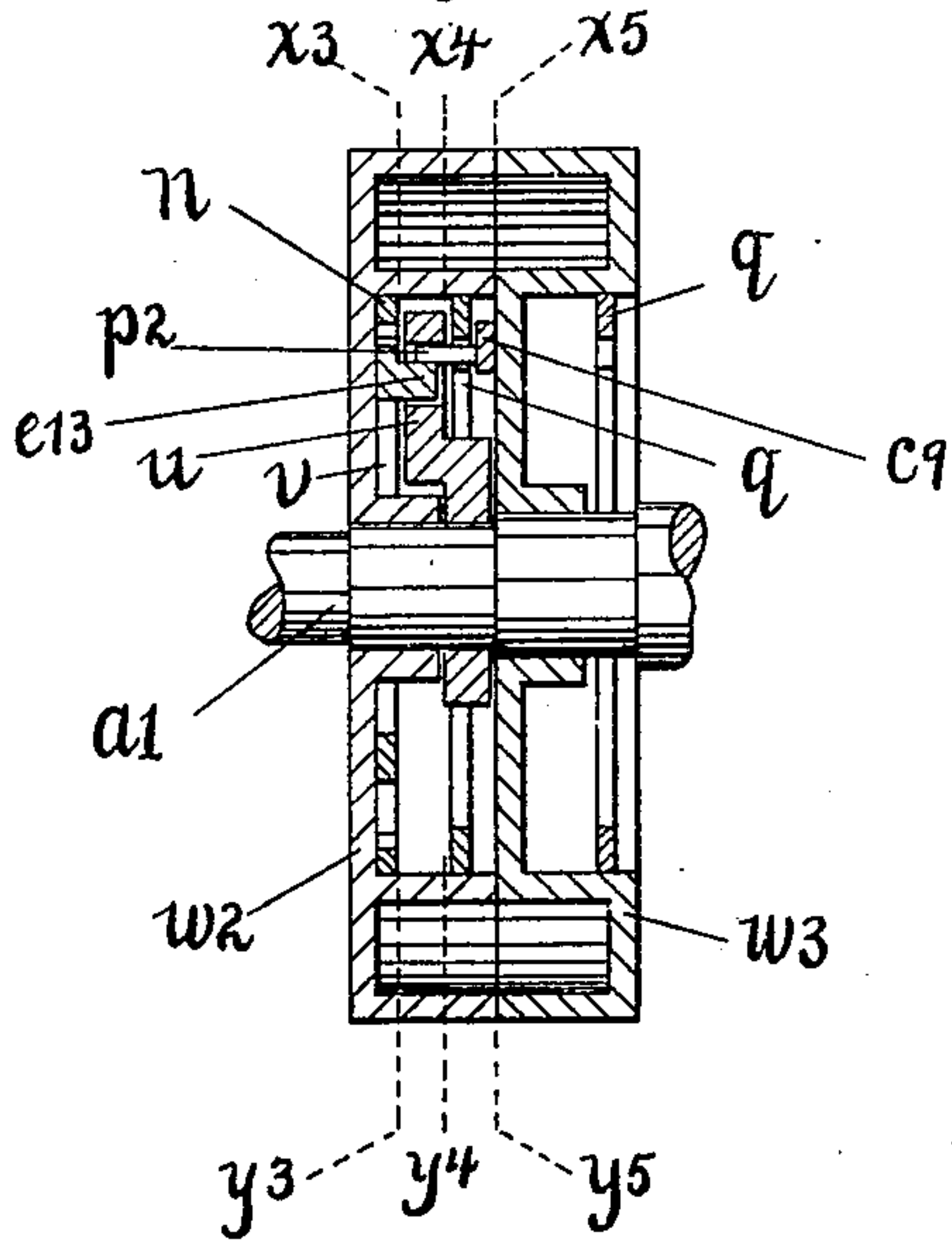


Fig. 16.

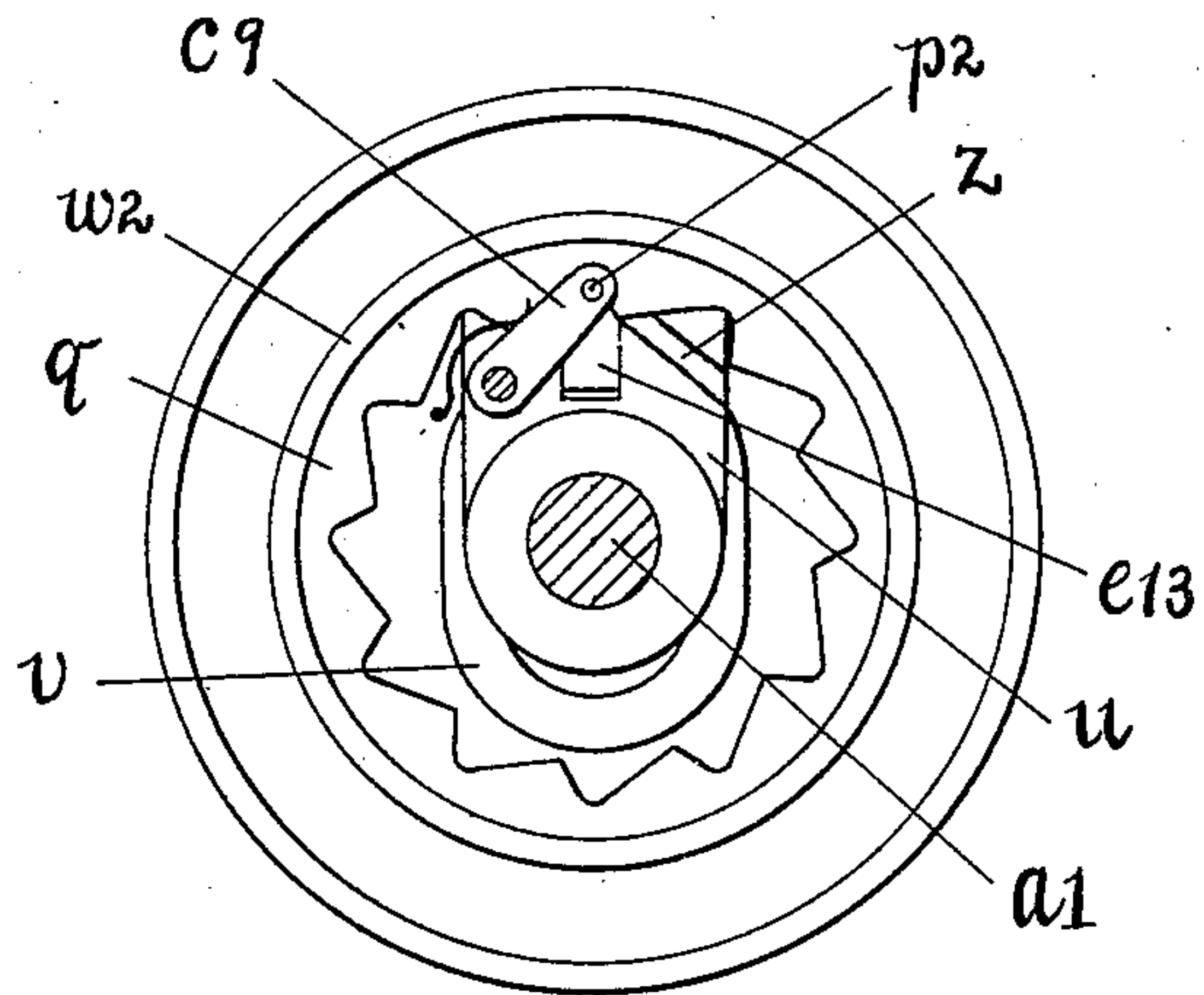


Fig. 17.

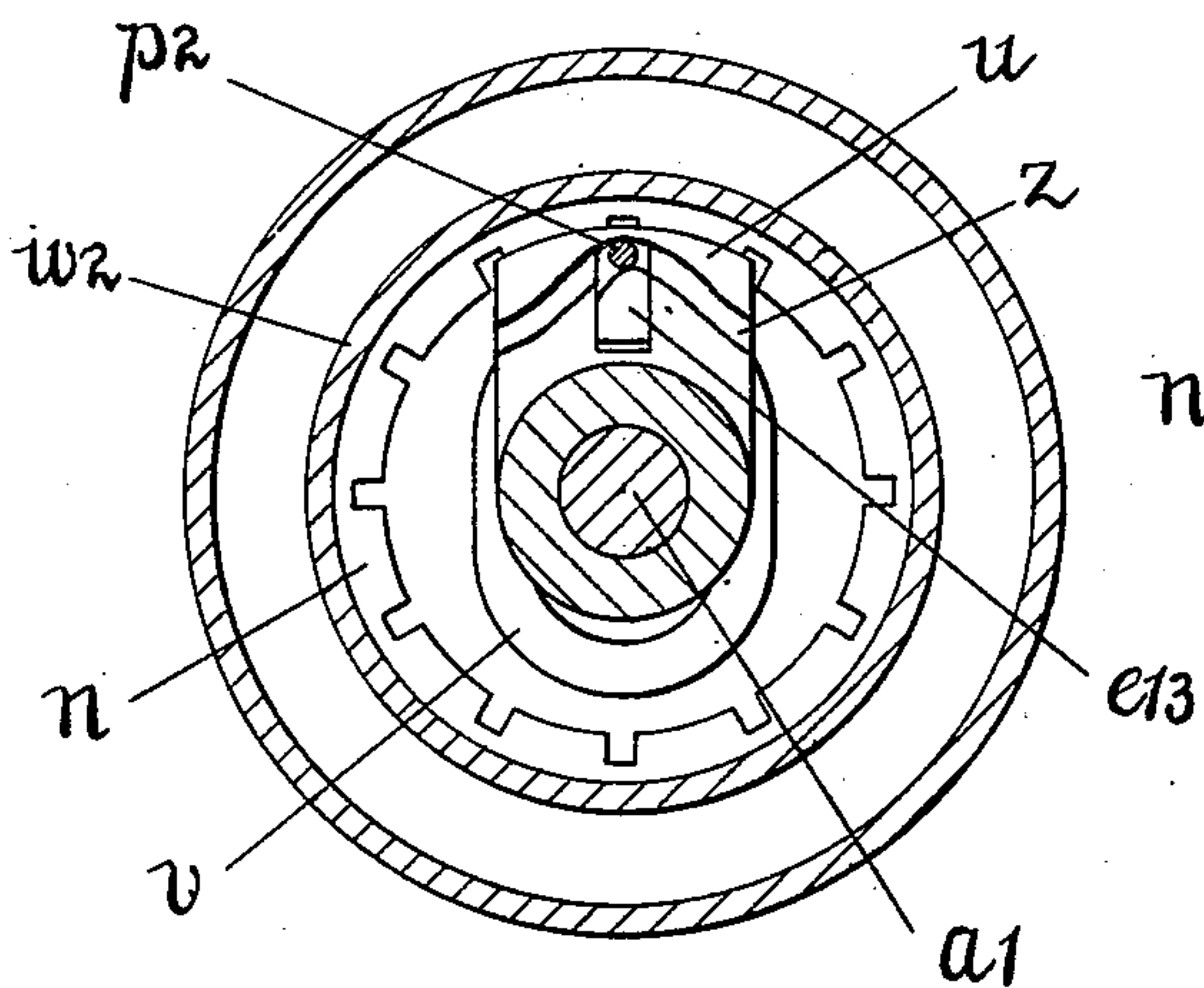
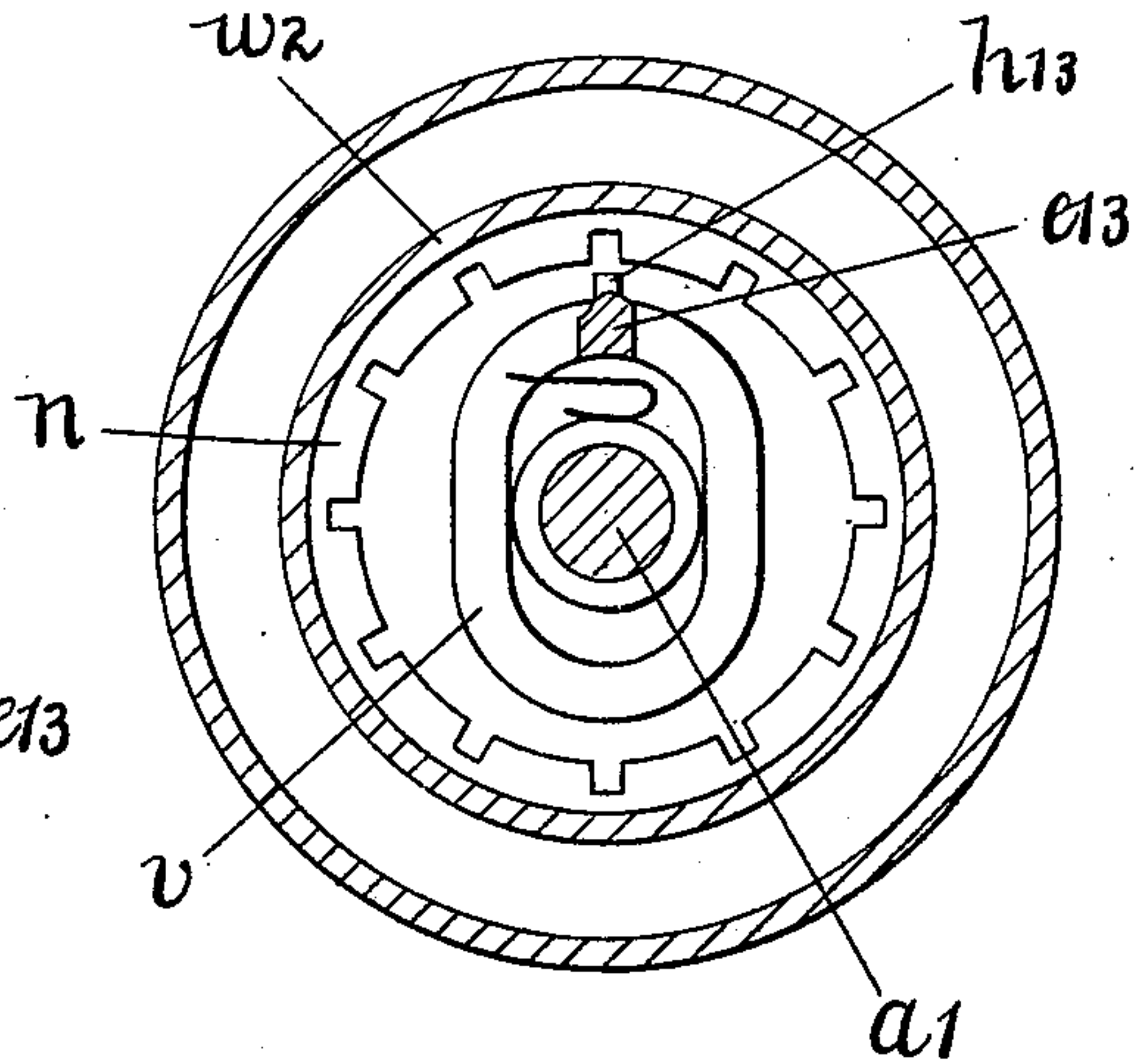


Fig. 18.



Witnesses:

B. E. Eaton

Albert C. Bell

Inventor

Wm. H. Cooley.

No. 680,645.

Patented Aug. 13, 1901.

W. H. COOLEY.

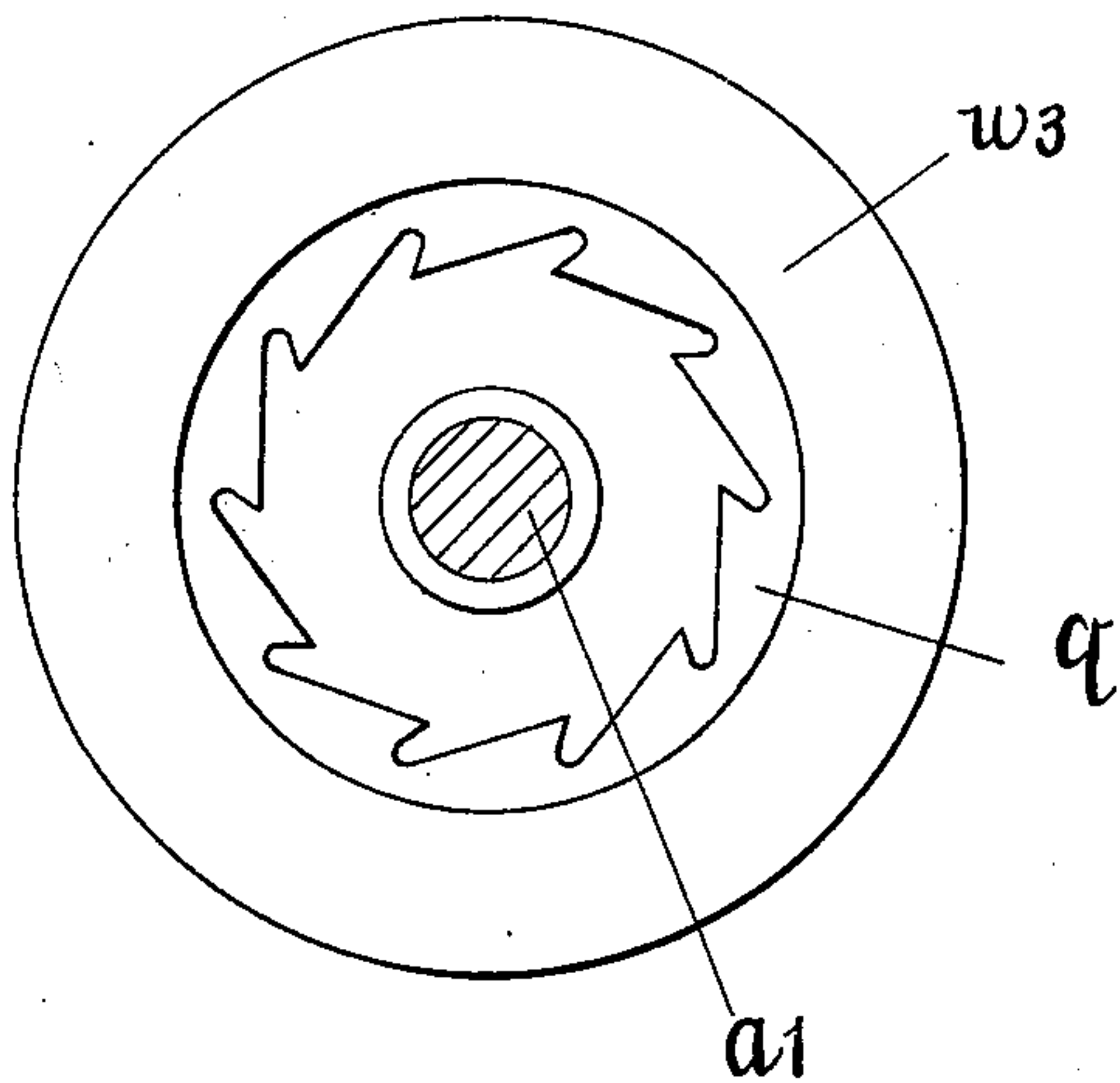
MEANS FOR LIMITING TRANSFER PRIVILEGES.

(Application filed May 10, 1900.)

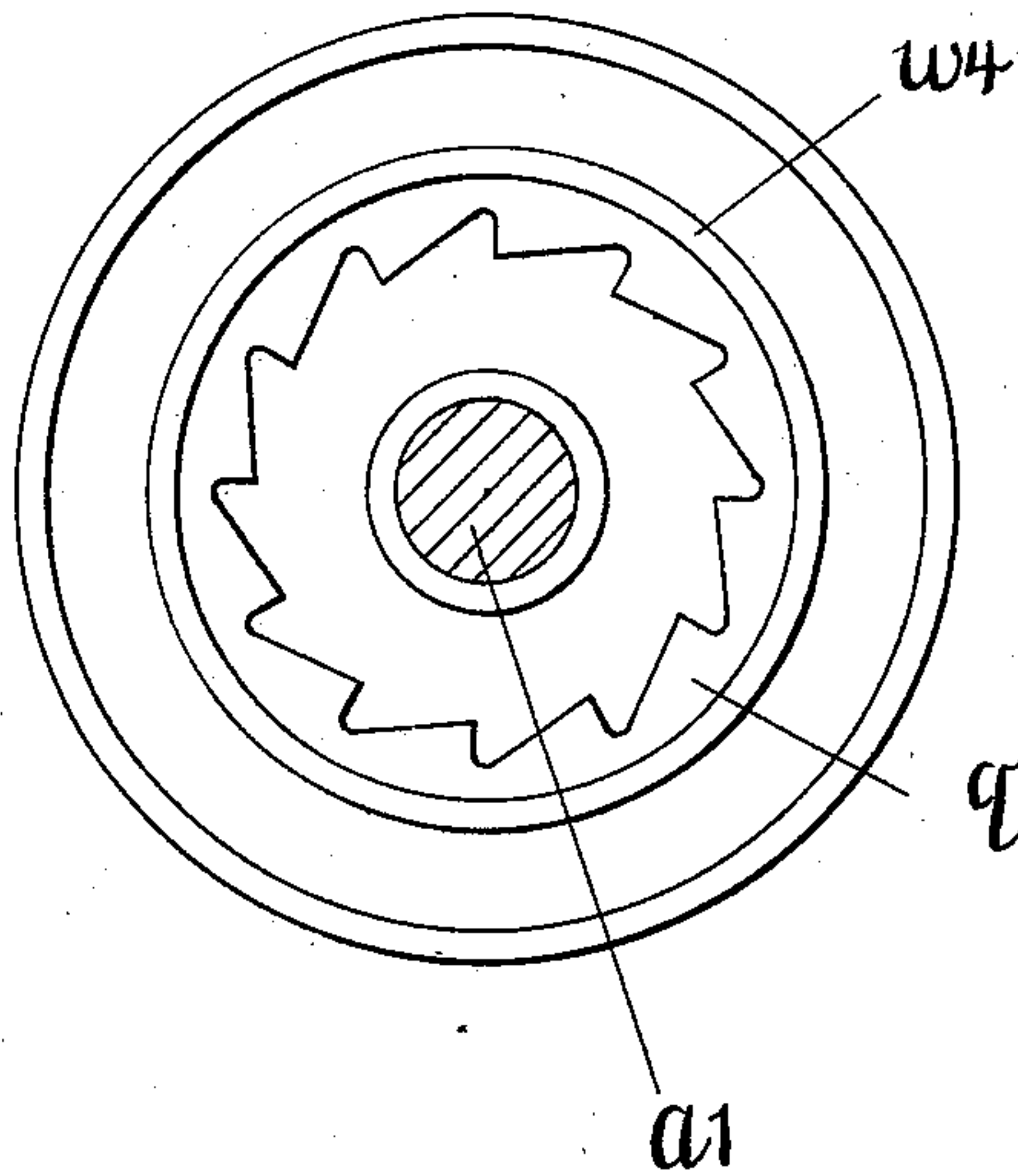
(No Model.)

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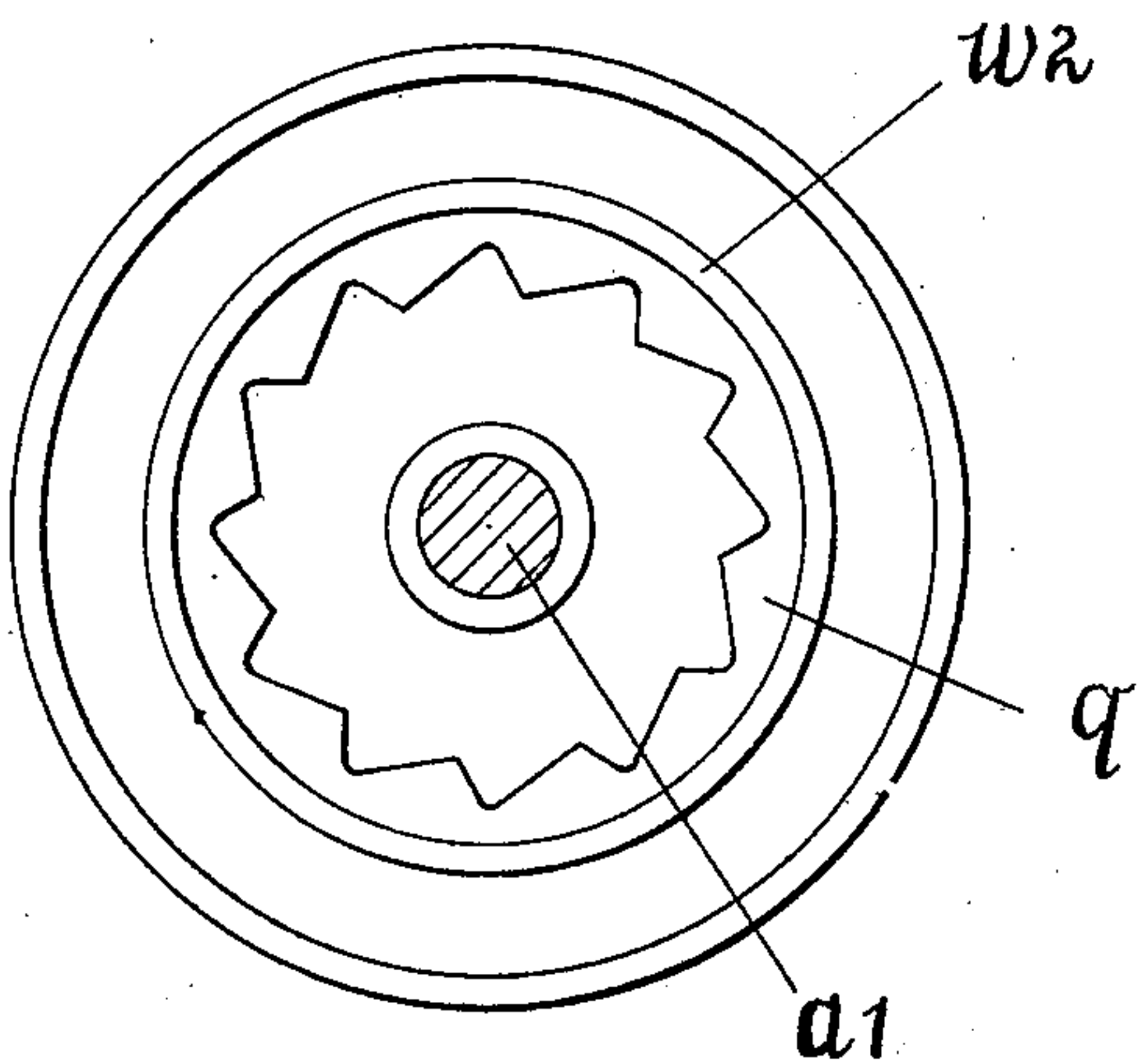
*Fig. 15.*



*Fig. 28.*



*Fig. 29.*



*Witnesses:*

*B. E. Eaton*  
*Albert C. Bell.*

*Inventor*

*W. H. Cooley*

W. H. COOLEY.

MEANS FOR LIMITING TRANSFER PRIVILEGES.

(Application filed May 10, 1900.)

5 Sheets—Sheet 5.

(No Model.)

Fig. 25.

11	12	13	14	15	16
11	S	O	L	11	3
10	1	2	V	10	S
9		3	L	9	1
8	3	8	V	8	0
7	5	7	L	7	2
6	1	6	V	6	H
5		5	L	5	3
4	3	4	V	4	S
3	S	3	L	3	1
2	1	2	V	2	0
1		1	L	1	2
15	3	1	V	15	H

Fig. 26.

C	A	1	RECEIVING PUNCH	LINES.	MONTH	DAY	A.M. P.M.	HOUR	FRACTION
				A1 SOUTH AVE. A2 LAKE " B1 UNIVERSITY " B2 LYELL " C1 NORTH " C2 WEST " D1 HUDSON " D2 EXCHANGE E1 N. ST. PAUL E2 SOPHIA F1 ALLEN F2 ST. JOSEPH G1 E. MAIN H1 PARK AVE.					
					12	31	A	24	

Fig. 27.

PUNCH CONDITION					
1	POINT A				
★	12	31	A	24	
Λ					
1	POINT B				
★	12	31	A	25	
Λ					
1	POINT C				
★	12	31	A	30	
Λ					
1	POINT D				
★	12	31	A	32	
Λ					
CAR NO.			TRIP NO.		

Witnesses:

Albert C. Bell,  
Ethel M. Smith.

Inventor  
W. H. Cooley.



# UNITED STATES PATENT OFFICE.

WILLIAM H. COOLEY, OF BROCKPORT, NEW YORK.

## MEANS FOR LIMITING TRANSFER PRIVILEGES.

SPECIFICATION forming part of Letters Patent No. 680,645, dated August 13, 1901.

Application filed May 10, 1900. Serial No. 16,200. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM H. COOLEY, a citizen of the United States, residing at Brockport, in the county of Monroe and State of New York, have invented a new and Improved Means for Limiting Transfer Privileges, of which the following is a specification:

One of the principal objects of my invention is to provide means for indicating upon a transfer or ticket the time limitations thereon of such a character that it shall be impossible for the conductor to give to a passenger a transfer good over more than the allotted period of time without detection—that is, the conductor cannot give to any one passenger a transfer good until any particular point of time and then deliver to another passenger a transfer with a time limitation expiring at an earlier point of time than that on the preceding transfer.

Another object of my invention is to provide a means for preventing the receipt and use of transfers by a conductor after the time limitation thereon has expired.

In carrying out my invention I make use of a transfer-ticket upon which there are printed in any suitable order the different divisions of the road or system of roads upon which transfers may be used, or, if preferred, the points at which a transfer may be made from one road to any other road passing that particular point. In connection with such a ticket I make use of several series of time-indicating punches—a first series arranged to indicate the fractions of the hour, as “1, 2, 3, 4, 5, 6,” indicating the six even divisions of an hour of ten minutes each or “1, 2, 3, 4,” indicating the four even divisions of an hour of fifteen minutes each. A second series of such punches is devoted to the hours of the day. A third series is devoted to the indications “A” or “P,” indicating time in the forenoon or afternoon. A fourth series is used to indicate the days of the month. This may be a single series for the units and another series for the tens cooperating together to indicate the days of the month. A fifth series is used to indicate the months of the year. These several series of punches cooperate together in such a way that the completion of a cycle in each series advances the next series

of a higher denomination one point or step in its cycle.

I have shown herein each series of dies and its corresponding cooperating punches arranged upon a pair of cooperating wheels, these wheels revoluble upon suitable bearings formed on the jaws of a suitable punch-frame in which preferably the jaws are arranged to so cooperate as to always remain parallel with each other.

The first series of wheels at the inner end of the punch may be arranged to indicate the fractions of the hour, and when they are revolved, so as to complete the cycle standing for the desired number of equal parts into which the hour is divided, they advance the next pair of cooperating wheels indicating the hours of the day one step or one hour. The complete rotation of the cooperating wheels standing for the twelve hours of the half-day serves to advance the cooperating “A. M.” and “P. M.” wheels one step, and these latter in turn at each alternate step complete their cycle and at each such completed cycle serve to advance the cooperating units-wheels of the system representing the days of the month one step or one day. This same system of cooperation is made use of also between the wheels representing the units and the tens of the days, and, further, also between the wheels representing the tens of the days and the wheels representing the months of the year. These cooperating punch and die wheels are arranged to be advanced by mechanism under the control of the conductor in such a way that any motion imparted thereto must be progressive, and no one pair of such cooperating punch and die wheels can be worked backward, so as to indicate a point of time earlier than that indicated at the time of the last punching. The result of this is that the conductor cannot give to any passenger a transfer with an extended time limitation indicated thereon without being compelled to give to the next transfer which he issues the same limitation. As an additional check upon the use of such transfers each conductor upon receiving a transfer is required to punch out of such transfer (and preferably in a space thereon devoted to this purpose) with his punch the time at which he re-



ceives it. Thus we have provided a double check against the abuse of the transfer privilege—the first consisting in means for preventing the issue of a transfer with an improper time limitation and the second check consisting in an indication of the time at which the transfer is received by the conductor on the car to which the passenger is transferred.

In carrying out my invention I also provide means whereby the conductor may periodically advance the cooperating punch and die wheels, so as to indicate the proper time of issuing the transfers. These punch and die wheels may be arranged to mark the transfers in any suitable way, so that such marking shall ineffaceably indicate the desired time limitation. While any system of so marking the transfers may be employed, I prefer to use punches and dies cooperating to punch out of the ticket and remove therefrom portions of such a conformation as to indicate by figures the desired time limitations. I also provide the punch with a number or other suitable characteristic indicating the line upon which the punch is used, such punch being used only upon a line whose indicating characteristic corresponds with the characteristic given on the ticket for that particular line or division of the road in the list of lines or divisions of the road or systems on the tickets. I prefer to provide the punch also with a suitable characteristic indicating the conductor in whose hand the punch is used.

In making out his trip-reports the conductor may be required to indicate upon the envelop or upon some predetermined point on his report-slip with his punch both the commencement and the completion of each trip. This will serve then also as a time-check upon the car and the conductor for each trip. It will also serve to indicate whether or no the conductor has his punch in proper condition for giving the desired time limitations at the commencement and end of each trip, serving also to indicate by comparison with the transfers received whether or not a conductor has taken any transfers after the time limitation thereon has expired.

The accompanying drawings, illustrating my invention, are as follows:

Figure 1 is a vertical longitudinal section through the center of my punch, while Fig. 2 is an end view of the stripping mechanism as seen from the left and with all the parts to the right of the left-hand end of the case C removed. Fig. 3 is a top view of the stripper S, and Fig. 4 is an end view of the stripper S with such stripper turned over to the left ninety degrees from the position indicated in Fig. 2. Fig. 5 is a detail of the locking mechanism of the stripper S, as will be explained. Fig. 6 is a view similar to Fig. 3 of the guide-plate S', while Fig. 7 shows in a view similar to Fig. 4 this same guide-plate S'. Fig. 8 is a view of the punch as seen from the rear. Fig. 9 is a side view of the handle and the operating mechanism for the punch.

Fig. 10 is a sectional view of the punch, taken along the line  $xy$  of Fig. 1 and with all the parts to the left of such line removed. In this figure none of the operating mechanism connected with the handle is shown. Fig. 11 is a view of the cam-operating plate D and its connecting mechanism, such as would be seen by removing the rear end of the case-pieces C C' along the line  $x'y'$  seen in Fig. 12. Fig. 12 is a side view of the cooperating punch and die wheels in their relative positions and also the permanent registry mechanism under the control of the cam-plate D seen in Fig. 11. In Fig. 12 the case-pieces C C' are shown in vertical section taken through the center of the punch. Fig. 13 shows in diagrammatic relation the extreme end punch-wheel  $v'$  and die-wheel  $w'$ , with the permanent registry-pawls  $h'$  and  $h''$  in operative position with all parts to the right of the line  $x^2y^2$  removed, as well as also the cases C and C'. In this figure the corresponding cams  $e'$  and  $e''$  are also seen supported by their respective shafts. Fig. 14 shows in enlarged view in vertical central section the cooperating mechanism between any two adjacent ones of either the punch or die wheels, whereby each one of such wheels communicates at the proper time the desired amount of angular motion to the next wheel in the system. Fig. 15 shows in a view from the right-hand side as seen in Fig. 14 and to the same scale as Fig. 14 die-wheel  $w^3$ , as will be explained. Figs. 16, 17, and 18 show vertical transverse sectional views of the parts seen in Fig. 14 and to the same scale as Fig. 14, taken, respectively, along the lines  $x^5y^5$ ,  $x^4y^4$ ,  $x^3y^3$ . Fig. 19 shows a portion of the upper corner of the case C, with the worm-carrying rod  $a^2$  seen therein, such section being taken along the center of the keyhole  $l$ . Fig. 20 shows a development of the keyhole  $l$  and the means for necessitating a partial removal of the key in order to complete each revolution of such key. Fig. 21 is a view of the extreme left-hand end of the key  $l$  seen in Fig. 22, while Fig. 22 is a side view of such key. Fig. 23 shows a top view of the worm-carrying shaft or rod  $a^2$ . Fig. 24 shows in detached detail the mechanism for preventing a backward rotation of this worm-carrying shaft or rod  $a^2$ . Fig. 25 shows a development of each set of such punch and die wheels. Fig. 26 shows one of the forms in which a transfer-ticket may be printed in accordance with my invention and adapted to use with the punch mechanism also illustrated herein. In Fig. 27 there is seen only the lower end of a trip-report slip such as may be used in connection with my punch and transfer to provide a time-check upon the trips of the car. Figs. 28 and 29 are views similar to Fig. 15 of the die-wheels  $w^4$  and  $w^5$ , respectively, as will be explained, drawn to the same scale as the parts shown in Fig. 14.

Similar letters refer to similar parts throughout the several views.



Referring to the drawings, my punch consists of two body-pieces  $H$  and  $H'$ , connected together by links  $c^3$  and  $c^4$ , pivoted, respectively, at their forward ends to the body-pieces  $H$  and  $H'$ . These links  $c^3$  and  $c^4$  are also pivotally connected together at their middle points, as indicated. In the rear ends of these body-pieces  $H$  and  $H'$  are seen slots  $j$  and  $j'$ , respectively, in which the pins connecting the rear ends of each pair of these links  $c^3$  and  $c^4$  may slide, the construction as thus far described consisting, substantially, in the usual arrangement of parallel moving parts already well known.

Refer to Figs. 1, 8, and 9. In order to increase the power which may be applied to the punch, I make use of a handle-piece  $H^2$ , articulating on each side of the body-pieces  $H$  and  $H'$  with the links  $c^5$  and  $c^6$  in such a way, as clearly indicated, that the amount of motion which may be imparted to this handle-piece  $H^2$  is several times that which is thereby communicated to the body-pieces  $H$  and  $H'$ , moving them together. Suitable guide-pins  $p$  and  $p'$  are provided to maintain a lateral alinement of the body-pieces  $H$  and  $H'$ . These pins are secured in the upper body-piece  $H$  and work in suitable holes therefor in the lower body-piece  $H'$ . The spring  $f$ , seated in suitable holes therefor in the body-pieces  $H$  and  $H'$ , is provided in order that the parts, when not otherwise operated on, may be forced thereby to the position indicated in Fig. 1. The handle  $H^2$  consists of a curved plate having arms extending, as indicated, on both sides of the body-pieces  $H$  and  $H'$ , so as to articulate with links  $c^5$  and  $c^6$  on both sides of the body-pieces  $H$  and  $H'$ . In operating the punch it is held so that the body-piece  $H$ , which in reality constitutes the upper handle of my punch, lies in the palm of the hand with the lower handle-piece  $H^2$  beneath it and grasped by the fingers of the operator. The body-pieces  $H$  and  $H'$ , respectively, are extended to the left to form the bearing-arms  $a$  and  $a'$ , respectively, carrying suitable cooperating punch and die wheels. The arm  $a$  is carefully turned to form a series of bearings decreasing in size as they go toward the left or toward the end of the punch, and on these several bearings are located the series of punch-wheels  $i^6 i^5 i^4 i^3 i^2 i^1$ , each of which carries a series of punches extending radially outward therefrom. In Fig. 12 these punches are shown as cylindrical. They are, however, so conformed as to operate in connection with their corresponding die-wheels to punch out from the ticket a series of figures, such as is indicated in Fig. 25, which shows the stretch-out or development of each set of punches. Those on the punch-wheel  $i^1$  are arranged to punch out from the ticket figures as follows: "12, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11," and those on the wheel  $i^2$  are arranged to punch out figures as follows: "3, 1, 2, 3, 1, 2, 3, 1, 2," and those on the wheel  $i^3$  are arranged

to punch out figures "1, 2, 3, 4, 5, 6, 7, 8, 9, 0," and those on the wheel  $i^4$  are arranged to punch out characters as follows: "A, P, A, P, A, P, A, P, A, P," and those on the wheel  $i^5$  are arranged to punch out figures as follows: "12, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11," and those on the wheel  $i^6$  are arranged to punch out figures as follows: "4, 5, 0, 1, 2, 3, 4, 5, 0, 1, 2, 3," all reading from the middle of Fig. 25 upward. In the same way there are carried upon the extension  $a'$  of the body-piece  $H'$  a series of die-wheels  $w^1 w^2 w^3 w^4 w^5 w^6$ , which cooperate with the just-above mentioned punch-wheels when brought together by the handles  $H$  and  $H^2$  in such a way as to effect the punching out of characters such as just described from the paper previously inserted between the punch-wheels and die-wheels, all as clearly indicated in Fig. 25, showing a development of the punch and die wheels in such a way that the progressive motion of the punches and dies on the wheels is toward the center of the figure from the upper and lower ends thereof. As just before mentioned, in Fig. 12 the punches on these wheels  $i^1 i^2 i^3 i^4 i^5 i^6$  are diagrammatically shown as plain cylinders, while the cooperating die-wheels therefor are shown with round holes therein. These cooperating systems of punch and die wheels are inclosed within the cases  $C$  and  $C'$ , within which there are also located, as indicated in Fig. 10, the bearings  $b^1, b^2, b^3$ , and  $b^4$  for the shaft  $a^2$ , carrying two worm-wheels  $g^2$  and  $g^3$ , arranged to mesh with and impart their motion, respectively, to the gear-wheels  $g$  and  $g'$ , carried by the extended hubs  $s^3$  and  $s^4$ , formed, respectively, on the punch-wheel  $i^6$  and the die-wheel  $w^6$ .

The upper end of the shaft  $a^2$ , as seen in Fig. 23, has a hole therein conformed to and arranged to receive the extension  $k'$  on the key  $k$ . This key  $k$  is arranged to be inserted through the keyhole  $l$ . The development of this keyhole, as seen in Fig. 20, is such that the projection formed just above the extension  $k'$  on the key  $k$  meets with a stop  $h^{14}$  in this keyhole  $l$  at each revolution of the key  $k$ , necessitating a slight raising of the key  $k$  before the revolution can be completed. A suitable clearance-slot allows the key to be inserted only at one point and also admits of the raising of the key when it meets with the stop  $h^{14}$ . The worm  $g^2$  is rigidly secured upon the shaft  $a^2$ , and this shaft  $a^2$  is capable of longitudinal movement through the bearings  $b^3$  and  $b^4$  to admit of the punch-carrying bars or spindles  $a$  and  $a'$  being forced together in punching the tickets or transfers. For this purpose also it will be understood that the worm  $g^3$  is splined upon the shaft  $a^2$  in such a way as to admit of a longitudinal movement of such shaft through such worm. This shaft  $a^2$  may be rotated in the manner already described at the proper time by means of the key  $k$  inserted in the keyhole  $l$ , and a backward rotation of this shaft  $a^2$  is prevented by



means of a ratchet-wheel  $r$ , carried thereby, cooperating with a suitable spring-pawl  $t^3$ , supported from the bearing  $b^2$ . A plate  $d$  is arranged to shut over the top of the shaft  $a^2$ , as will be explained later, to prevent the insertion of the key except under proper conditions. The cases  $C$  and  $C'$  are secured upon the members  $a$  and  $a'$ , respectively, in any suitable manner. (Not shown.)

Refer to Figs. 1, 2, 3, 4, 5, 6, and 7. In order that the ticket may not be drawn upward with the punches on the wheels  $i' i^2 i^3 i^4 i^5 i^6$  after it has been punched and when the spring  $f$  forces the jaws of the punch apart, I provide a stripper  $S$ , carrying on its horizontal portion a series of holes through which the punches on the wheels  $i' i^2 i^3 i^4 i^5 i^6$  may freely pass. This stripper  $S$  has at its right-hand end spring projections  $s'$  and  $s^2$ , arranged to enter suitable slots in the sides of the upper case  $C$ . These projections  $s'$  and  $s^2$  when they have entered suitable slots therefor provided in the sides of the upper case  $C$  are securely held there by means of the latches  $t'$  and  $t^2$ , respectively. These latches  $t'$  and  $t^2$  are so formed and pivoted to the case  $C$ , as seen in Figs. 4 and 5, that the projections  $s'$  and  $s^2$  may be inserted into the slots in the case  $C$  through clearance-openings in such latches, and then by moving the latches to their other extreme position these projections  $s'$  and  $s^2$  are retained in such slots. In order to press the rear end of the stripper  $S$  (or the end near the handles) down away from the punch-wheels, the latches  $t'$  and  $t^2$  are moved so as to release the projections  $s'$  and  $s^2$ . These projections are forced downward out of the slots in the case  $C$ , and then by moving the latches  $t'$  and  $t^2$  to their locking position the projections  $s'$  and  $s^2$  are prevented from reëntering such slots. The stripper  $S$ , it will be seen, occupies such a position that the punch-wheels  $i' i^2 i^3 i^4 i^5 i^6$  cannot be rotated until such stripper is forced downward. Provision is made for this as follows: In the vertical member of this stripper  $S$  there is formed a slot  $j^3$ , through which pass screws, as seen, and by means of which this stripper is secured to the block  $i$ , which in turn is secured upon the front end of the member  $a$ . The upper screw just referred to carries also a latch  $t$ , which is arranged to engage the opening  $j^2$ , formed in the vertical member of the stripper  $S$  and hold such stripper downward against the action of the spring  $f'$  when such stripper has been forced downward. Upon releasing the latch  $t$  the spring  $f'$  forces the stripper upward to the position shown in Fig. 1. The rear end of the stripper—that is, the end toward the handle—must also be forced downward on each side and held down by means of the latches  $t'$  and  $t^2$  when it is desired to rotate any one or more of the wheels  $i' i^2 i^3 i^4 i^5 i^6$ . It will be understood then that at each adjustment of any one of the punch-wheels  $i' i^2 i^3 i^4 i^5 i^6$  this stripper must be forced downward and held there by means of the latch  $t$  at its front end, and also the projections  $s'$  and  $s^2$  must be forced downward in the slots in the sides of the upper case  $C$  and held there by the latches  $t'$  and  $t^2$ . The spring  $f'$  is rigidly secured at one end to the vertical member of the stripper  $S$  and also at the other end of the block  $i$ . This provides that when the punch is operated the stripper  $S$  is first pressed upward against the action of the spring  $f'$  and the spring projections  $s'$  and  $s^2$ . Then the punching is effected and then when the pressure on the handles of the punch is relieved, as the spring  $f$  forces the body-pieces of the punch apart, the spring  $f'$  and the spring-projections  $s'$  and  $s^2$  force the stripper  $S$  downward and away from the punches, removing therefrom the ticket or transfer punched. In order to present a smooth and level surface for the insertion of the ticket, the guide-plate  $S'$  is provided, which may be secured to the block  $w$ , secured in turn to the lower member  $a'$  of my punch, at its front end. A suitable sight-opening  $j^4$  is provided in the end of the stripper  $S$  in order that the conductor may properly locate the ticket or transfer in the punch before operating the punch.

The block  $i$ , secured to the front member  $a$  of my punch, may carry punches arranged to punch out from the ticket characters which shall indicate the particular conductor in whose hands the punch is used and also the line upon which the punch is used. Such an arrangement is indicated in the drawings in Fig. 26. Here the star opposite the line "C1, north," and lying also opposite to the time indication punched out on the transfer, is used to indicate the conductor who has the punch in hand—that is, it is the conductor's characteristic—while the characters punched out immediately above and below it are used to indicate the line on which the punch is used—that is, "A" and "1" stand for "South ave." All of the punches that are used on any one line will bear a common line characteristic or indication, while each punch used upon that line will bear a conductor's characteristic or indication different from that of any of the other punches used on the same line. The punches carried by this block  $i$  cooperate with suitable dies formed in the block  $w$ , secured at the left-hand or front end of the member  $a'$  of my punch, to punch out from the ticket or transfer the desired characteristics, just-above described, indicating the conductor and the line. The punches standing for the conductor's characteristic and for the line characteristic may be so made and inserted in this block  $i$  as to be readily removable therefrom, so that by changing such punches the characteristic standing for the conductor and the line may be changed and varied at pleasure by means of mechanism so well known in the art as to call for no further description or illustration. In the same way also the dies cooperating with such punches may be removably secured in the



block  $w$ , so as to be interchangeable, or, if preferred, this block  $i$  may carry fixed punches cooperating with fixed dies formed on or secured to the block  $w$ , and such blocks  $i$  and  $w$  may be made readily removable and interchangeable by means of devices already well known in the art. The gear  $g$  and  $g'$  and their operating-worms  $g^2$  and  $g^3$ , respectively, may be so arranged that either one revolution or two revolutions may be required in order to advance the punch-wheel  $i^6$  one step, together also with the die-wheel  $w^6$ . In Figs. 10 and 24 there is shown a ratchet-wheel  $r$ , carried by this shaft  $a^2$  and so engaged by a spring-pawl  $t^3$  as to prevent a backward rotation of this shaft  $a^2$ .

In Fig. 1 the mechanism internal to the punch and die wheels, by means of which each one of such wheels actuates the next adjacent one to the left, is omitted. I will now describe such mechanism, reference being made to Figs. 14, 15, 16, 17, and 18. On the punch-wheels the punches extend radially outward from the several wheels  $i^1 i^2 i^3 i^4 i^5 i^6$ , as indicated; while in the case of the die-wheels  $w^1 w^2 w^3 w^4 w^5 w^6$  there is a second or outer rim carrying the dies that cooperate with the punches on the punch-wheels. The inner rim of the die-wheels is of exactly the same diameter as the rim of the punch-wheels, from which the punches extend outward. The mechanism within the several punch-wheels is exactly the same as that located within the inner rim of the corresponding die-wheels. Hence it will be necessary to describe only the mechanism located within the inner rims of one adjacent pair of wheels—for instance, the die-wheels  $w^2$  and  $w^3$ . Each of these die-wheels is arranged, as indicated in Fig. 1 and in enlarged view in Fig. 14, to revolve freely upon the member  $a'$  and near the outer end of that particular step of this member  $a'$  on which it is located, while against the shoulder formed by the next step to the right there is rigidly secured to this member  $a'$  the cam-arm  $u$ , in which there is formed the cam-slot  $z$ , and through an opening in this arm  $u$  there projects the cam  $e^{13}$ , formed on the latch-plate  $v$ , which is seated against the web of the die-wheel  $w^2$ , and is arranged to reciprocate vertically upon the hub of the wheel  $w^2$ , as indicated in Fig. 18. This cam  $e^{13}$  projects through an opening in the cam-plate  $u$  in such a way as to close the cam-slot  $z$  therein when this latch-plate  $v$  is forced upward by a suitable spring, as indicated in Fig. 18, so as to cause the latch  $h^{13}$ , attached to this latch-plate  $v$ , to engage one of the notches in the ratchet  $n$ , projecting inwardly from the inner rim of the wheel  $w^2$ . Carried by the web of the wheel  $w^3$  is seen a pawl  $c^9$ , which is pivoted to the web of this wheel  $w^3$  and normally forced inward by means of a spring, as indicated in Fig. 16, to such a point that it will just engage the left-hand end of the slot  $z$  in the cam-plate  $u$ , as seen in Fig. 17, but be entirely free from the

teeth of the ratchet  $q$ . Projecting from the pawl  $c^9$  toward the front end of the punch or toward the next wheel in the series which is to be operated is seen a pin  $p^2$ , secured in this pawl  $c^9$ . The rotation of the wheel  $w^3$  over to the right, as seen in Figs. 15, 16, and 17, causes this pin  $p^2$  to enter the cam-slot  $z$  in the cam-plate  $u$ . The further rotation of the wheel  $w^3$  over to the right causes this pin  $p^2$  to force downward the cam  $e^{13}$  on the latch-plate  $v$ , disengaging the latch  $h^{13}$  from the notches of the ratchet  $n$  on the wheel  $w^2$ , whereby the wheel  $w^2$  may be carried forward by the further rotation of this wheel  $w^3$  over to the right, as at this time the pin  $p^2$  has engaged a tooth on the ratchet  $q$ , extending inwardly from the inner rim of the wheel  $w^2$  between the cam-plate  $u$  and the body of the pawl  $c^9$ . The further rotation of the wheel  $w^3$  over to the right first results in a release of the cam  $e^{13}$  from the pin  $p^2$ , at which time the latch-plate  $v$ , encircling the hub on the wheel  $w^2$  under the influence of its spring, as indicated in Fig. 18, is forced upward, so that the latch  $h^{13}$  rests in the space between the notches in the ratchet  $n$ . When this wheel  $w^3$  has been rotated so as to bring the pin  $p^2$  out of the slot  $z$ , then this pin  $p^2$  is forced inward by means of its spring, as indicated in Fig. 16, so that it is out of engagement with any of the teeth on the ratchet  $q$ , and at the same time the latch  $h^{13}$  engages a notch in the ratchet  $n$ . This operation, it will be understood, is repeated with each revolution of the wheel  $w^3$ . Attention is called to the following sequence of events in the cooperation between the wheels  $w^3$  and  $w^2$ . Pin  $p^2$  does not engage a tooth on the ratchet  $q$  of the wheel  $w^2$ , so as to advance the wheel  $w^2$ , until by arriving at the position indicated in Fig. 17 it has forced down the latch-plate  $v$ , so as to release the latch  $h^{13}$  from one of the notches of the ratchet  $n$  on the wheel  $w^2$ . Just at this time the pin  $p^2$  engages the rear side of one of the teeth in the ratchet  $q$ , and the further rotation of the wheel  $w^3$  over to the right sufficient to disengage the pin  $p^2$  from the slot  $z$  in the cam-plate  $u$  is just that amount required to advance the wheel  $w^2$  one step, or the angular space between two adjacent punches, which is also just the angular motion required to bring the next notch in the ratchet  $n$  opposite to latch  $h^{13}$ . Attention is also called to the fact that the formation of the cam-slot  $z$  is such as to force the pin  $p^2$  inward and out of engagement with the teeth in the ratchet  $q$ . The conformation and cooperation between the parts, as just above described, it will be understood, is sufficient to provide for the advancing of any one wheel by the next preceding one in the system an angular distance equal to the advance of the operating-wheel. In some instances, to which reference will be made later, it is necessary that the operated wheel be advanced one-sixtieth of a revolution more than the operating-wheel. In cases where this is necessary I



make use of the following arrangement—that is, in the ratchet  $q$  the teeth are formed on their rear surfaces, as indicated in Fig. 15, in such a way that as the pin  $p^2$  is forced downward under the influence of the cam-slot  $z$  the inclined rear surfaces of the teeth on this ratchet cause an angular advance of the driven wheel greater than the angular motion of the driving-wheel. By referring to Fig. 25 it will be seen that the punch and die wheels  $i^6$  and  $w^6$ , respectively, carry twelve cooperating punches and dies. Hence they are arranged to receive simultaneously twelve different impulses for each revolution. These wheels  $i^6$  and  $w^6$ , it will be understood, further, receive these twelve impulses in two cycles of six each. Hence the wheels  $i^6$  and  $w^6$  will carry each of them two pawls  $c^9$  in order that at the completion of each half-revolution of these wheels  $i^6$  and  $w^6$  the adjacent wheels  $i^5$  and  $w^5$  may be advanced one-twelfth of a revolution. These wheels  $i^5$  and  $w^5$  carry twelve different characters, constituting a single cycle, which is completed only by one revolution of such wheels. Hence these wheels  $i^5$  and  $w^5$  will carry each of them only one pawl  $c^9$ . The wheels  $i^4$  and  $w^4$  carry twelve characters arranged in six cycles for each revolution of such wheels. The wheels  $i^4$  and  $w^4$  will therefore carry six pawls  $c^9$ . As thus far described, the rotation of each one of the wheels imparts to its adjacent wheel an equal angular motion. The wheels  $i^3$  and  $w^3$  carry ten characters, which constitute a complete cycle for each revolution of such wheels. Hence the advance of the wheels  $i^4$  and  $w^4$  over the last one-twelfth of a revolution to complete their cycle must impart to the wheels  $i^3$  and  $w^3$  just one-tenth of a revolution. For this purpose on the wheels  $i^3$  and  $w^3$  the ratchets  $q$  have teeth formed thereon, with their operative faces inclined to the rear in the manner indicated in Fig. 15. The wheels  $i^2$  and  $w^2$  carry twelve characters, constituting three complete cycles for each revolution of such wheels. For this reason the teeth on the ratchets  $q$  on the wheels  $i^2$  and  $w^2$  have a conformation, as shown in Fig. 29, the reverse of that seen in Fig. 15, which will admit of such wheels receiving an angular motion slightly less than that imparted to the wheels  $i^3$  and  $w^3$ —that is, one-tenth of a rotation of the wheels  $i^3$  and  $w^3$  imparts to the wheels  $i^2$  and  $w^2$  just one-twelfth of a rotation. On each of these wheels  $i^3$  and  $w^3$  there is located one pawl  $c^9$ . The wheels  $i^1$  and  $w^1$  carry each of them twelve characters, constituting one complete cycle for each revolution of such wheels, and as they are to be advanced one-twelfth of a revolution at the completion of each one-third of a revolution of the wheels  $i^2$  and  $w^2$  such wheels  $i^1$  and  $w^1$  carry each of them three pawls  $c^9$ .

The several conformations given to the ratchets  $q$  are shown in enlarged detail view in Figs. 15, 28, and 29, by the use of which the motion imparted to the driven wheel is, re-

spectively, greater than, equal to, and less than the motion of the driving-wheel.

As it is necessary that a perfect alignment be maintained at all times between the punches on the punch-wheels and the cooperating dies on the die-wheels, I have found it desirable to make use of the mechanism now to be described. Referring to Figs. 11, 12, and 13, from which letters referring to some of the parts are omitted, as will at once be understood, to avoid confusion, but from the plan of lettering the parts to which the omitted letters refer will be readily understood, in the rims of the punch-wheels  $i^1$   $i^2$   $i^3$   $i^4$   $i^5$   $i^6$  there are formed a series of holes or notches arranged to be engaged by pins projecting from the free ends of the pawls  $h^1$   $h^2$   $h^3$   $h^4$   $h^5$   $h^6$ , loosely supported upon the shaft  $a^4$  and arranged to be forced into engagement with the holes in the wheels  $i^1$   $i^2$   $i^3$   $i^4$   $i^5$   $i^6$  by means of a corresponding series of cams  $e^1$   $e^2$   $e^3$   $e^4$   $e^5$   $e^6$ , secured upon the shaft  $a^3$ . The shafts  $a^3$  and  $a^4$  have suitable bearings in the front and rear ends of the upper case C. The cams  $e^1$   $e^2$   $e^3$   $e^4$   $e^5$   $e^6$  are arranged to engage each one a stiff spring, as indicated in Fig. 13, formed on the outer surfaces of the pawls  $h^1$   $h^2$   $h^3$   $h^4$   $h^5$   $h^6$ . Each one of these pawls  $h^1$   $h^2$   $h^3$   $h^4$   $h^5$   $h^6$  is arranged to be withdrawn from engagement with its corresponding wheel  $i^1$   $i^2$   $i^3$   $i^4$   $i^5$   $i^6$  by means of a suitable spring, as indicated in Fig. 13. A similar series of pawls  $h^7$   $h^8$   $h^9$   $h^{10}$   $h^{11}$   $h^{12}$ , loosely supported upon the shaft  $a^5$ , is provided for the series of wheels  $w^1$   $w^2$   $w^3$   $w^4$   $w^5$   $w^6$ , and these pawls in turn are arranged to be similarly engaged by a series of corresponding cams  $e^7$   $e^8$   $e^9$   $e^{10}$   $e^{11}$   $e^{12}$ , secured upon the shaft  $a^6$ . These shafts  $a^5$  and  $a^6$  have bearings formed in the front and rear ends of the lower case C'. A spring is also provided for each one of the pawls  $h^7$   $h^8$   $h^9$   $h^{10}$   $h^{11}$   $h^{12}$  to withdraw it from its corresponding wheel when not engaged by its corresponding cam  $e^7$   $e^8$   $e^9$   $e^{10}$   $e^{11}$   $e^{12}$ .

Referring to Fig. 11, seated against the rear side of the upper and lower cases C and C' of my punch is seen a plate D, having slots formed in the upper and lower ends thereof, through which screws pass securing this plate D to the rear end of the cases C and C' in such a way as to admit of a horizontal motion to and fro of this plate D upon such screws, of which there are two passing through slots into the upper case C and also two passing through slots in this plate D into the lower case C'. The lower slots in this plate D have an upward extension formed at their right-hand ends, as seen in Fig. 11 in which this plate D is shown in the normal position for the operation of the punch) in order that the cases C and C' may be forced together in the operation of the punch. As a result of this construction also it will be understood that the plate D may be drawn to the right, as seen in Fig. 11, only when the punch is open and the jaws thereof apart. Upon the shaft  $a^3$  is secured a crank  $o$ , the



projecting pin of which is arranged to engage a slot near the right-hand edge of this plate D. Similarly upon the shaft  $a^6$  is located a crank  $o'$ , with its pin arranged to engage also a slot near the right-hand edge of this plate D. These slots and the cranks just referred to are so arranged to coöperate, as indicated, that the motion of the plate D to the right rotates the shafts  $a^3$  and  $a^6$  in such a way as to release the series of cams  $e^1 e^2 e^3 e^4 e^5 e^6$  from the corresponding series of pawls  $h^1 h^2 h^3 h^4 h^5 h^6$  and also to release the series of cams  $e^7 e^8 e^9 e^{10} e^{11} e^{12}$  from its corresponding series of pawls  $h^7 h^8 h^9 h^{10} h^{11} h^{12}$ . In the center of this cam-plate D there is formed an opening admitting of the horizontal motion of this plate D around and over the body-pieces of the punch H and H', and at the left-hand side of this plate D there is seen a projection  $d'$ , which is arranged to pass between the body-pieces H and H' of my punch when the plate D is moved to the right in such a way as to prevent the operation of the punch, at which time also the system of punch and die wheels carried by the body-pieces H and H' of my punch are not firmly held in registry by means of the series of pawls  $h^1 h^2 h^3 h^4 h^5 h^6$  and  $h^7 h^8 h^9 h^{10} h^{11} h^{12}$ . This plate D is arranged to be operated by means of the handle  $m$ . Suitable slots are also provided for the shafts  $a^3$ ,  $a^4$ ,  $a^5$ , and  $a^6$ , as seen in Fig. 11, to admit of the motion of this plate D to the right and also to admit of the cases C and C' approaching each other in the operation of the punch. It will of course be understood that, as already described, each punch and each die wheel is always prevented from rotating by a latch  $h^{13}$ , engaging a ratchet  $n$ , carried by such wheel, excepting when the proper conditions exist to advance such wheel one step. Thus when the punch and die wheels are released from the pawls  $h^1 h^2 h^3 h^4 h^5 h^6 h^7 h^8 h^9 h^{10} h^{11} h^{12}$  they are not free to rotate unless the adjustment of the punch requires that they should rotate. The function of the latches  $h^{13}$  and ratchets  $n$  is simply to prevent the punch and the die wheels rotating, but not to positively aline them, while the function of the pawls  $h^1 h^2 h^3 h^4 h^5 h^6 h^7 h^8 h^9 h^{10} h^{11} h^{12}$  and the corresponding cams is to positively lock and aline such wheels in any particular operative position desired.

A guard-plate  $d$  is provided, extending inwardly from the plate D, so as to cover the top of the shaft  $a^2$  when the plate D occupies the position indicated in Fig. 11, which occurs when the punch is in operative condition, at which time access to the shaft  $a^2$  by means of the key  $k$  should not be permitted. Refer now to Fig. 26, which shows one arrangement of the several features embodied in my ticket or transfer. Upon this ticket to the left there is noticed a space which is devoted, as indicated, to the punch indications to be given by the receiving-conductor. Next to the right there are arranged in a suitable column, headed by the word "Lines," the dif-

ferent roads or divisions of the same road upon which it is desired to transfer passengers. Opposite each one of these roads or divisions of the road there is printed a characteristic, as "A1," "A2," "B1," "B2," &c., "A1" and "A2" standing for the two divisions of a single section or branch of the road, as "South" and "Lake" avenues, "B1" and "B2" standing for two divisions or sections of the road, as "University" and "Lyell" avenues. To the right of the column, in which there are printed the names of the lines or divisions of the road, are arranged a series of columns in which there is to be punched out by means of the punch, in the manner already described, a series of figures standing for the month of the year in the months'-column and in the day-column figures standing for the day of the month and in the "A.M." and "P.M." columns a character standing for forenoon or afternoon, and in the next column to the right figures standing for the hour in the forenoon or afternoon and in the extreme right-hand column figures standing for one of the even divisions of the hour into four or six equal parts. In the column of lines and opposite the word "C1, north," there is punched out in the transfer indicated in Fig. 26 a star, which may be in alinement with the several time indications punched out in the different columns just referred to. This star constitutes the conductor's characteristic, while immediately above and below this star is punched out the figure "1" and the letter "A," which taken together constitute the line characteristic.

A conductor receiving a transfer bearing all the indications seen in Fig. 26, except those noted in the space allotted to the receiving-punch, will at once know that such a transfer has been given by a conductor whose punch characteristic is a star and that that conductor was on the South-avenue division of the South and Lake avenues road and that it was given December 31 at 2.40 a. m. In this case the star, which is the conductor's characteristic, is punched opposite the word "North," indicating that this transfer entitled the bearer to continue his trip upon a North-avenue car. The time indications to the right of the star indicate the point of time when he received the transfer, which is good for ten minutes after the time indicated by the punch-marks. The passenger taking the transfer enters the North-avenue car and hands the transfer to the conductor upon that car, who immediately punches out in the space allotted to the receiving-punch the indications seen at the extreme left hand of Fig. 26, the time indication being "12-31-A-2-5," standing for "December 31, 2.50 a. m." The triangular opening immediately above the figure "12" indicates the particular conductor who received the transfer, and the characters "C" and "1" punched out at the left and right of this conductor's characteristic indicate the line upon which the



transfer is received. This, it will be borne in mind, should correspond with the indication standing for the North-avenue line, which is "C1." The transfer then, it will be seen, has been properly issued and used by the passenger within the allotted time and received by the conductor on the North-avenue line also and the date of receipt punched thereon.

In the use of this punch the conductors are required to advance the time indications on their punch by means of the key  $k$  in the manner already clearly indicated and described in proper order after passing each predetermined fixed point in the route, so that the time indication given upon the punch shall properly correspond with the different times at which such transfers may be issued and received on the lines on which they are working.

A conductor receiving a transfer after the time limitation indicated thereon has expired gives by his receiving-punch an indication of that state of affairs. By the use of this ticket and punch it is only necessary to examine the transfers handed in by each conductor, in connection with the punch-mark made thereon, to determine whether or not transfer privileges have been abused, and if so by whom.

Attention is called to the fact that the receiving conductor cannot give a receiving indication of the time when he accepted a transfer different from the time indication which he gives at the same time to the transfers which he issues. The passenger receiving a transfer will detect an improper issue—that is, if a conductor keeps his punch back he cannot issue transfers with the proper time limitation indicated thereon.

A further time-check upon each trip of a car may consist, if desired, in a series of time indications on a trip report-slip, such as seen in Fig. 27, upon which the conductor may be required to indicate the condition of his punch at the time of or just after passing each one of a series of points in his route. By this means there is secured a check upon each individual trip of each car in the system regardless of whether there are any transfers issued during that trip or not.

In using my punch the conductor will be required to advance the punch in the manner already clearly described by means of the key  $k$ , so as to cause the time indications which the punch gives to correspond with the time at which the car passes predetermined points in the route, as determined by a clock or other suitable time-piece on the car. The manner of punching the tickets by the issuing and receiving conductor is clearly indicated in Fig. 26.

It will of course be readily understood that the coöperating punches and dies in my punch may be readily so adjusted, if desired, as to displace from the plane of the ticket operated on thereby characters conforming in outline to

the characters on the punch-wheels in such a way as to produce nearly or quite the effect which would be secured by embossing.

Attention is called to the fact that in each one of the several series of marking characters or punches and dies the marking characters or punches and dies are arranged in one or more cycles, and, further, to the fact that by reason of the connections between the several wheels on which they are located no one of such wheels, except the first, can be advanced one step until all of the marking characters or punches and dies in a complete cycle in the next series of lower denomination have been brought into operative position, while no one series, except the last, can be moved from a last step in a cycle therein to a first step in a cycle therein without advancing the next series of higher denomination one step in a cycle of its marking characters or punches and dies.

By the term "cycle" in the above specification and following claims in this case there is meant at least two or more marking characters or punches, with their corresponding dies, which when taken together give indications covering one of the periods or cycles of time into which the whole period of time covered by all the indications which can be given by the entire system is divided. For instance, the hour is taken as the cycle and divided into six equal divisions, each complete hour standing for one step in the cycle of the half-day composed of twelve hours. Each half-day (indicated by the characters "A" and "P") stands for one of the divisions of the cycle of the complete day, which in turn is one of the divisions of the cycle of the units of days, while each complete cycle of the units of days stands for one step in a cycle of the tens of days. A complete cycle of the tens of days stands for one month or one step in the cycle of months of which the year is composed.

What I claim is—

1. Two or more series of marking characters arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series, except the last, standing for a step in a cycle of the next series of higher denomination, means whereby each one of such series may be moved only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle in the next series of lower denomination have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the marking characters therein advances the next series of higher denomination one step in a cycle of its mark-



ing characters, means whereby all of the characters standing for each different relation between the several steps in the cycles of the marking characters in such different series  
 5 may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, and means whereby the mechanism for actuating such characters is inoperative except when a character in each  
 10 one of such series is in operative relation to such mechanism coöperating therewith to displace from the plane of the ticket such portions thereof.

2. Two or more series of marking characters  
 15 arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means  
 20 whereby each one of such series may be moved only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive order throughout each cycle in such series,  
 25 means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle, in the next series of lower  
 30 denomination, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the marking characters therein advances the next  
 35 series of higher denomination one step in a cycle of its marking characters, means whereby all of the characters standing for each different relation between the several steps in the cycles of the marking characters in such  
 40 different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, and means whereby, at the time of such operation of such characters, there is opposed to each  
 45 one of such characters mechanism coöperating therewith to displace from the plane of a ticket portions thereof conforming in outline to such characters.

3. Two or more series of marking characters  
 50 arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means  
 55 whereby each one of such series may be moved only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive order throughout each cycle in such series,  
 60 means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle, in the next series  
 65 of lower denomination, have been brought into operative position, means whereby the movement of one or more of such series, ex-

cept the last, from a last step to a first step in a cycle of the marking characters therein advances the next series of higher denomi- 70  
 nation one step in a cycle of its marking characters, means whereby all of the characters standing for each different relation between the several steps in the cycles of the marking  
 characters in such different series may be op- 75  
 erated simultaneously, or nearly so, to indicate the step to which each series has been advanced, means whereby, at the time of such operation of such characters, there is opposed  
 to each one of such characters mechanism co- 80  
 operating therewith to displace from the plane of a ticket portions thereof conforming in outline to such characters, and means whereby the mechanism for actuating such characters is inoperative except when a character in  
 each one of such series is in operative rela- 85  
 tion to such mechanism coöperating therewith to displace from the plane of the ticket such portions thereof.

4. Two or more series of marking characters 90  
 arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means 95  
 whereby each one of such series may be moved only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive  
 order throughout each cycle in such series, 100  
 means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle, in the next series of lower 105  
 denomination, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the marking characters therein advances the next 110  
 series of higher denomination one step in a cycle of its marking characters, means whereby, at the time of the operation of such characters, there is opposed to each one of such characters mechanism coöperating therewith 115  
 to displace from the plane of a ticket portions thereof conforming in outline to such characters, and means whereby the mechanism for actuating such characters is inoperative except when a character in each one of such se- 120  
 ries is in operative relation to such mechanism coöperating therewith to displace from the plane of the ticket such portions thereof.

5. Two or more series of marking characters  
 125 arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series, except the last, standing for a step in a cycle of the next series of higher denomination, means  
 whereby each one of such series may be moved 130  
 only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive order throughout each cycle in such series,



means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle in the next series of lower denomination have been brought into operative position, means for preventing the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the marking characters therein until the next series of higher denomination has been advanced one step in a cycle of its marking characters, means whereby all of the characters standing for each different relation between the several steps in the cycles of the marking characters in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, and means whereby the mechanism for actuating such characters is inoperative except when a character in each one of such series is in operative relation to such mechanism cooperating therewith to displace from the plane of the ticket such portions thereof.

6. Two or more series of marking characters arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby each one of such series may be moved only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the marking characters therein until the next series of higher denomination has been advanced one step in a cycle of its marking characters, means whereby all of the characters standing for each different relation between the several steps in the cycles of the marking characters in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, and means whereby, at the time of such operation of such characters, there is opposed to each one of such characters mechanism cooperating therewith to displace from the plane of a ticket portions thereof conforming in outline to such characters.

7. Two or more series of marking characters arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby each one of such series may be moved

only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the marking characters therein until the next series of higher denomination has been advanced one step in a cycle of its marking characters, means whereby all of the characters standing for each different relation between the several steps in the cycles of the marking characters in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, means whereby, at the time of such operation of such characters, there is opposed to each one of such characters mechanism cooperating therewith to displace from the plane of a ticket portions thereof conforming in outline to such characters, and means whereby the mechanism for actuating such characters is inoperative except when a character in each one of such series is in operative relation to such mechanism cooperating therewith to displace from the plane of the ticket such portions thereof.

8. Two or more series of marking characters arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby each one of such series may be moved only progressively or forward so as to bring the marking characters in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the marking characters therein, and only after all the marking characters in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the marking characters therein until the next series of higher denomination has been advanced one step in a cycle of its marking characters, means whereby, at the time of the operation of such characters, there is opposed to each one of such characters mechanism cooperating therewith to displace from the plane of a ticket portions thereof conforming in outline to such characters, and means whereby the mechanism for actuating such characters is inoperative except when a character in each one of such series is in operative relation to such mechanism cooperating



therewith to displace from the plane of the ticket such portions thereof.

9. Two or more series of punches with their corresponding dies, means for supporting each series of punches and their corresponding dies whereby the punches of each series may be brought into operative relation with their corresponding dies *seriatim*, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, and means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the cooperating punches and dies therein advances the next series of higher denomination one step in a cycle of its cooperating punches and dies.

10. Two or more series of punches with their corresponding dies, means for supporting each series of punches and their corresponding dies whereby the punches of each series may be brought into operative relation with their corresponding dies *seriatim*, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the cooperating punches and dies therein advances the next series of higher denomination one step in a cycle of its cooperating punches and dies, and means whereby all of the punches and dies standing for each different relation between the several steps in the cycles of the punches and dies in such different series may

be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced.

11. Two or more series of punches with their corresponding dies, means for supporting each series of punches and their corresponding dies whereby the punches of each series may be brought into operative relation with their corresponding dies *seriatim*, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the cooperating punches and dies therein advances the next series of higher denomination one step in a cycle of its cooperating punches and dies, means whereby all of the punches and dies standing for each different relation between the several steps in the cycles of the punches and dies in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, and means whereby the mechanism for actuating such punches and dies is inoperative except when a punch in each series is in operative relation to its corresponding die.

12. Two or more series of punches with their corresponding dies, means for supporting each series of punches and their corresponding dies whereby the punches of each series may be brought into operative relation with their corresponding dies *seriatim*, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomina-



tion, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the co-  
 5 operating punches and dies therein advances the next series of higher denomination one step in a cycle of its coöperating punches and dies, and means whereby the mechanism for actuating such punches and dies is inopera-  
 10 tive except when a punch in each series is in operative relation to its corresponding die.

13. Two or more series of punches with their corresponding dies, means for supporting each series of punches and their corresponding  
 15 dies whereby the punches of each series may be brought into operative relation with their corresponding dies *seriatim*, such punches and dies arranged to give indications of progressive values in one or more cycles in each  
 20 series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the coöperating punches and dies in each one of such series may be  
 25 moved only progressively or forward so as to bring the coöperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or  
 30 more of such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomina-  
 35 tion, have been brought into operative position, and means for preventing the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the coöperating punches and dies therein un-  
 40 til the next series of higher denomination has been advanced one step in a cycle of its coöperating punches and dies.

14. Two or more series of punches with their corresponding dies, means for supporting each  
 45 series of punches and their corresponding dies whereby the punches of each series may be brought into operative relation with their corresponding dies *seriatim*, such punches and dies arranged to give indications of progress-  
 50 ive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomina-  
 55 tion, means whereby the coöperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the coöperating punches and dies in such series into operative position only in  
 60 regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only  
 65 after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of

one or more of such series, except the last, from a last step to a first step in a cycle of the coöperating punches and dies therein  
 70 until the next series of higher denomination has been advanced one step in a cycle of its coöperating punches and dies, and means whereby all of the punches and dies standing for each different relation between the sev-  
 75 eral steps in the cycles of the punches and dies in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced.

15. Two or more series of punches with their  
 80 corresponding dies, means for supporting each series of punches and their corresponding dies whereby the punches of each series may be brought into operative relation with their cor-  
 85 responding dies *seriatim*, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a  
 90 cycle of the next series of higher denomination, means whereby the coöperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the coöperating punches and dies in  
 95 such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only  
 100 after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of one or more of such series, except the last,  
 105 from a last step to a first step in a cycle of the coöperating punches and dies therein until the next series of higher denomination has been advanced one step in a cycle of its coöperating punches and dies, means whereby  
 110 all of the punches and dies standing for each different relation between the several steps in the cycles of the punches and dies in such different series may be operated simulta-  
 115 neously, or nearly so, to indicate the step to which each series has been advanced, and means whereby the mechanism for actuating such punches and dies is inoperative except  
 120 when a punch in each series is in operative relation to its corresponding die.

16. Two or more series of punches with their corresponding dies, means for supporting each  
 125 series of punches and their corresponding dies whereby the punches of each series may be brought into operative relation with their corresponding dies *seriatim*, such punches and dies arranged to give indications of progress-  
 130 ive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the coöperating punches and dies in each one of such series may be  
 moved only progressively or forward so as to



bring the coöperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of  
 5 such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have  
 10 been brought into operative position, means for preventing the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the coöperating punches and dies therein until the next  
 15 series of higher denomination has been advanced one step in a cycle of its coöperating punches and dies, and means whereby the mechanism for actuating such punches and dies is inoperative except when a punch in  
 20 each series is in operative relation to its corresponding die.

17. Two concentrically - arranged wheels each carrying characters representing progressive values, a complete cycle of the characters on a first one of such wheels standing  
 25 for a step in the cycle of the characters on the second wheel, the angular advance between the steps in the cycle of the characters on the first wheel less than that between the steps in the cycle of the characters on the second  
 30 wheel, means carried by the first wheel and engaging the second wheel whereby the angular motion necessary to move the first one of such wheels from the last step in one cycle to the first step in the next succeeding  
 35 cycle of its characters imparts to the second one of such wheels the different and greater angular motion necessary to move such second wheel from one step to the next in the  
 40 cycle of the characters thereon.

18. Two concentrically - arranged wheels each carrying characters representing progressive values, a complete cycle of the characters on a first one of such wheels standing  
 45 for a step in the cycle of the characters on the second wheel, the angular advance between the steps in the cycle of the characters on the first wheel greater than that between the steps in the cycle of the characters on the  
 50 second wheel, means carried by the first wheel and engaging the second wheel whereby the angular motion necessary to move the first one of such wheels from the last step in one cycle to the first step in the next succeeding  
 55 cycle of its characters imparts to the second one of such wheels the different and lesser motion necessary to move such second wheel from one step to the next in the cycle of the characters thereon.

19. Two or more series of punches with their corresponding dies, means for supporting such punches and dies whereby each punch and its  
 60 corresponding die in each series may be brought into proper alinement at the time they are operated, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a

complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means  
 70 whereby the coöperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the coöperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such  
 75 series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only after all the  
 80 punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, and means whereby the movement of one or more of such series, except the last, from a last step to a  
 85 first step in a cycle of the coöperating punches and dies therein advances the next series of higher denomination one step in a cycle of its coöperating punches and dies.

20. Two or more series of punches with their  
 90 corresponding dies, means for supporting such punches and dies whereby each punch and its corresponding die in each series may be brought into proper alinement at the time they are operated, such punches and dies arranged  
 95 to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means  
 100 whereby the coöperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the coöperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such  
 105 series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only after all the  
 110 punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a  
 115 first step in a cycle of the coöperating punches and dies therein advances the next series of higher denomination one step in a cycle of its coöperating punches and dies, and means whereby all of the punches and dies standing  
 120 for each different relation between the several steps in the cycles of the punches and dies in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced.

21. Two or more series of punches with their corresponding dies, means for supporting such punches and dies whereby each punch and its corresponding die in each series may be  
 130 brought into proper alinement at the time they are operated, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series ex-



cept the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the cooperating punches and dies therein advances the next series of higher denomination one step in a cycle of its cooperating punches and dies, means whereby all of the punches and dies standing for each different relation between the several steps in the cycles of the punches and dies in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, and means whereby the mechanism for actuating such punches and dies is inoperative except when a punch in each series is in proper alinement with its corresponding die.

22. Two or more series of punches with their corresponding dies, means for supporting such punches and dies whereby each punch and its corresponding die in each series may be brought into proper alinement at the time they are operated, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means whereby the movement of one or more of such series, except the last, from a last step to a first step in a cycle of the cooperating punches and dies therein advances the next series of higher denomination one step in a cycle of its cooperating punches and dies, and means whereby the mechanism for actuating such punches and dies is inoperative except when a punch in each series is in proper alinement with its corresponding die.

23. Two or more series of punches with their corresponding dies, means for supporting such

punches and dies whereby each punch and its corresponding die in each series may be brought into proper alinement at the time they are operated, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, and means for preventing the movement of one or more of such series except the last, from a last step to a first step in a cycle of the cooperating punches and dies therein until the next series of higher denomination has been advanced one step in a cycle of its cooperating punches and dies.

24. Two or more series of punches with their corresponding dies, means for supporting such punches and dies whereby each punch and its corresponding die in each series may be brought into proper alinement at the time they are operated, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the cooperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the cooperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the cooperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of one or more of such series except the last, from a last step to a first step in a cycle of the cooperating punches and dies therein until the next series of higher denomination has been advanced one step in a cycle of its cooperating punches and dies, and means whereby all of the punches and dies standing for each different relation between the several steps in the cycles of the punches and dies in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced.

25. Two or more series of punches with their corresponding dies, means for supporting such punches and dies whereby each punch and its



corresponding die in each series may be brought into proper alinement at the time they are operated, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the coöperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the co-operating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of one or more of such series except the last, from a last step to a first step in a cycle of the coöperating punches and dies therein until the next series of higher denomination has been advanced one step in a cycle of its coöperating punches and dies, means whereby all of the punches and dies standing for each different relation between the several steps in the cycles of the punches and dies in such different series may be operated simultaneously, or nearly so, to indicate the step to which each series has been advanced, and means whereby the mechanism for actuating such punches and dies is inoperative except when a punch in each series is in proper alinement with its corresponding die.

26. Two or more series of punches with their corresponding dies, means for supporting such punches and dies whereby each punch and its corresponding die in each series may be brought into proper alinement at the time they are operated, such punches and dies arranged to give indications of progressive values in one or more cycles in each series, a

complete cycle in each one of such series except the last standing for a step in a cycle of the next series of higher denomination, means whereby the coöperating punches and dies in each one of such series may be moved only progressively or forward so as to bring the coöperating punches and dies in such series into operative position only in regular progressive order throughout each cycle in such series, means whereby one or more of such series, except the first, can be advanced one step only in a cycle of the coöperating punches and dies therein, and only after all the punches and dies in a complete cycle, in the next series of lower denomination, have been brought into operative position, means for preventing the movement of one or more of such series except the last, from a last step to a first step in a cycle of the coöperating punches and dies therein until the next series of higher denomination has been advanced one step in a cycle of its coöperating punches and dies, and means whereby the mechanism for actuating such punches and dies is inoperative except when a punch in each series is in proper alinement with its corresponding die.

27. Two wheels each carrying characters representing progressive values, a complete cycle of the characters in a first one of such wheels standing for a step in a cycle of the characters on the second wheel, an operating-pawl carried by and articulating with such first wheel, a ratchet on such second wheel arranged to be engaged by such pawl, and a cam for guiding such pawl, such cam coöperating with such pawl to impart to such second wheel angular motions varying according to the conformations of the operating-surfaces of the teeth on such ratchet engaged by such pawl.

WM. H. COOLEY.

Witnesses:

MARK W. KNOWLTON,  
E. M. SMITH.