

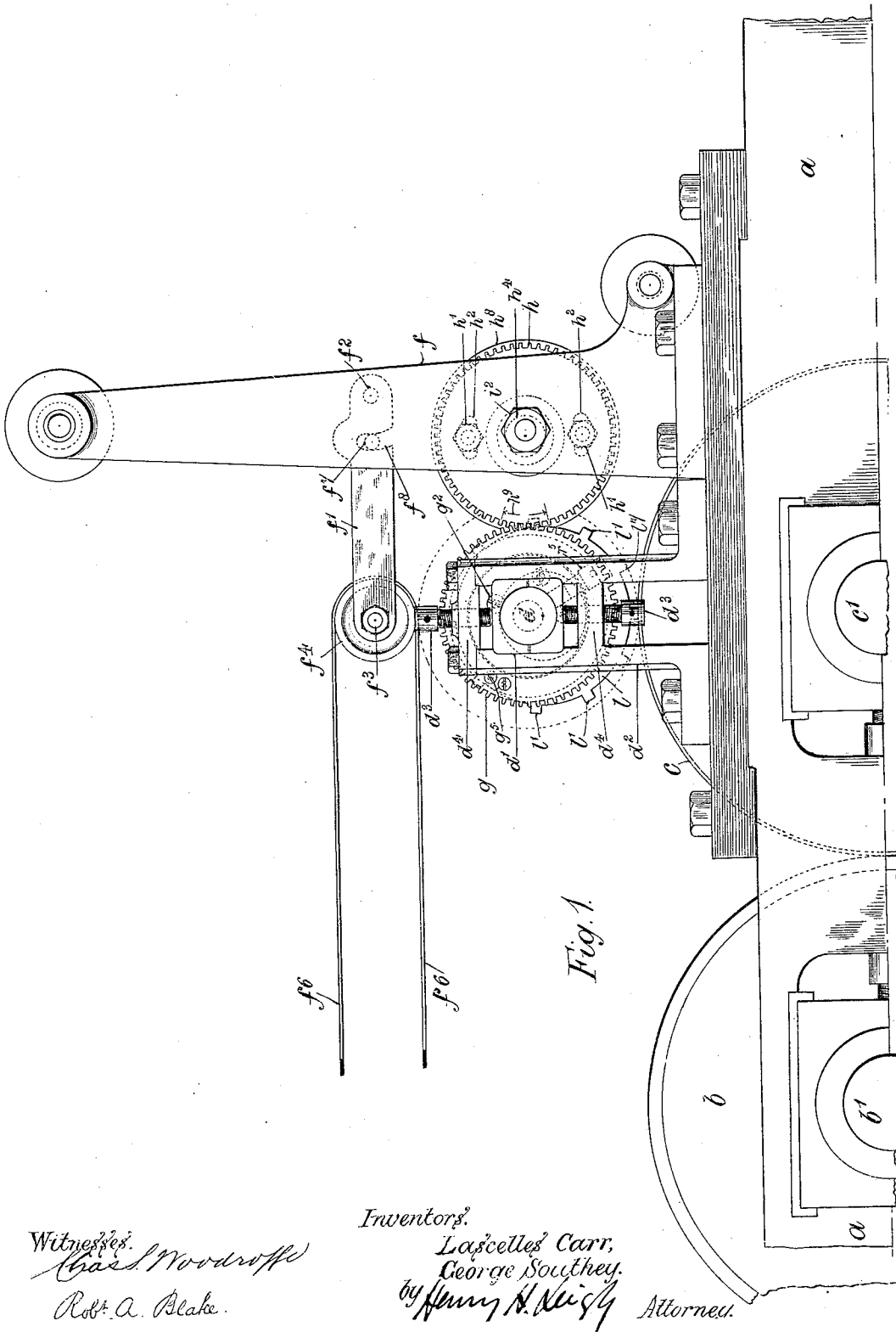
(No Model.)

4 Sheets—Sheet 1.

L. CARR & G. SOUTHEY.
ROTARY NUMBERING MACHINE.

No. 550,482.

Patented Nov. 26, 1895.



Witnesses:

Witnesses.
Chas. L. Woodroffe

Robt. A. Blake.

Inventors?

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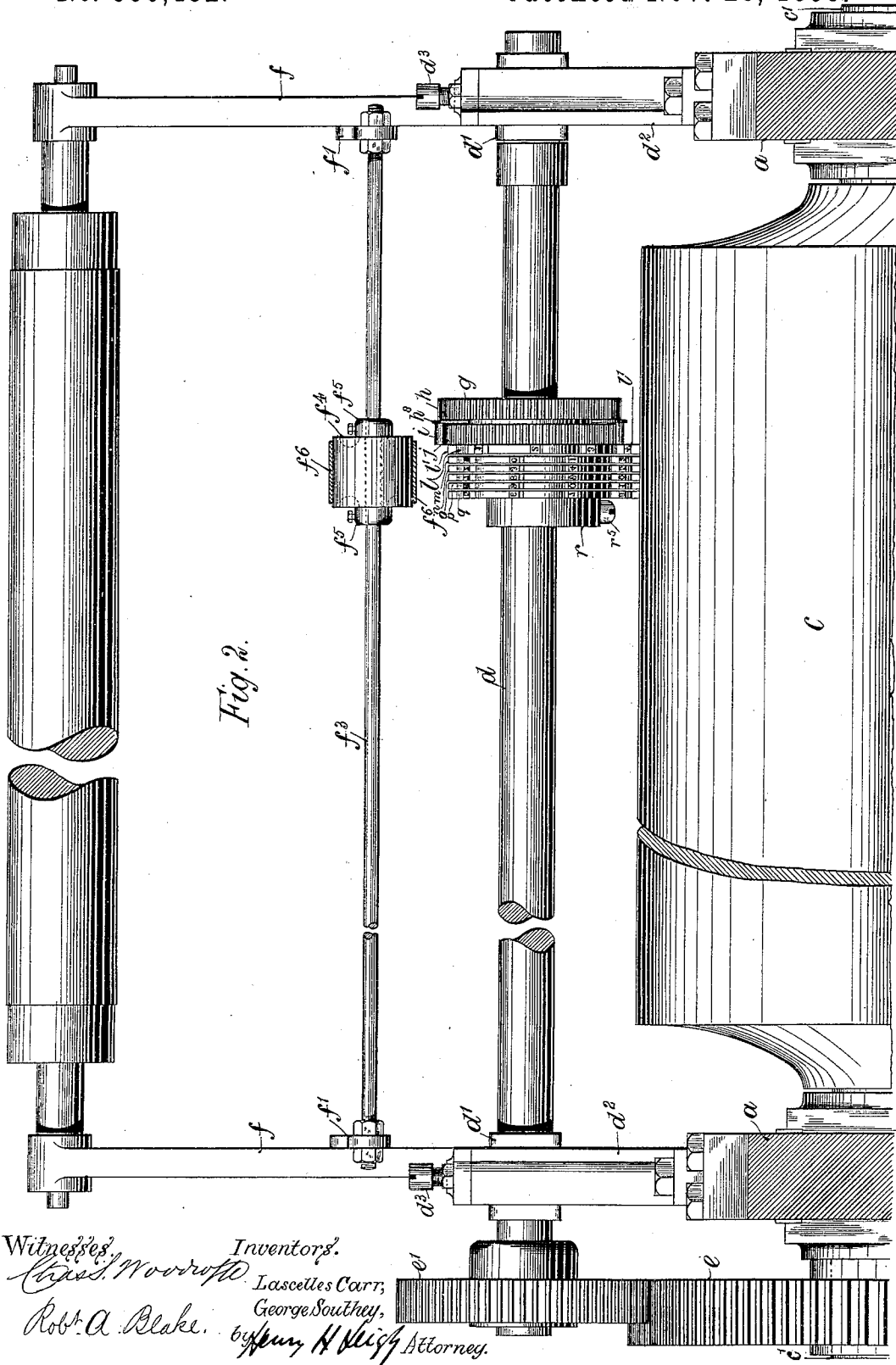
(No Model.)

4 Sheets—Sheet 2.

L. CARR & G. SOUTHEY.
ROTARY NUMBERING MACHINE.

No. 550,482.

Patented Nov. 26, 1895.



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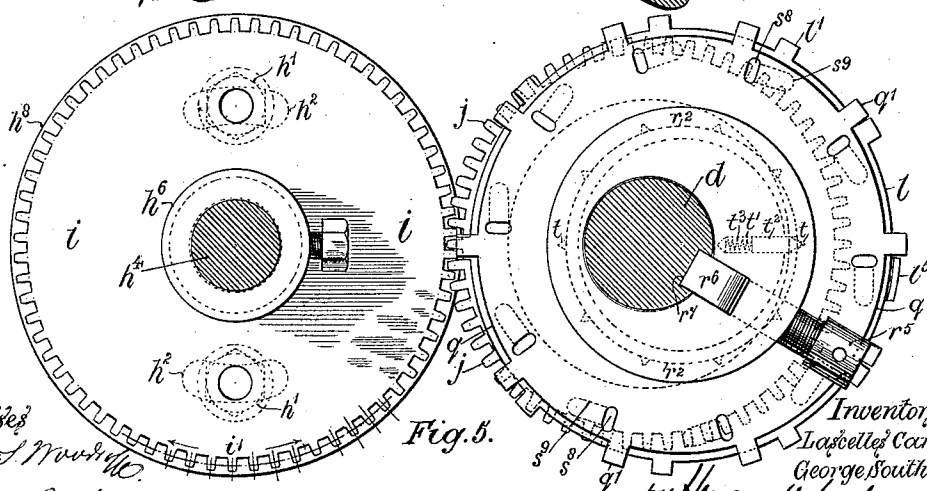
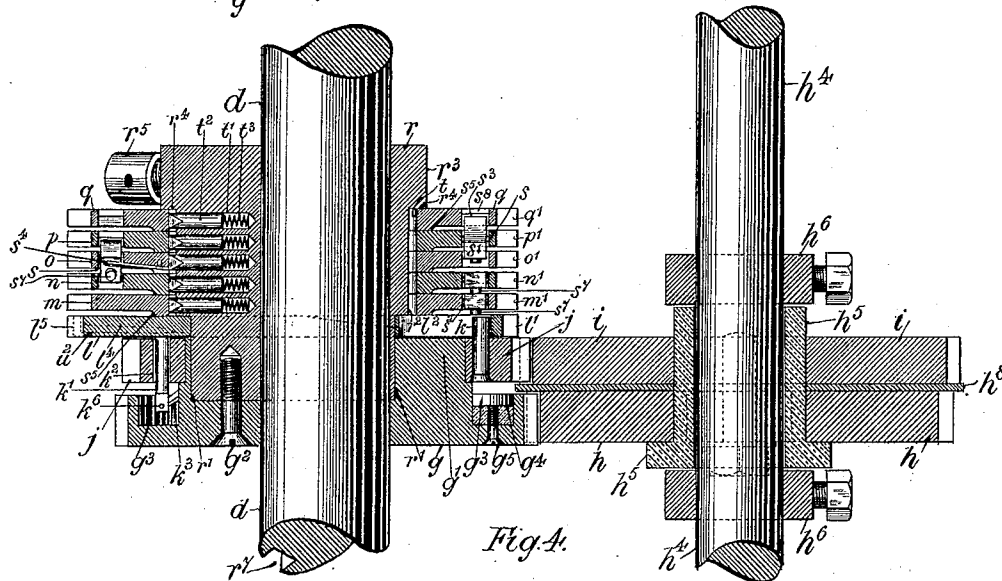
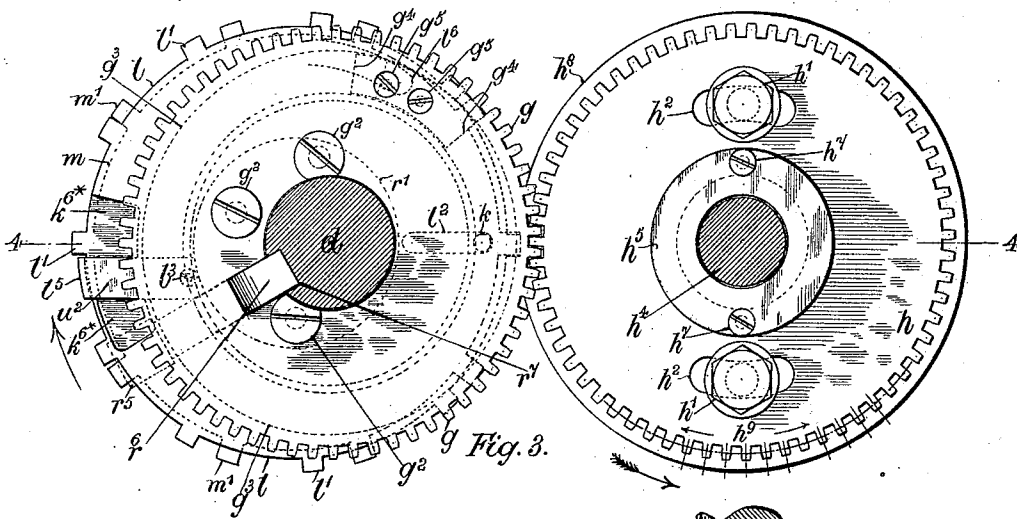
(No Model.)

4 Sheets—Sheet 3.

L. CARR & G. SOUTHEY.
ROTARY NUMBERING MACHINE.

No. 550,482.

Patented Nov. 26, 1895.



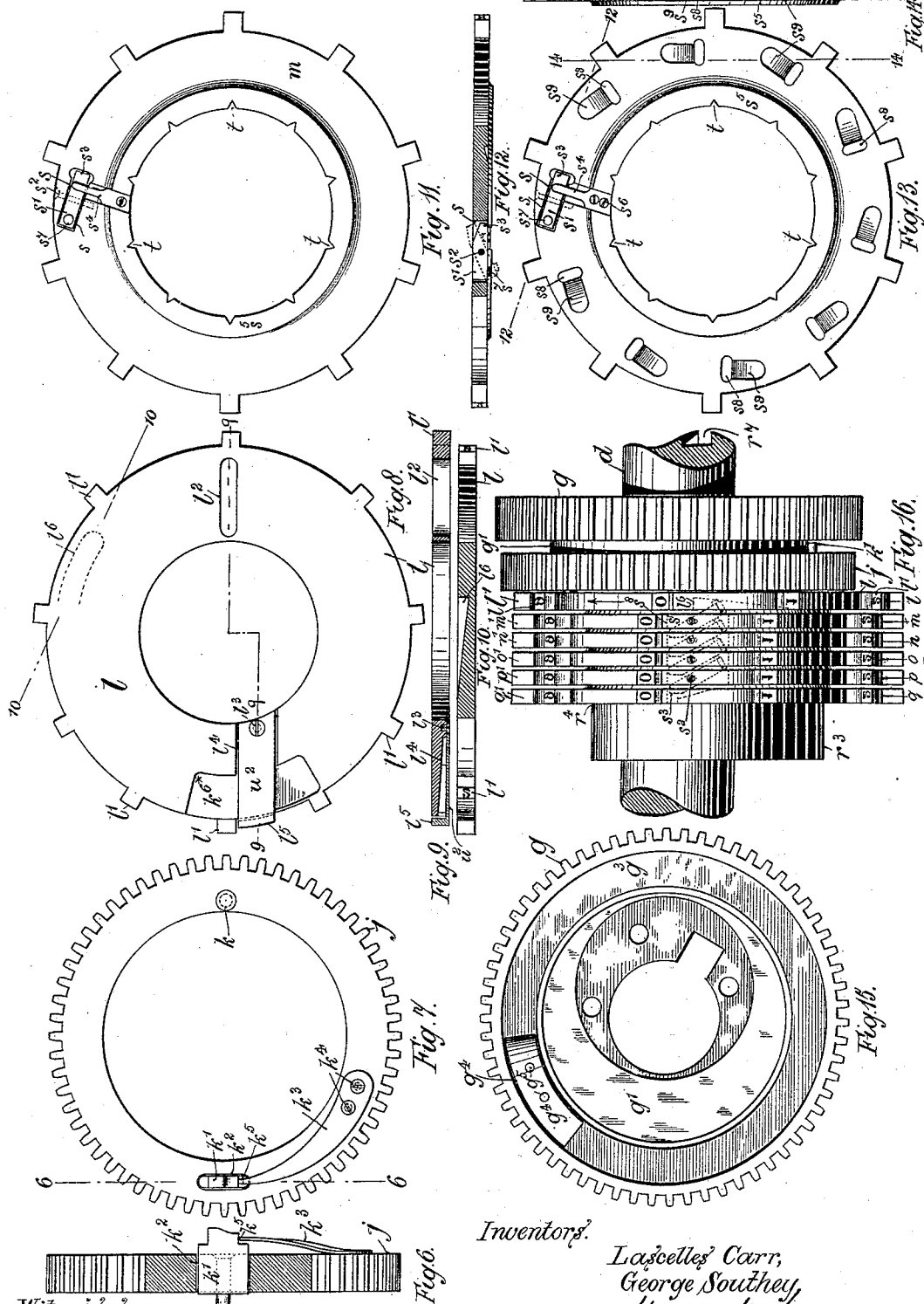
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4 Sheets—Sheet 4.

No. 550,482.

Patented Nov. 26, 1895.



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UNITED STATES PATENT OFFICE.

LASCELLES CARR AND GEORGE SOUTHEY, OF CARDIFF, ENGLAND.

ROTARY NUMBERING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 550,482, dated November 26, 1895.

Application filed May 20, 1893. Serial No. 474,989. (No model.) Patented in England December 5, 1892, No. 22,207.

To all whom it may concern:

Be it known that we, LASCELLES CARR and GEORGE SOUTHEY, subjects of the Queen of the United Kingdom of Great Britain and Ireland, residing at Cardiff, in the county of Glamorgan, England, have invented certain new and useful Improvements in Rotary Numbering-Machines, (for which we have obtained a patent in Great Britain, No. 22,207, dated December 5, 1892;) and we do hereby declare that the following is a full, clear, and exact description of the invention, reference being made to the accompanying drawings, which are to be taken as part of this specification and read therewith, and one which will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to improvements in the mechanism and devices for, first, rotating the printing-disks continuously and for making the units-disk present a fresh type after each impression; second, preventing the impression being slurred; third, advancing the printing-disks to the paper before the impression is made and for withdrawing them afterward, and, fourth, making the tens and higher value disks present a fresh type after each impression.

The accompanying drawings are to be taken as part of this specification and read therewith. They illustrate the construction and use of the invention for and with a printing-machine of the rotary type, for which type it is specially adapted.

Figure 1 is a side elevation of the improved rotary numbering-machine and of the adjacent portions of the rotary printing-machine to which it is applied. Fig. 2 is a front elevation, partly in section, corresponding with Fig. 1. Fig. 3 is a side elevation, on an enlarged scale, of the numbering-machine only. Fig. 4 is a sectional plan taken on the line 4 4 of Fig. 3. Fig. 5 is a side elevation of Fig. 3 reversed. Fig. 6 is a sectional elevation taken on the line 6 6 of Fig. 7. Fig. 7 is a side elevation of the fourth wheel of the mechanism for rotating the printing-disks. Fig. 8 is a side elevation of the (referring to Fig. 2) right-hand face of the units-printing disk. Fig. 9 is a sectional plan taken on the line 9 9 of Fig. 8. Fig. 10 is a sectional plan taken on the line 10 10 of Fig. 8. Fig. 11 is a side

elevation of the right-hand face of the tens-printing disk. Fig. 12 is a sectional plan taken on the line 12 12 of Fig. 13. Fig. 13 is a side elevation of the right-hand face of the hundreds-printing disk. Fig. 14 is a sectional rear elevation taken on the line 14 14 of Fig. 13. Fig. 15 is a front elevation of the inside or cam face of the first wheel of the mechanism for rotating the printing-disks. Fig. 16 is a front elevation of the printing-disks, their eccentric sleeve, the fourth and first wheels of the mechanism for rotating the printing-disks, and of part of the shaft about which the said wheels are rotated.

a a are parts of the side frames of a rotary printing-machine; *b*, the type-cylinder; *b'*, its shaft; *c*, the blanket-cylinder; *c'*, its shaft, and *d*, the principal and first-motion shaft of the numbering-machine. This last-mentioned shaft is supported in bearings *d'*, which are adjustable vertically in either direction in standards *d²* by means of set-screws *d³ d³* working through cross-pieces *d⁴ d⁴*. The standards *d² d²* are bolted upon the side frames *a a*, respectively, in a proper position for supporting the shaft *d* parallel with the shafts *b' c'* and with its axis in the same vertical plane as that of the shaft *c'* of the blanket-cylinder *c*. Suitable provision is made for driving the shaft *d* from any conveniently-situated revolving part of the printing-machine. The details of the mechanism for so driving the shaft *d* may be of any suitable kind. The mechanism illustrated in Fig. 2 consists of a gear-wheel *e* fast on the end of the shaft *c'* and meshing with a second one *e'* fast on the end of the shaft *d*. The ratio between these two gears is shown as three to one, but this may be varied.

f f are a pair of standards bolted upon the respective side frames *a a* immediately behind the standards *d² d²*.

f' f' are a pair of arms pivoted by studs *f² f²* passing through their rear ends into the standards *f f*, respectively, from which they project, standing parallel with each other over the blanket-cylinder *c* and at right angles with it. The front ends of the arms *f' f'* carry a shaft *f³*, with its axis parallel with and in the same vertical plane as that of the shaft *c'*. This shaft *f³* serves as the axis of a drum *f⁴*, revolving freely thereon.

$f^5 f^5$ are a pair of collars fast on the shaft f^3 . They serve to prevent the drum moving to either hand out of its proper position, which is over the printing-disks of the numbering-machine. The function of the drum f^4 is to carry the inking-band f^6 , from which the types of the printing-disks take their ink as they and the band pass and touch each other. This band is a continuous one. Neither the other drum or drums about which it is led nor the mechanism by which it is inked and traversed are illustrated, first, because the construction and action of such devices are well understood, and, secondly, because they do not form any part of the present invention.

$f^7 f^7$ are stops fast on the standards f and engaging in slots $f^8 f^8$ in the arms $f' f'$, for the purpose of preventing them dropping low enough for the contact between the inking-band f^6 and the types of the printing-disks to become too close.

1. *Mechanism for rotating the printing-disks continuously and for making the units-disk present a fresh type after each impression.*—This consists of four gear-wheels g, h, i , and j , pitched and working together in a novel manner. The wheel g is the driver and is held concentrically on the shaft d by the following devices: g' is a bush fast on the side of the wheel g , preferably by being integral with it. It and the wheel are bored to fit and revolve together about the smaller periphery of a sleeve r , described farther on. This sleeve is held fast to the shaft d in the way described farther on and the wheel g to the sleeve by screws g^2 and to the shaft by the gib r^6 . The wheel g , periphery of the collar g' , and the shaft d are concentric with each other. The bore of the collar g' shares the eccentricity of the sleeve r . h is the second and i the third wheel. The former meshes with the driver g . The wheels h and i are held together in order that they shall both revolve with the same angular velocity, but provision must also be made for their being adjusted circumferentially in respect of their several positions about their common axis. The device illustrated for holding them together and for providing for their adjustability also consists of a pair of set-screws $h' h'$, which pass through arc-shaped slots $h^2 h^2$ in the wheel h wide enough to pass their shanks, which are screwed into the wheel i . h^4 is a shaft fixed parallel with the shaft d to the standards $f f$. It receives a loose bush h^5 between a pair of collars $h^6 h^6$, which are made fast to it. The wheels h and i are mounted concentrically upon the bush h^5 and are made fast to it by set-screws h^7 . h^8 is a distance or packing disk between the said wheels.

j is the fourth wheel. It is bored out concentrically to fit upon and revolve about the bush g' , already described, and therefore concentrically with the driver g . The ratios of the four wheels in respect of diameter are as follows: The driver and second wheel g and h are equal, but the third wheel i is one-tenth

larger than the fourth wheel j . The distance between the axes of the shafts d and h^4 is settled by the diameters of the wheels g and h .

The units-disk l and the others of the series receive their motion from the wheel j , through a connection which is described farther on. If the ratios of the four wheels g, h, i , and j were such that the last of them—the wheel j —would revolve with the same velocity as the wheel g the velocity of the units-printing-disk l would be only that which the sleeve r and the wheel g have in common. This velocity, which for the purpose of this specification is hereinafter referred to as the “normal” one, would obviously lead to a repetition of the last impression.

According to the present invention we make special provision for giving the units-disk a velocity higher than its normal one. This acceleration suffices to substitute the next type for the one which has just made an impression upon the paper, the acceleration in question being effected during a rotation of the disk upon its seat. The amount of it is according to the system of notation for which the numbering-machine is made and is produced by the differentiation in the diameters of the wheels j and i , the latter being the larger wheel. As the machine illustrated is made for the decimal notation, the respective diameters of the two wheels are as ten to eleven. Therefore while the sleeve r and the wheels g, h , and i are making one revolution the wheel j and the disk l make one and one-tenth.

The connection between the gear-wheel j and the units-printing disk l is a self-adjusting one, and consists of a stud k^2 on the former entering a slot l^2 in the latter. This connection is self-adjusting in respect of the radial distance between the axis of rotation and the point at which actual contact between the said stud k^2 on the one hand and the said disk l on the other takes place, for that distance must vary from one moment to the other in the way and for the reason next described and explained.

k is a stud fast to the fourth wheel j and projecting from it in a line parallel with the axle of the shaft d . It engages with the units-printing disk l by entering a radial slot l^2 , cut in it for that purpose. The reason for there being a radial slot instead of a hole to receive the stud k is that the motion of the said disk is eccentric to, while that of the stud is concentric with, the shaft d . The position of the stud in the slot is therefore constantly changing. At one moment it is at the outer end of the slot, as illustrated in Fig. 4, and at another it is at the inner end. The rate at which the units-disk l moves varies accordingly, and this variation must be compensated for by setting the type l' on it at varied distances accordingly, as they are shown to be in Fig. 8, because if they were set at equal distances they would not be brought up to the printing-line punctually. They would be either too

soon or too late. The gear-wheel j is thus adapted to travel at the same angular velocity which it is required shall be imparted to both the said wheel and the disk l . The above-mentioned combination of radial slot 7^3 in the disk l and stud K , fast on the wheel j and projecting therefrom into the said slot, constitutes a self-adjusting connection between the two—self-adjusting, that is in respect of the constantly-changing position of the stud in the slot.

2. *Mechanism for preventing the impression being slurred.*—It is obvious that if the gears g , h , i , and j have all their teeth pitched alike the fourth wheel j , and consequently the printing-disks, will be rotated at a regular rate throughout their revolutions. Our invention provides for the rate of the printing-disks being varied to the extent of their receiving a slower movement from the commencement of the impression to the end of it. The advantage gained by the said slower movement is the obviation of the risk of the impression being slurred. According to this part of our invention, the wheels g and j , the driver and the fourth, and the greater portions of the peripheries of the intermediate wheels h and i are pitched alike; but the remaining portions of the two last-mentioned wheels are pitched differently and also differently from each other as follows: The wheel h has sixty-three teeth and a normal pitch of .34. Seven of its teeth h^9 —those included between the pairs of arrows in Figs. 1 and 3—

have a pitch of $.34 - \frac{.34}{20} = .323$, or one-twentieth less than the normal pitch. The wheel i has sixty-six teeth and a normal pitch of .34. Seven of its teeth i' —those included between the pairs of arrow-heads in Fig. 5—have a pitch of $.34 + \frac{.34}{20} = .357$, or one-twentieth greater than the normal.

This differentiation in pitch can be perceived by comparing the distances between the radii through the normally pitched teeth and those drawn through the abnormally-pitched ones in Figs. 3 and 5. It is to be noted that the two sets of seven teeth coincide with each other set with set. This coincidence will be understood from a comparison of the representations of the wheels h and i in Figs. 3 and 5, its object being to provide that the respective meshings of the teeth h^9 with the driver g and of the teeth i' with the fourth wheel j shall be synchronous with each other and with the impression.

We do not confine ourselves to differentiating the pitch of only seven teeth in each of the intermediate wheels, but may differentiate the pitch of as many as the circumstances of any particular case may render necessary to secure the desiderated slower movement during impression term. The shaft h^4 is preferably held to the standards ff by a pair of set-screws i^2 i^3 . The coned ends of these

screws enter holes of a corresponding contour in the respective ends of the shaft h^4 . These holes (not shown in the drawings) are eccentric to the shaft, the object of this eccentricity being to permit of the distance between the axes of the shafts d and h^4 being adjusted at the time that the numbering-machine is being erected.

3. *Mechanism for advancing the printing-disks to the paper before the impression is made and for withdrawing them from the paper afterward.*— l , m , n , o , p , and q are a series of six printing-disks. Each is provided with radially-projecting type l' m' n' , &c., according to the decimal notation, the value of the disks rising accordingly in the direction of the disk q and the quantity of disks being decided by the highest number which the machine is required to print, as heretofore.

The improved mechanism for advancing and withdrawing the disks consists of a cylindrical surface eccentric to the axis about which it is rotated and upon the eccentric surface of which the printed disks are carried and rotated independently of and concentrically therewith. The eccentric surface in question is provided with the sleeve r . It is shown as made with three different diameters. The periphery r' of the smallest diameter carries the units-disks l and the before-described bush g' of the driver g . The periphery r^2 of the intermediate diameter carries the rest of the printing-disks, while the periphery r^3 of the largest diameter provides an annular shoulder r^4 against which the highest-value disk q bears. The three peripheries are concentric with each other. The sleeve r is bored longitudinally to fit on the shaft d , but its bore on the one hand and the three peripheries on the other are eccentric to each other, the degree of eccentricity being equal to the desiderated advance or withdrawal of the disks to or from the paper. The said sleeve is fixed fast, but removably upon the shaft d by a set-screw r^5 , which bears upon a gib r^6 , lying in the slot r^7 in the shaft d .

4. *Mechanism for making the tens and higher value disks present a fresh type after each impression,* Figs. 3 and 4, and 6 to 10.—The units-printing disk l is bored out concentrically to fit upon and rotate freely about the periphery r' of the sleeve r .

w^2 is a radial spring-arm made fast to the outer face of the disk by a screw-pin l^3 passed through the inner end of the arm into the disk. The arm lies normally within a radial groove l^4 cut in the said face to receive it. This groove is cut, preferably, just behind, with reference to the direction of the disk's rotation one of the type l' .

l^5 is a finger carried by the outer end of the spring-arm w^2 . This finger is as long as the disk l is thick. (See Fig. 9.) Its function is to engage behind a type on the tens-disk m for the purpose of rotating the latter one number forward—e. g., from "7" to "8." The groove l^4 is deepened toward the edge of the disk to

allow of the engaging motion of the said arm and finger. The arm u^2 and finger l^5 are actuated by the following device, (see Figs. 4 and 15:)

5 g^3 is an annular concentric groove cut in that face of the driver g which is next to the fourth wheel j . g^4 is a cam-surface held therein and to the driver by screws g^5 . The effective arcual length of this cam-surface is the
10 circumference of the groove g^3 divided by the number of types on a printing-disk.

k' is a push-piece standing parallel with the axis of the shaft d and capable of working to and fro through a hole k^2 in the fourth wheel
15 j . k^3 is a spring made fast by screws k^4 passed through its base into the said wheel j .

k^5 is the operative nose of the spring and stands away from the wheel j in the groove g^3 . This is best seen in Figs. 6 and 7. It is
20 connected to the adjacent end of the push-piece k' by entering a small hole k^6 therein. (See Fig. 4.) The spring k^3 normally holds the push-piece k in the position illustrated in Fig. 4—*i. e.*, with its nose just clear of the
25 opposite face of the units-disk l . The rise of the cam g^4 is parallel with the axis of the shaft d and is equivalent to nearly the thickness of the printing-disk l , the object of such equivalence being that the engagement of the
30 push-piece k' with the said cam-surface g^4 shall protrude the said push-piece far enough in a line parallel with the axis of the shaft d to insure its making the finger l^5 stand across the periphery of the tens-disk m between two
35 of the type m' .

k^{6a} is an arcual enlargement of the groove l^4 . The object of this enlargement is to make room in the printing-disk l for the nose of the push-piece k' to move parallel with the
40 axis of the shaft d as well as about it as a center during the time that it is pushing the spring-arm u^2 far enough and keeping it there long enough to make the tens-disk m present a fresh type m' in the printing-line.

45 The change of type in the printing-disks of higher value than the tens-disk is effected by the following devices, (see Figs. 11 and 12 to 16:.) Each disk from the tens-disk m up to the one of highest value but one engages
50 just before the end of its first revolution with the one of higher value by means of the following device with which each of the said disks is fitted.

s is a slot cut in the disk near to its periphery and parallel with a diameter of it.

s' is a catch standing normally within the slot s . It is pivoted to the disk by a pin s^2 , which passes through it transversely and midway of its length. The leading end of the
60 catch s' is inclined away from the adjacent disk with which it is to engage in the direction of the nose s^3 of the catch. The edge of the nose is radial to the disk and the sides of the catch are at right angles with the said
65 edge. The catch is kept in its normal position—*i. e.*, within its slot s —by two forces acting on it from opposite sides of its pivot, *viz.*,

on one side a radial bar-spring s^4 , the base of which is recessed in the distance-ring s^5 and held to the disk by screw-pins s^6 , and on the
70 other side the contact of the adjacent face of the lower-value disk with the face of a stud s^7 , which projects from the catch beyond the face of the respective disk for a distance equal to the thickness of the distance-ring s^5 .
75 Each distance-ring is in one piece with its disk. Each disk from the tens-disk m upward has ten sockets formed in one of its sides for the catch of the respectively lower-value disk to engage in from time to time, as
80 may be required to rotate it. These sockets are equidistant from each other and all in the path of their respective catches. They are illustrated as being radial slots s^8 cut through the respective disks. There is com-
85 bined with each nine of the slots and entering them on their rear sides (see Fig. 13) a tangential incline s^9 down which the nose of the engaging-catch can slide. The tenth incline is lost in the slot s , except in the case
90 of the highest-value disk q , because the latter has neither slot s nor catch s' in it, inasmuch as being the highest-value disk in the series it has not to move any disk. The act of engagement of a catch with the next higher-
95 value disk is illustrated in Fig. 16. No engagement on the part of any catch is possible until there are in position a socket to receive the nose of a catch and a cavity to receive
100 the tail of the catch. These cavities are provided by the rear portions of the slots s . As there are not any slots in the units-disk l , there is formed in the side of the latter and between the types "1" and "0" an inclined
105 notch l^6 . The depth of the notch increases in the direction of rotation, as shown by the dotted lines in Fig. 16.

The position of the notch l^6 with reference to that of the type on the disk l , as well as with reference to that of the finger l^5 , is im-
110 portant. The function of the said notch is to receive in its deepest part the tail of the catch s' , carried by the tens-disk m , whenever it becomes necessary for the said catch s' to engage in one of the slots s^8 in the disk
115 n to make the latter present a fresh type n' in the printing line. Therefore the notch l^6 occupies the respective dimensions and position illustrated in Fig. 8—*i. e.*, between the
120 "0" and "1" types—at the same radial distance from the axis of the shaft d as the tails of the catches s' , with its deepest part behind the "10" type (speaking in terms of the direction
125 of rotation) and its shallowest part merging into the side of the printing-disk along a radius in front of the "1" type. Further, seeing that the disk n is moved over the sleeve
periphery r^2 by an engagement between the catch s' and a slot s^8 , just mentioned, and that the disk m can be moved over the said sleeve
130 periphery only by the finger l^5 , engaging behind one of its types m' , the arcual distance at which the said finger is fixed from the deepest part of the notch l^6 must be so ad-

justed that the tail of the catch s' , carried by the disk m , will swing threinto at the moment when the said finger l^5 engages behind one of the type m' .

5 The highest-value disk q does not require a catch, but only slots s^8 and inclines s^9 thereto. Each of the printing-disks of higher value than the unit-disk l has ten equidistant notches t cut in the face of the bore of it and transversely of said face. Each notch is radially coincident with the center of a printing-type.

10 t' t' are radial holes bored into the sleeve r in the respective planes of the last-mentioned group of disks. These holes are set out in ten equidistant rows parallel with the axis of the sleeve.

15 t^2 t^2 are locking-catches, each capable of sliding into its cavity flush with the periphery r^2 of the sleeve.

20 t^3 t^3 are the catch-protruding springs.

The nose of each catch is chisel-shaped to fit into the notches t of its respective disk.

25 The machine, constructed as above described, works as follows: Let it be supposed that all the printing-disks present their "0" types in the printing-line. The units-disk l is held in that position by the engagement of the stud k in the radial slot l^2 and the higher-value disks by the engagement of their locking-catches t^2 in the respective notches t . The radius of the maximum eccentricity of the sleeve r is aligned with the vertical diameter of the cylinder c . The two sets of 35 teeth that are pitched out of the normal in the wheels i and j mesh together. The push-piece k^2 stands with one end in the groove g^3 in front (speaking with reference to the direction of rotation) of the step or drop of the cam-surface g^4 and the catches s' in the position indicated by the dotted lines in Fig. 16—i. e., with their noses s^3 each in a slot s^8 . The sleeve r revolves about its own axis once for each impression, during which revolution 45 the types are inked as they pass the inking-device. As the rate at which the sleeve r revolves is regular, that of as many of the printing-disks as are free of the direct control of the wheel j is regular too, for they are 50 carried by it, being held to it by the locking-catches t^2 .

Printing units.—The wheel j makes one and one-tenth revolution for each one that the sleeve r makes and in the same time. 55 Further, it always has the units-printing disk l fast to it. The consequence is that the end of the first revolution of the sleeve finds the "1" type on the said disk l brought into the printing-line and the impression is "000001" instead of "000000." The accelerated speed of the units-disk l is constant, so that at the end of the second revolution it has gained two-tenths of a revolution upon the sleeve periphery r' , whereby the "2" type of the series l' 60 is brought into the printing-line, and so on in regular sequence so long as the machine is at work.

Printing tens.—The printing-disk m is brought into and maintained in operation as follows: By the time that the highest unitary 70 impression "000009" is made the disk l has gained nine-tenths of a revolution upon the sleeve r . During that revolution of the sleeve periphery r' , which immediately precedes the next impression "000010," which latter is the 75 initial of the next higher class of values after the units, there will take place the first of the engagements between the push-piece k' and the cam-surface g^4 . The object of such an engagement is to move the tens-disk m through 80 one-tenth of a revolution in addition to that which it receives from the sleeve periphery r^2 , so that the said disk m may present a fresh type in the printing-line at the end of each tenth revolution of the units-disk l . Each 85 engagement projects the finger l^5 across the periphery of the tens-disk m , making it stand behind one of the type m' thereon. The continued rotation of the disk l takes the finger l^5 up to the said type, and therefore the disk 90 m along with it. The engagement lasts for one-tenth of a revolution of the sleeve periphery r^2 , and is an acceleration of the normal rate of the said sleeve periphery r^2 to the same extent. As the type m' are thirty-six degrees 95 apart from each other, such acceleration presents the "1" type of the series m' in the printing-line by the side of the "0" type of the series l' on the disk l , which last-mentioned type has been brought there by the contemporaneous 100 revolution of the said disk. The disk m is held in its new position by the engagement of the respective locking-catch t^2 in a fresh notch t in it. The next impression is therefore "000010." 105

It has already been explained what are the necessary dimensions of the cam-surface g^4 in respect of its length and of its projection or rise from the bottom of the groove g^3 . Its position in the latter is of equal importance, 110 and will be understood from the following detailed description of the engagement between the push-piece k^2 and the said cam-surface g^4 . This engagement takes place and may take place only during that revolution of the sleeve 115 r which follows any impression the unitary value of which is nine. It is brought about as follows: The push-piece k^2 , rotating at a rate one-tenth faster than that of the cam-surface g^4 , comes up with the latter where the bottom 120 surface of the groove g^3 merges into the said cam-surface immediately after the impression last referred to, and travels over the said cam-surface g^4 during the following revolution of the sleeve periphery r^2 , during which revolution 125 the finger l^5 on the spring-arm u^2 (the latter being actuated by the push-piece k^2) is projected across the periphery of the disk m and engages with the type m' in front of it. When the revolution in question is finished, 130 the push-piece k^2 leaves the cam-surface g^4 and is withdrawn from the spring-arm u^2 by the spring k^3 .

The above-described co-operation between

the cam-surface g^4 , the push-piece h^2 , the spring-arm u^2 , the finger l^5 , and one of the type m' is repeated during each subsequent tenth revolution of the sleeve periphery r^2 , whereby the tens-disk m is made to present in the printing-line all its types, one after the other, in the order of their value. The recurrence of the same type m' in each of the nine revolutions of the sleeve periphery r^2 , which intervene between any two of the tenth revolutions mentioned in the preceding paragraph, is due to the engagement of the respective locking-catch t^2 in the proper notch t in the disk m , whereby the latter is held to the sleeve periphery r^2 and must rotate with it. During the said intervening nine revolutions the notch l^6 will move over the tail end of the catch s' , carried by the printing-disk m nine times, but at none of these contacts will there be an engagement between the said catch s' and the printing-disk n sufficient to move the latter, because the slot l^6 moves smoothly over the tail end and the said disk n is held to the sleeve periphery r^2 by its locking-catch t^2 . The engagements of the finger l^5 behind the types m' always take place at the same point in the revolution in the machine, and consequently each engagement is with the type m' that stood behind the one concerned in the immediately preceding engagement.

Printing hundreds.—The hundreds-printing disk n is brought into and maintained in operation as follows: At the moment when the nine types on the printing-disks l and m are side by side in the printing-line the deepest part of the notch l^6 in the said disk l is opposite the tail end of the catch s' , carried by the disk m , and the nose s^3 thereof opposite the radial slot s^8 close to the "1" type of the n' series. The respective spring s^4 swings the said tail end into the notch l^6 and the said nose s^3 into the said radial slot s^8 . This engagement of catch s' and slot s^8 is accompanied by that of the finger l^5 , behind a type m' . This double engagement puts both disks m and n under the control of the stud k , fast on the wheel j . Consequently, during the revolution of all the parts mentioned, which follows the impression "000099," the disk l brings up its type "0" into the printing-line, moves the disk m through one-tenth of a revolution beyond that shared by it with the sleeve periphery r^2 , the latter brings up its type "0" into the printing-line and further liberating the disk n from the hold of its locking-catch t^2 makes it partake its own accelerated motion of one-tenth of a revolution and bring up its type "1" into the printing line also, whereupon the disk n is re-engaged by its locking-catch t^2 . The next impression will be "000100," which is the initial impression of the next higher class of values after the tens. The cycle of changes from "1" to "99," or the part of the disks l and m will be repeated, during which repetitions the disk n remains locked to the sleeve periphery r^2 . Then the

engagement above described between the deepest part of the notch l^6 and the catch s' , carried by the disk m and a radial slot s^8 in the disk n is repeated, only this time it is the slot s^8 next to the "2" type of the n' series which is concerned instead of the one next the "1" type. When the impression "000999" has been made, the catch s' in the disk n engages during the revolution of the sleeve r immediately following such impression in a radial slot s^8 in the disk o and moves it through one-tenth of a revolution in addition to that which it shares with the said sleeve.

All subsequent changes of type on any printing-disk are effected in the respective ways described above.

It should be borne in mind that all the printing-disks from and including the tens-disk m upward are held in their respective positions upon the sleeve periphery r^2 by the respective locking-catches t^2 , and that one of such disks is liberated from the hold of its catch t^2 only by the engagement of the finger l^5 behind the type m' at the moment of and by which engagement the driving energy of the stud k is brought to bear upon through the intervening parts, upon the hold of said locking-catch t^2 upon the said disk.

We claim—

1. The combination of a printing disk having its type set thereon at unequal distances apart according to the varying rate at which the said type are rotated; a gear wheel adapted to travel at the angular velocity which it is required to impart to the said disk and gear wheel; a self-adjusting connection between the said disk and gear wheel; means for supporting the said disk and gear wheel in their respective operative positions, and means for rotating said gear wheel.

2. The combination with the printing disks of a numbering machine, of a slot in each disk of the series excepting the first or units disk and the last or highest value disk, a catch held in the said slot of each of the said disks by a pivot radial to the axis of the said disk and upon which the said catch may be swung; a series of sockets in the side of each of the disks from the second or tens disk to the last disk inclusive, the said sockets standing in the path of the catch in the disk of next lower value; a spring on each slotted disk adapted to press the catch into one of the sockets in the disk of next higher value; and a notch in the first or units disk adapted to allow of the catch on the second or tens disk swinging on its pivot by receiving its tail.

3. The combination with the printing disks of a numbering machine, of a radial spring arm on the units disk; a finger on the end of the said arm, carried by it outside the said disk, a cam surface rotating with the units disk and adapted to engage with the said arm during each tenth revolution and to hold it for a definite time behind a type on the second or tens disk; between two of the type thereon, and adapted to be held by the said

arm between any two types on the said first or units disk; a slot in each disk of the series excepting the first or units disk and the last or highest value disk; a catch held in the said slot of each of the said disks by a pivot radial to the axis of the said disk and upon which the said catch may be swung; a series of sockets in the sides of each of the disks from the second or tens disk to the last disk inclusive, the said sockets standing in the path of the catch in the disk of next lower value; a spring on each slotted disk adapted to press the catch into one of the sockets in the disk of next higher value; and a notch in the first or units disk adapted to allow of the catch on the second or tens disk swinging on its pivot by receiving its tail.

4. The combination with the printing disks of a rotary numbering machine, of a radial spring arm on the first or units disk; a finger on the end of the said arm and carried by the latter outside the said disk between two of the type thereon; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the second or tens printing disk after each impression by the highest value type on the said first disk, and a spring on the first mentioned gear adapted to withdraw the said finger from between the said two types after the said impression.

5. The combination with the printing disks of a rotary numbering machine, of a slot in each disk excepting the first or units disk and the last or highest value disk; a catch held in the said slot of each of the disks by a pivot radial to the axis of the disk and upon which the said catch may be swung; a series of sockets in the side of each of the disks from the second or tens disk to the last or highest value disk inclusive, the said sockets standing in the path of the catch in the disk of next lower value; a spring on each slotted disk adapted to press the catch into one of the sockets in the disk of next higher value; a notch in the first or units disk adapted to allow of the catch on the second or tens disk swinging on its pivot by receiving its tail; a radial spring arm on the first or units disk; a finger on the end of the said arm and carried by the latter outside the said disk between two of the type thereon; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the second or tens print-

ing disk after each impression by the highest value type on the said first disk, and a spring on the first mentioned gear adapted to withdraw the said finger from between the said two types after the said impression.

6. The combination of a printing disk having its type set thereon at unequal distances apart according to the varying rate at which the said type are rotated about the axis of their disk; a cylindrical surface eccentric to its axis of rotation about which surface the said disk can be rotated; a gear driven at a velocity greater than the normal velocity of the said cylindrical surface, the excess velocity being according to the system of notation for which the disk is made; and a self adjusting connection between the said gear and disk providing for the former driving the latter at the same angular velocity.

7. The combination of a printing disk; a cylindrical surface eccentric to its axis of rotation and a train of gearing adapted to rotate the said disk about the said surface, said train having two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the meshings of the said portions with the driving and driven wheels of the said train being synchronous with the production of the impression.

8. The combination of a printing disk having its type set thereon at unequal distances apart according to the varying rate at which the said type are rotated about the axis of their disk; a cylindrical surface eccentric to its axis of rotation about which the said disk can be rotated concentrically therewith; and a train of gearing adapted to rotate the said disk about the said surface, the said train having two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the meshings of the said portions with the driving and driven wheels of the said train being synchronous with the production of the impression.

9. The combination of a printing disk having its type set thereon at unequal distances apart according to the varying rate at which the said type are rotated about the axis of their disk; a cylindrical surface eccentric to its axis of rotation and about which surface the said disk can be rotated concentrically therewith; a train of gearing adapted to rotate the said disk about the said surface having its first member driven at the normal velocity of the said cylindrical surface and its last member at a higher one according to the system of notation for which the printing disk is made, and two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the driving and driven wheels being synchronous with the production of the impression; and a connection between the said higher velocity or driven

member of the train and the said disk by which the former drives the latter at its own angular velocity.

10. The combination of a first or units printing disk; a second or tens printing disk; a cylindrical surface eccentric to its axis of rotation about which surface the said disks can be rotated concentrically therewith; gearing adapted to rotate the said first disk; a radial or spring arm on the first or units disk; a finger on the end of the said arm, carried by it outside the said disk, between two of the type thereon and adapted to be held by the said arm between any two types on the said second disk; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear wheel rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear wheel rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the said second disk after each impression by the highest value type on the said first disk; and a spring on the first mentioned gear wheel adapted to withdraw the said finger from between the said two types after the said impression.

11. The combination of a first or units printing disk; a second or tens printing disk; a cylindrical surface eccentric to its axis of rotation about which surface the said disks can be rotated; a train of gearing adapted to rotate the said disks about the said surface, the said train having two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their peripheries, the respective meshings of the said portions with the driving and the driven wheels of the said train being synchronous with the production of the impression; a finger on the end of the said arm, carried by it outside the said disk, between two of the type thereon, and adapted to be held by the said arm between any two types on the said second disk; a radial or spring arm on the first or units disk; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear wheel rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear wheel rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the said second disk after each impression by the highest value type on the said first disk; and a spring on the first mentioned gear wheel adapted to withdraw the said finger from between the said two types after the said impression.

12. The combination of a first or units printing disk; a second or tens printing disk; a cylindrical surface eccentric to its axis of rotation about which surface the said disks can be

rotated concentrically therewith; a train of gearing adapted to rotate the said disks about the said surface, the said train having its first member driven at the normal velocity of the said cylindrical surface and its last member at a higher one according to the system of rotation for which the numbering machine is made, and two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the meshings of the said portions with the driving and driven member respectively being synchronous with the production of the impression by the aligned types; a connection between the said higher velocity or last member and the first or units disk by which the former drives the latter at its own angular velocity; a finger on the end of the said arm, carried by it outside the said disk, between two of the type thereon, and adapted to be held by the said arm between any two types on the said first disk; a radial or spring arm on the first or units disk; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear wheel rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear wheel rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the said second disk after each impression by the highest value type on the said first disk; and a spring on the first mentioned gear wheel adapted to withdraw the said finger from between the said two types after the said impression.

13. The combination of a series of printing disks; a cylindrical surface eccentric to its axis of rotation and about which the said disks can be rotated concentrically therewith; a train of gearing for rotating them, having its first member driven at the normal velocity of the said series and its last at a higher one according to the system of rotation for which the disks are made; a connection between the said last member and the lowest value disk of the series by which the latter is rotated at the same rate as the former; and an automatic device in each disk adapted to engage the disk of next higher value during that rotation of the series of disks about the cylindrical surface which precedes the initial impression of any class of values and to accelerate its rate of rotation.

14. The combination of a series of printing disks; a cylindrical surface eccentric to its axis of rotation about which surface the said disks can be rotated concentrically; a train of gearing adapted to rotate the said disks about the said surface, the said train having two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the driving and the driven members of

the said train being synchronous with the production of the impression; and mechanism for causing the printing disks to present a higher number after each rotation.

5 15. The combination of a series of printing disks with a train of gearing for rotating them having its first member driven at the normal velocity of the said series and its last at a higher one according to the system of notation for which the disks are made and two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the first and last members of the train being synchronous with the production of the impression by the aligned types.

16. The combination of a series of printing disks; a cylindrical surface eccentric to its axis of rotation about which surface the said disks can be rotated concentrically; a train of gearing adapted to rotate the said disks about the said surface, the said train having two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the driving and the driven wheels respectively of the said train being synchronous with the production of the impression; a finger carried between two types on the first or units disk of the said series by an arm carried by the said disk and adapted to hold the said finger between any two types on the second or tens disk of the said series; and a device on the said gearing adapted to push the said finger between two types on the said second or tens disk after the production of each impression by the highest value type on the said first or units disk and to release it afterward.

17. The combination of the printing disks of a numbering machine; a cylindrical surface eccentric to its axis of rotation about which surface the said disks can be rotated concentrically; a train of gearing adapted to rotate the said disks about the said surface, the said train having two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the driving and driven wheels of the said train being synchronous with the production of the impression; a finger on the end of the said arm, carried by it outside the said disk, between two of the type thereon, and adapted to be held by the said arm between any two types on the second or tens disk of the said series; a radial or spring arm on the first or units disk; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear wheel rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear wheel rotating concentrically with and by the side of the one last mentioned and

adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the said second disk after each impression by the highest value type on the said first disk, a spring on the first mentioned gear wheel adapted to withdraw the said finger from between the said two types after the said impression; and mechanism for effecting the advance motions of the higher value disks in the required order.

18. The combination with the several printing disks of a numbering machine, of a slot in each disk of the series excepting the first or units disk and the last or highest value disk; a catch held in the slot of each of the said disks by a pivot radial to the axis of the respective disk and upon which the said catch may be swung; a series of sockets in the side of each of the disks from the second or tens disk to the last disk inclusive, the said sockets standing in the path of the catch in the disk of next lower value; a spring on each slotted disk adapted to press the catch into any one of the sockets in the disk of next higher value; a notch in the first or units disk adapted to allow of the catch in the second or tens disk swinging on its pivot by receiving its tail; a cylindrical surface eccentric to its axis of rotation about which surface the said disks can be rotated concentrically therewith; a train of gearing adapted to rotate the said disks about the said surface, having two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the driving and driven wheels of the said train being synchronous with the production of the impression by the aligned types; a finger on the end of the said arm, carried by it outside the said disk, between two of the type thereon, and adapted to be held by the said arm between any two types on the second or tens disk of the said series; a radial or spring arm on the first or units disk; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear wheel rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear wheel rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the said second disk after each impression by the highest value type on the said first disk; and a spring on the first mentioned gear wheel adapted to withdraw the said finger from between the said two types after the said impression.

19. The combination of the printing disks of a numbering machine; a cylindrical surface eccentric to its own axis of rotation about which surface the said disks can be rotated concentrically; a train of gearing adapted to rotate the said disks about the said surface,

having its first member driven at the normal velocity of the said cylindrical surface and its last member at a higher one according to the system of notation for which the printing disks are made, and two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the driving and driven members of the train of gearing being synchronous with the production of the impression by the aligned types; a connection between the said higher velocity or last member of the train of gearing and the first or units disk of the series by which the former is adapted to drive the latter at its own angular velocity; a finger on the end of the said arm, carried by it outside the said disk, between two of the type thereon, and adapted to be held by the said arm between any two types on the said first disk; a radial or spring arm on the first or units disk; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear wheel rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear wheel rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the said second disk after each impression by the highest value type on the said first disk; a spring on the first mentioned gear wheel adapted to withdraw the said finger from between the said two types after the said impression; and mechanism for effecting the advance motions of the higher value disks in the required order; and devices for making the higher value disks of the series present a higher number after the production of each impression.

20. The combination with the several printing disks of a numbering machine, of a slot in each disk of the series excepting the first or units disks and the last or highest value disk; a catch held in the said slot of each of the said disks by a pivot radial to the axis of the said disk and upon which the said catch may be swung; a series of sockets in the side of each of the disks from the second or tens disk to the last disk inclusive, the said sockets standing in the path of the catch in the disk of next lower value; a spring on each slotted disk

adapted to press the catch into any one of the sockets in the disk of next higher value; a notch in the first or units disk adapted to allow of the catch on the second or tens disk swinging on its pivot by receiving its tail; a cylindrical surface eccentric to its axis of rotation about which surface the said axis can be rotated concentrically therewith; a train of gearing adapted to rotate the said disk about the said surface, having its first member driven at the normal velocity of the said cylindrical surface and its last member at a higher one according to the system of notation for which the printing disks are made, and two intermediate and adjacent wheels differentiated in respect of the pitch of angularly coincident portions of their toothed peripheries, the respective meshings of the said portions with the driving and driven members of the train of gearing being synchronous with the production of the impression by the aligned types; a connection between the said higher velocity or last member of the train of gearing and the first or units disk by which the former drives the latter at its own angular velocity; a finger on the end of the said arm, carried by it outside the said disk, between two of the type thereon, and adapted to be held by the said arm between any two types on the said first disk and a radial or spring arm on the first or units disk; a push piece adapted to work to and fro in a line parallel with the axis of the numbering machine through a gear wheel rotating concentrically with and by the side of the said first disk; a cam surface in an annular groove of a gear wheel rotating concentrically with and by the side of the one last mentioned and adapted to engage the said push piece and to thereby make it push the finger above mentioned between two types on the said second disk after each impression by the highest value type on the said first disk; a spring on the first mentioned gear wheel adapted to withdraw the said finger from between the said two types after the said impression.

In witness whereof we have hereunto affixed our signatures, in presence of two witnesses, this 29th day of March, 1893.

LASCELLES CARR.
GEORGE SOUTHEY.

Witnesses:

JNO. A. DAY,
ARTHUR DAVIES.