2 Sheets—Sheet 1.

P. F. PETTIBONE.

Tax-Calculator.

No. 212,498. **Patented Feb. 18, 1879.**

Fig: 1.

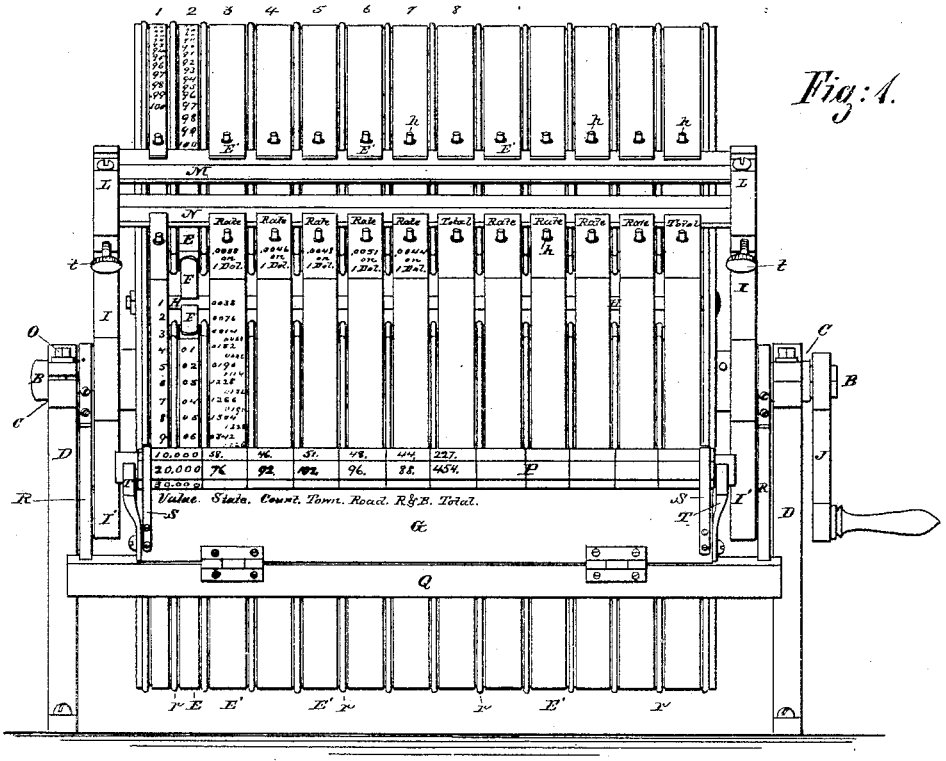

Fig: 2.

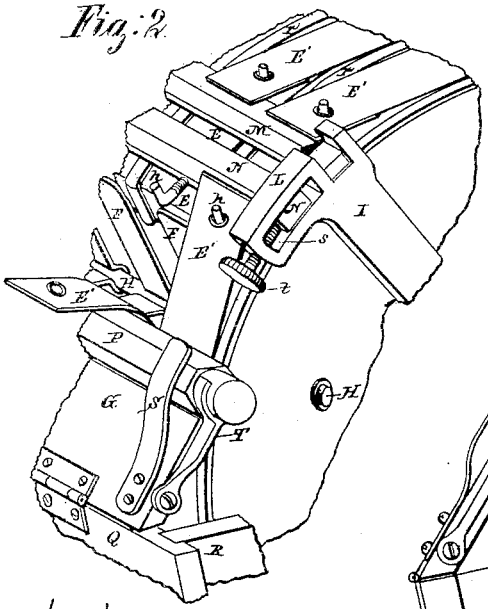

Fig: 3.

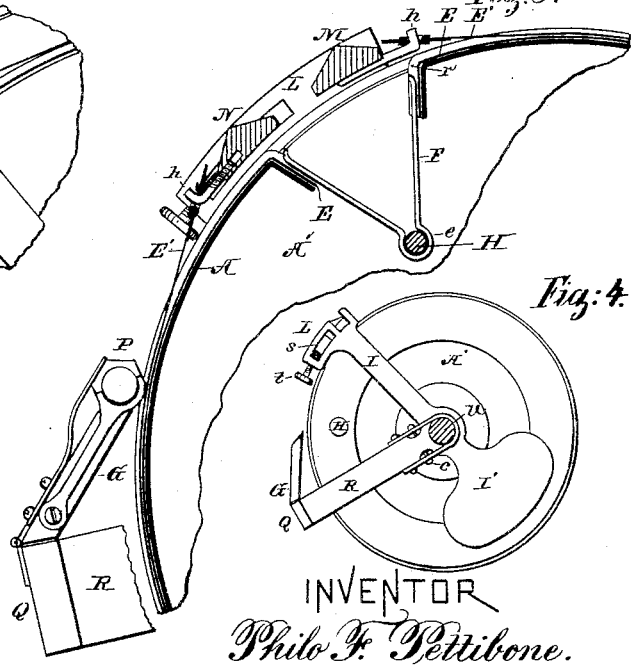

Fig: 4.

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2 Sheets—Sheet 2.

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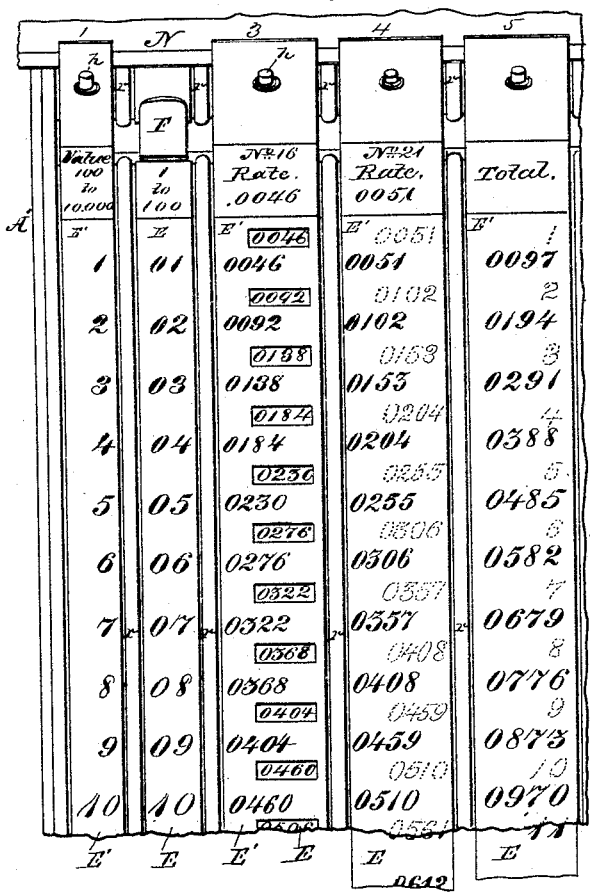
Fig: 5.



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UNITED STATES PATENT OFFICE.

PHILO F. PETTIBONE, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN TAX-CALCULATORS.

Specification forming part of Letters Patent No. **212,498**, dated February 18, 1879; application filed October 1, 1878.

To all whom it may concern:

Be it known that I, PHILO F. PETTIBONE, of the city of Chicago and State of Illinois, have invented certain new and useful Improvements in Tax-Computing Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to an apparatus intended to facilitate the computation and summation of taxes as they are required to be estimated in State, county, or district offices; and to that end it consists in the several devices and combination of devices hereinafter fully described.

In the drawings, A is a cylinder, circumferentially ribbed at *r r*, and fitted to rotate freely on the shaft B, which is supported in bearings C C of standards D. In the circumference of the cylinder A means are provided for securing both ends of a set or series of bands, E E, so that they will severally lie taut upon the cylinder between the ribs *r r*.

In Fig. 3 of the drawings the cylinder is clearly shown as being made of sheet metal, having the ribs *r* swayed outwardly therefrom, A′ being one of the two sheet-metal heads, provided with suitable central bearings to ride the shaft B. The band-fastening device referred to is also herein clearly shown to consist in a longitudinal gap in the cylinder, formed by bending the edges of the cylindric metal sheet inwardly, and a series of metal springs arranged to bear upon such inbent margins, and lying severally between adjacent ribs *r*. The springs shown consist of metal strips F, bent at the middle to form eyes *e*, through which and the cylinder-heads A′ passes the rod H, holding them properly in place.

In applying the bands to the cylinder by means of the springs described, one end of a band is inserted beneath the spring at one side of the gap, the band is drawn taut around the cylinder between the proper ribs, and the other end secured at the other side of the gap in like manner as the first. Marks on the bands will guide the operator in their application to bring them in proper position relative to each other, for purposes hereinafter explained.

Referring to Fig. 1, which presents a front view of the machine, the set of bands thus described as fixed to the cylinder will occupy the spaces numbered at the top 2, 3, 4, &c.

I I are arms, made fast to the shaft B, and rotated with it by means of the crank J, or otherwise. These arms extend in one direction beyond the cylinder to support the cross-bars M and N, in close proximity to the cylinder, and at the other end they are provided with suitable counter-balances I′. At least one of the cross-bars, as N, is movably secured to the arms, for which purpose the arms terminate in heads L L, each provided with the slot *s*, in which the ends of N slide in a direction parallel with the surface of the cylinder.

Adjustment of the bar N in the slots is effected by means of the set-screws *t*. At points centrally opposite the spaces on the cylinder-surface, between ribs *r r*, hooks *h h* are secured to the cross-bars M N, by which a second set of bands, E′ E′, are applied to the cylinder, not fixedly, as in the case of the former set, E, but movably with the carrier constituted of the arms I and cross-bars M N, which, as already seen, has movement independent of the cylinder on their common axis. The spaces on the cylinder occupied by the bands thus movably applied thereto are those numbered 1, 3, 4, 5, &c., in Fig. 1. Thus it appears that in space 1 there is a single band secured to the carrier; in space 2 there is a single band secured to the cylinder; and in the remaining spaces, 3, 4, 5, &c., there are in each two bands, of which the under one is fixed to the cylinder, and the upper or outer one is secured to the cross-bars M N of the carrier.

It is desirable that all of the bands of the outer series shall be equally taut upon the cylinder. They are therefore punctured and eyeleted, with care to make them of equal length between eyelets; but as a means of individual adjustment of these bands the hooks *h h* are shown to be threaded and to screw to the cross-bar, so that either may be lengthened or shortened to properly adjust a band slightly shorter or longer than others.

On each of the bands 1 and 2, Figs. 1 and 5, are printed the numbers 1 to 100, inclusive,

in the vertical order, (most clearly shown in Fig. 5,) spaces being left between the successive numbers at least equal to, and preferably somewhat greater than, that occupied by the figures themselves. The figures of band 2 represent units and tens of value, and those of band 1 hundreds and thousands of value, wherefore these bands will hereinafter be called "value-bands."

It is plain that, by means of the relatively-movable cylinder and carrier to which they are respectively attached, the value-bands may be brought into positions to read any number required from 1 to 10,000, inclusive—as, for example, the 78 of band 1 brought opposite the 63 of band 2 gives the reading $7,863.

Bands applied to the cylinder at the right of the value-bands described are called "rate-bands." They are made of proper width to fill the spaces on the cylinder-surfaces between adjacent ribs *r r*, and are each printed with an arithmetically progressive series of one hundred numbers, beginning and increasing with a number expressing a given rate per cent. Said series of numbers are arranged in the same vertical order and with the same vertical spaces between them as in the value-bands described, wherefore a rate-band being placed beside a value-band, with the several numbers of one horizontally opposite those of the other, each number of the rate series will correctly express the amount of tax on the opposite value.

As above explained, two rate-bands are applied to each cylinder-space, one above the other. On those of the under set, E, the figures stand near the right of the bands, and are arranged to severally lie horizontally opposite the spaces above the values to which they relate. On those of the upper set, E′, the figures stand two places to the left of those on set E, being related to values in hundreds place, and horizontally in line with the values to which they relate.

The upper set of bands, E′, are either made of transparent material or are perforated in their spaces, as shown at 3, Fig. 5, so that when applied to the cylinder as described—that is, E′ above E—the figures upon the latter are seen through the former in proper position at the right and above them to be added as they stand, to give the total tax at each given rate on a value embracing units to thousands, as the case may be.

To make the distinction between the two series more clear, and to avoid confusion in adding, the under series may be printed in black, and the upper one in red.

It is contemplated to have a large number of rate-bands printed, including all rates likely to be required, and adapted to be applied to the cylinder as described—some as fixed bands E, and an equal number as movable bands E′. In this case, suppose several taxes—as State, county, and town—are to be computed at the respective rates of .0038, .0046, and .0051 on the dollar. From the printed bands provided, those for these rates are selected and applied to the cylinder—the under or black ones by means of the spring-clasps F, and the upper or red ones by means of the carrier-hooks *h h*.

At the right of the rate-bands are similarly affixed two total-bands, one above the other, each bearing a series of numbers expressing the total of all rate numbers in the same horizontal line at the left. Though they are summaries of the same rate series, these total-bands will rarely bear the same figures; for in making up the under one fractions of cents will often be discarded, as required by local law, while in making up the outer one there are no fractions to be rejected. For the outer total, therefore, a printed band may be found among those provided, if the aggregate be not too great.

In the above example a rate series based on .0135 would be a proper total-band for the outer series, E′. The under one will need to be computed specially for the purpose. Fractions of cents may be rejected or saved in the preparation of the lower bands, E, if desired, according to local requirements, and the bands so printed.

To illustrate the use of the machine thus provided with value, rate, and total bands, suppose it be required to compute the several taxes specified on the value $7,860. To obtain their sum, bring the 78 of value-band 1 into convenient position before the eye by means of the crank J, and the 60 of band 2 horizontally opposite to it by rotating the cylinder. The two, taken together, read the required number, 7,860. Proceeding directly to the right of the value number thus produced to the number on each outer rate-band in the same horizontal line, add that of the inner band seen above it, observing the same practice in the rejection of fractions of cents as was observed in preparing the under total-band. The several sums will be the amounts of the several taxes required to be estimated. The total of these taxes will be obtained by adding the corresponding figures on the total-bands.

For the purpose of guiding the eye with greater ease and certainty along the horizontal line of figures upon the rate and total bands, the guide G is provided, hinged to the cross-piece Q, and supported movably by the arms R. These arms have a common center of motion with the cylinder and carrier—namely, the axis of the cylinder or shaft B.

In the drawing the arms are shown clamped by the straps *u u* upon an inward cylindric elongation of the bearing-boxes, concentric with the shaft B. The straps *u* are adapted to be tightened upon said extensions of the bearings by means of the screws *c*, Fig. 4, which will draw the light metal straps into the spaces cut in the arms beneath them, and thus cause them to bind. The guide will thus be held by friction at any desired point, and is either stationary or movable independently of the shaft B or the cylinder A.

The guide may be permanently fixed at any desired point, or it may be in any other manner movably supported.

The guide-piece G is hinged to the cross-piece Q, in order that its upper edge may be brought into close proximity to the bands or figures to be read, and that it may also be lifted when necessary to permit the carrier I M N to pass beneath it.

As the value-bands 1 and 2 together read no higher than ten thousand dollars, for larger sums I have provided the prism P, which is removably attached to the guide G, and is adapted to rotate, so as to present any of its faces uppermost. The prism is shown supported at its ends, reduced for the purpose, in bearings T, and as being temporarily held from rotating by means of the spring S, which is arranged to bear upon the uppermost face of the prism. On the several faces of the prism, opposite the value-bands 1 and 2, are written the values 10,000, 20,000, and the succeeding multiples of 10,000, according to the number of faces on the prism; and at the right of these, opposite the several rate-bands, and in position to be added in with them, are penciled figures expressing the taxes on such numbers at the rates of the bands opposite.

If taxes are then required on, say, $17,863, the 63 of value-band 2, the 78 of band 1, and the 10,000 face of prism P are brought into proper juxtaposition, and the three sets of rate-figures are added. Similarly, total figures on the prism are added in with the totals of the bands to obtain the sum of the several taxes on this amount or valuation.

The figures on the rate-bands described are preferably in four places of decimals, giving on the under set, E, mills and tenths of mills. If, therefore, the value-bands are assumed to read ten higher or ten lower than units to hundreds, the said rate-bands will show, with practical accuracy, the proper taxes on such differently-read values.

In like manner, and for the same reason, the rate-bands may be read ten higher or lower than they are pointed to indicate.

For the purpose of facilitating the operation of the two series of bands as I have applied them to a cylinder, I have provided the set-screw O, worked by a small wrench, by which the cap of the bearing-box C may be made to bind the shaft B, and so set the carrier, with the bands attached, in any desired position. Wherefore, to produce a new reading on the value-bands, first bring the proper figures of band 1 before the eye and lock the shaft and carrier, as described. Then rotate the cylinder by the fingers applied to the heads thereof, A′, until the proper figures of value-band 2 are in place. Finally, move the guide G into position, as already set forth.

When a number of values having the same or proximate thousands figure are to be successively estimated upon—as, say, from 2,000 to 4,000, inclusive—they can all be brought within range of the eye, and no movement of the carrier need be made until they are all disposed of. The carrier can, in this case, remain locked, and only the cylinder and the guide rotated to obtain the proper successive readings.

Of course, any other forms of locking device can be applied to the shaft B in place of that shown, and the cylinder may be made fast to the shaft, and the carrier loose thereon, in which case the locking device might be preferably applied otherwise than to the shaft.

In general, I do not limit myself to the specific devices shown for fixing the separately-detachable bands either to the cylinder or to the carrier, nor to the devices herein employed for obtaining the relative movement of the value, rate, and total bands, nor to the exact construction of my apparatus in other respects as shown, for it is evident that bands may be similarly operated, and to the same effect, on a plane instead of a cylindric surface; and it is also evident that on either a plane or a cylindric surface another value-band and another series of rate and total bands may be applied and operated. The added value-band would be placed at the left of the two described, and the third series of other bands above series E′, as these are now above E. In that case the vertical spaces would need to be greater, and the outer series would probably need to be perforated to reveal two sets of figures, one above the other, the middle series being transparent or perforated, as thought best. Such addition would require an extended frame if made to work in a plane, or, if otherwise, a cylinder having a circumference much greater than the length of the printed portion of the bands, in order to avoid certain mechanical difficulties. Wherefore the use of the two bands only with the prism P for occasional higher values is believed to be preferable.

It is further plain that at the right of one double series of value, rate, and total bands, as described, others may be applied to the cylinder, either for other values, rates, and totals, or for other rates and totals having reference to the values of bands 1 and 2.

The apparatus described may be adapted to the computation of interest, and to other commercial or actuarial uses, by the substitution of bands for those described as the several purposes may require.

The following is an actual problem worked according to directions above given. Say the value-bands are set at 72.86. The black and red bands will then read as below. The prism is set 20,000. Then—

Rates.	.0038	.0046	.0051	.0048	.0044	Totals.
Value.—Black	.3268	.3956	.4386	.4128	.3784	1.97
72.86 Red	27.36	33.12	36.72	34.56	31.68	163.44
20,000	76.00	92	102	96	88	454
	103.69	125.52	139.16	130.98	120.06	619.41

In a plane or cylindric machine having relatively-movable bands, as described, the bands may be all arranged side by side, instead of upon each other, as herein explained; but such

arrangement would bring the figures to be added in the same horizontal line, instead of above one another, in which position their addition would not only be far less convenient, but would also be extremely liable to error.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. A computing-machine having relatively-movable rate and value bands, each bearing two places of figures—that is to say, the right-hand band bearing units and tens, the next hundreds and thousands, and so on for others to the left of these.

2. In combination with two or more relatively-movable value-bands, two or more series of rate or of rate and total bands, connected, in a manner to be separately detachable, with mechanism adapted to hold each series in fixed relation with the particular value-band to which it arithmetically relates, substantially as described.

3. The combination, in a computing-machine, of double bands or a double series of bands bearing numerical figures, one of the bands or series of bands being movable upon the other, and transparent, so as to disclose the figures on the under band or series, substantially as described.

4. In a computing apparatus, the combination of the rotating cylinder A and the separately-rotating carrier I M N, both having a common axis, and both adapted to hold a series of bands encircling the cylinder, substantially as and for the purposes specified.

5. The combination of the cylinder A and the circumferentially-moving carrier I M N, each provided with mechanism by which a number of bands may be separately applied and detached.

6. In the combination of the cylinder A, carrier I M N, and the bands E and E′, the circumferential ribs *r r* upon the cylinder, substantially as shown and described, and for the purposes set forth.

7. In combination with the cylinder A, carrier I M N, and bands E and E′, bearing numerical figures, as described, the fixed or movable guide G, substantially as and for the purposes set forth.

8. The combination, with the relatively-movable value-bands 1 2 and the rate or the rate and total bands of series E and E′, of the prism P, bearing the higher value numbers in multiples of 10,000, and adapted to have penciled thereon other numbers opposite the rate and total bands, substantially as described.

9. In combination with the cylinder A, a circumferentially-moving carrier having adjustable cross-bars M N, provided with hooks *h h*, or other devices for holding and separately releasing a number of bands encircling the cylinder, substantially as described.

10. In combination with the cross-bars M N and the bands E′, the hooks *h h*, adapted to screw to the cross-bars or one of them, or other equivalent devices, whereby the bands E′ may be separately adjusted to the cylinder, substantially as described.

11. In the combination of a shaft, B, bearing the fixed arms I of the carrier I M N, and also bearing the loosely-rotating cylinder A, mechanism for binding the shaft in its bearings, or otherwise holding the shaft and carrier rigidly, while the cylinder is free to rotate within it, substantially as described.

12. The guide-arms R, hinged to inward or outward projections of the shaft-bearings C, so as to have a common center of motion with the shaft, but adapted to move or be fixed independently of the shaft.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

PHILO F. PETTIBONE.

Witnesses:
M. E. DAYTON,
A. D. HOFFMAN.