C. P. SULLIVAN.
Adding-Machine.

No. 228,416. Patented June 1, 1880.

Fig. 1

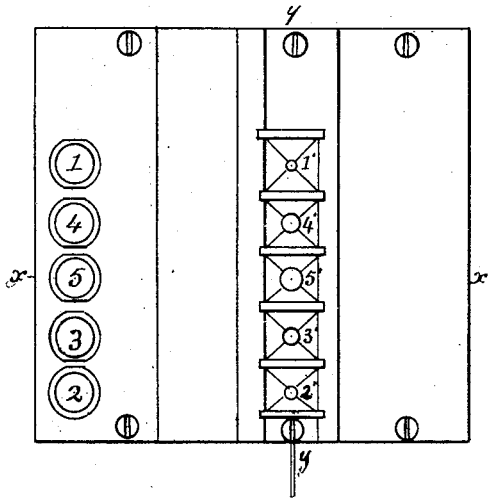
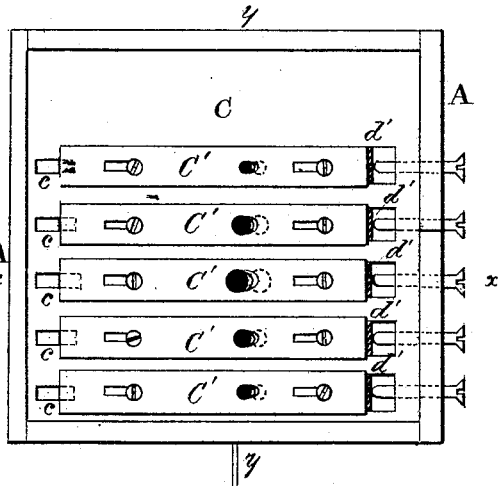


Fig. 2.



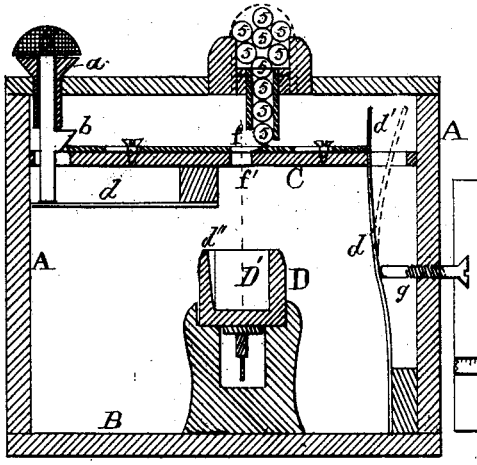


Fig. 3.

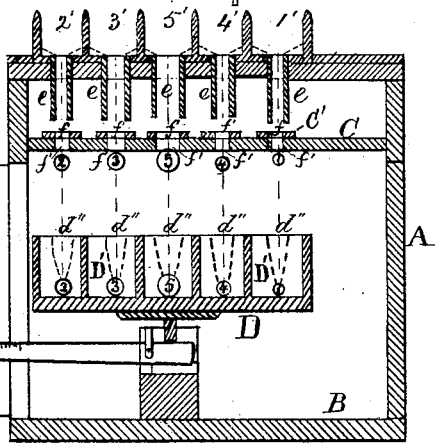


Fig. 4

Witnesses
John Lockie
R. P. Edwards

Inventor
Charles P. Sullivan
Per Wm. R. Singleton and
Wm. M. Ireland Attys

UNITED STATES PATENT OFFICE.

CHARLES P. SULLIVAN, OF LINE CREEK, SOUTH CAROLINA.

ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 228,416, dated June 1, 1880.

Application filed February 12, 1880.

To all whom it may concern:

Be it known that I, CHARLES P. SULLIVAN, of Line Creek, in the county of Laurens and State of South Carolina, have invented certain Improvements in Calculating-Machines, of which the following is a specification.

This invention relates to an improved apparatus for calculations, operated by means of balls of different sizes and weights, which are caused to drop through proportional tubes and orifices, and which balls falling into a weighing-receptacle placed beneath, the result is thereby determined by the weight of the balls in the units of weight representing numbers, all of which will be hereinafter more fully described.

Figure 1 is a top view of the apparatus. Fig. 2 is a view of the interior, the top being removed. Fig. 3 is a vertical section on *x x* of Fig. 1. Fig. 4 is a vertical section on *y y* of Figs. 2 and 1.

A A represent the side walls of a box or case, in which all the parts are sustained. B is the bottom, and C is a horizontal division-floor. Numbers 1, 4, 5, 3, 2 represent a series of keys having stems descending through tubes *a a*, &c., and orifices *c c*, &c., in the floor C. These stems have a wedge-shaped projection, *b*, the purpose of which will hereinafter be explained. The stems of the keys pass through the tubes *a a* and orifices *c c*, and are sustained by the springs *d d*, &c., fastened to the under side of floor C, which springs *d* keep the keys well above the tubes *a a*. On an exact line with keys are ranged a series of hoppers, 1′ 4′ 5′ 3′ 2′, having holes connecting with tubes *e e*, which depend below the hoppers nearly to the floor C. These tubes *e e* are of different diameters, corresponding with the number on each hopper—that is, their proportions are as 1, 2, 3, 4, and 5, the purpose of which will be hereinafter explained.

On the floor C, and immediately in line with the stems of the keys, are slides C′, held to the floor by screws in slots, so that the slides can be easily moved longitudinally. The ends of slides C′ at the stems of the keys are wedge-shaped to correspond with these stems, so that when the keys are depressed the projections *b b* will force the slides forward. In each slide C′ is an orifice, *f*, corresponding to its number in the hopper immediately above it. In Fig. 3 the slide 5 has its orifice *f* large enough to allow a ball in 5′ to pass through it. The sides of the orifices *f f* next to the tubes *e e* are countersunk, to readily receive the balls from the tubes, as seen in Fig. 3, when the key 5 forces the slide under the hopper 5′. In the floor C, under each slide C′, is an orifice, *f′*, corresponding to the orifice *f* in the slide, and when the keys are permitted to rise by action of the lower springs, *d d*, &c., the slides C′ are forced back by the end springs, *d′ d′*, the tension of which springs *d′ d′*, &c., is regulated by set-screws *g g*, &c., as seen in Figs. 2 and 3.

When the slides C′ are forced back they carry with them in the orifice *f* a ball corresponding to its number, which drops through the orifice *f′* into a trough, D, which has divisions in it corresponding to and immediately under the hoppers, as seen in Fig. 4, where the balls are represented as dropping from the holes in floor C. This trough D is accurately balanced upon a scale-beam, as seen in Fig. 4.

Any other arrangement of weighing-scales may be adopted, as the scale *per se* is not claimed as my invention. Spring-balances also may be used, and an index and dial be placed on top of the box to indicate the weight of the balls dropped.

In the hopper marked 1′ balls of a determined weight and diameter may be adopted as the unit of calculations. Nos. 2′ 3′ 4′ 5′ will have balls of corresponding diameter and weight thereto, each to each. The scale-beam or index-face must be correspondingly graduated according to the unit of weight and calculation established for No. 1.

The trough D has its compartments D′ D′, &c., exactly corresponding to those of the hopper above. On one side of the trough D grooves *d″ d″* are formed, so that when trough D is carried above and placed correspondingly to the hoppers and tilted the balls will roll into their appropriate hoppers, and not become mixed, as it is essential that each hopper shall have only its appropriate ball.

From the foregoing general description the operation will be easily understood.

To add up a column of figures, let the operator force down the No. 5 key for every five in the

column, and for every digit larger than 5, as 6, 7, 8, and 9. Every time this key is depressed a five-ball drops into the trough below. So for the fours, threes, twos, and ones in the column and the differences between five and the larger digits. Thus it will be seen that five keys only are necessary; but nine may be used. I prefer five, as the four fingers and thumb may be used, as in playing on the keys of any musical instrument, and, as above explained, all the digits can be accounted for in the five thus employed. When the first column has been counted the scale will indicate the number of units of weight, which, of course, will be the sum total of the column. Then set this amount down, and add up likewise each succeeding column and set them all under the result of the first, and then add these together for the final result.

To multiply two sums—take, for instance, 265 and multiply by 8—put one finger on 5 and another on 3; then press both down five times. Then weigh the result, which will be 40. Put down 0 (zero) and press No. 4. Then press down 5 and 3 six times and weigh; the result is 52; set down to the left of 0, (zero.) Then press on No. 5 and on 5 and 3 twice and weigh. The result will be 21, which set down to left of 20, and is 2120, the product.

Division and subtraction may also be performed by this means, also sums in fractions which must be reduced to decimals. The chief utility, however, in this apparatus is in performing sums in addition with lengthy columns and many of them, and in the hands of an expert these may be speedily added up.

This apparatus may be constructed of any suitable material. The tubes leading from the hoppers, as also the hoppers and trough, may be of metal; or all the apparatus may be of metal, and made very compact and neat, and make a suitable accompaniment to a counting-room desk. The balls must be accurately weighed and be made to conform in gage and weight proportionally to the unit of calculation.

I claim—

1. In a calculating apparatus, the series of keys, the hoppers, tubes, and slides, controlled by springs d', and the trough D, with divisions D′ D′, &c., supported on a weighing-scale, substantially as and for the purpose described.

2. In slides C′, the partially-countersunk orifices *f*, in combination with the tubes *e e*, &c., substantially as and for the purpose described.

CHARLES PLEASANT SULLIVAN.

Witnesses:
A. W. SHARP,
J. B. HUMBERT.