(No Model.) 4 Sheets—Sheet 1.

E. SELLING.

CALCULATING MACHINE.

No. 420,667. Patented Feb. 4, 1890.

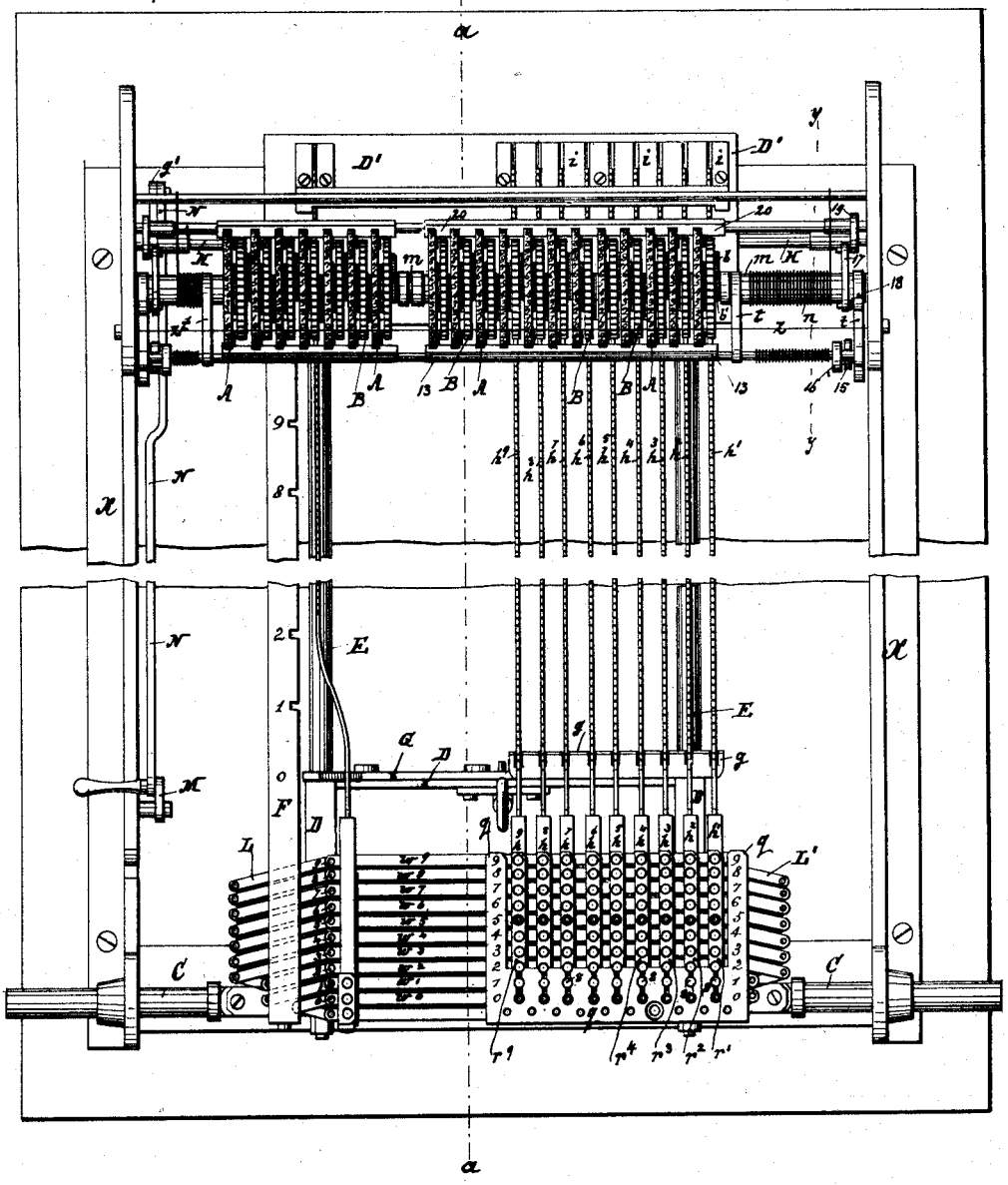

FIG. I.

WITNESSES

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(No Model.) 4 Sheets—Sheet 2.

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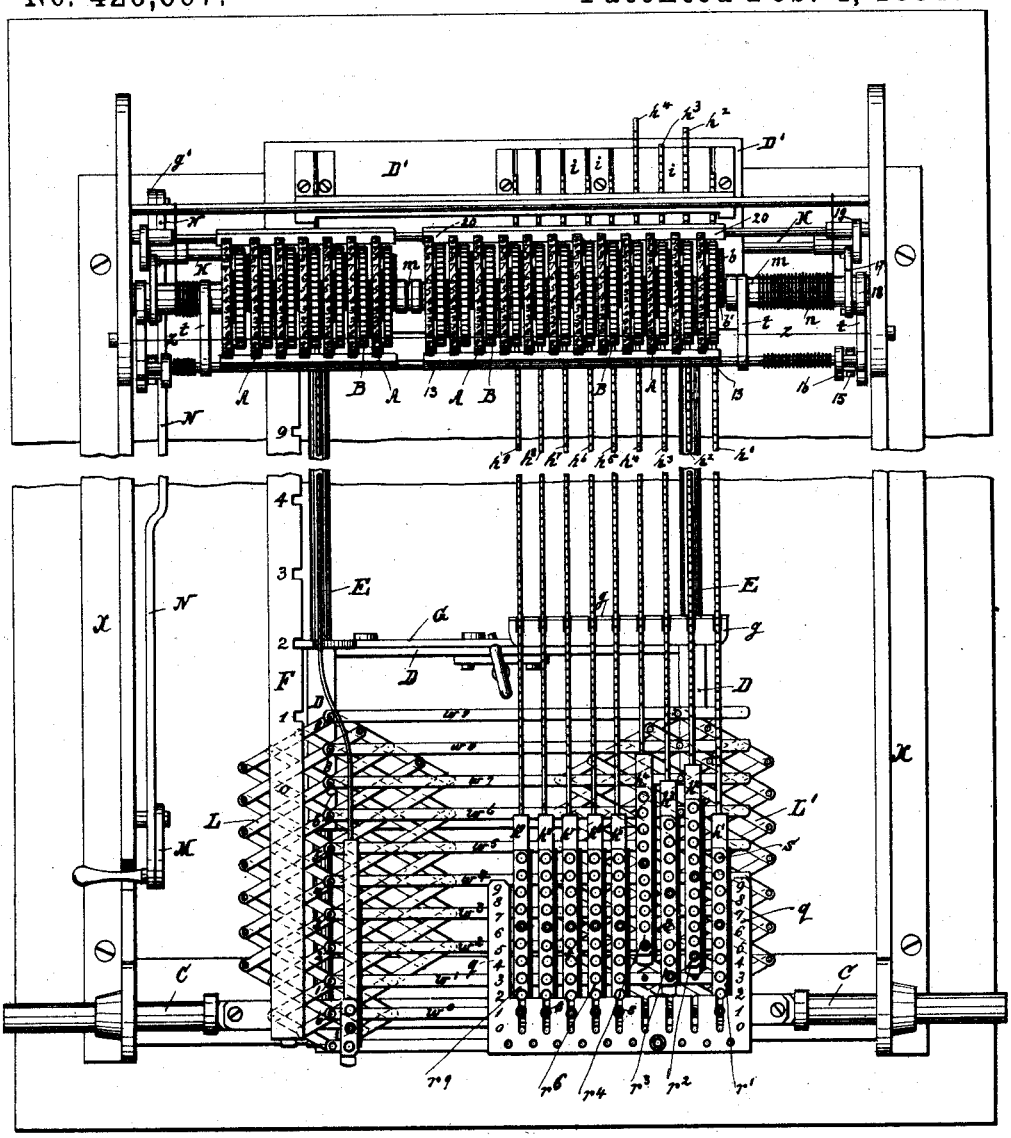

FIG. II.

WITNESSES

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4 Sheets—Sheet 3.

E. SELLING.

CALCULATING MACHINE.

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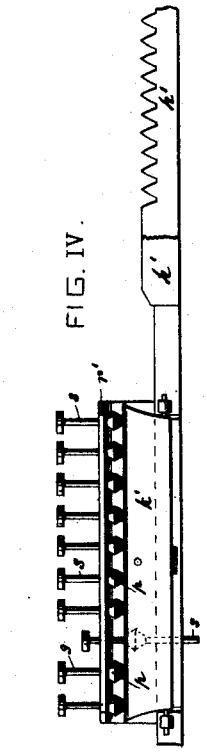

FIG. IV.

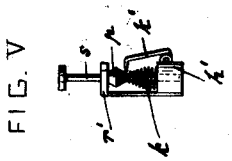

FIG. V

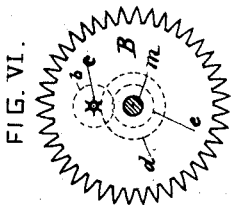

FIG. VI.

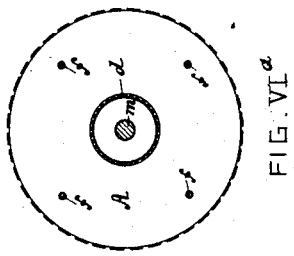

FIG. VI a

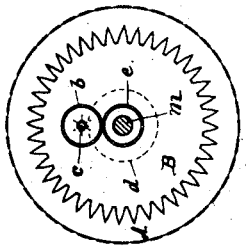

FIG. VII.

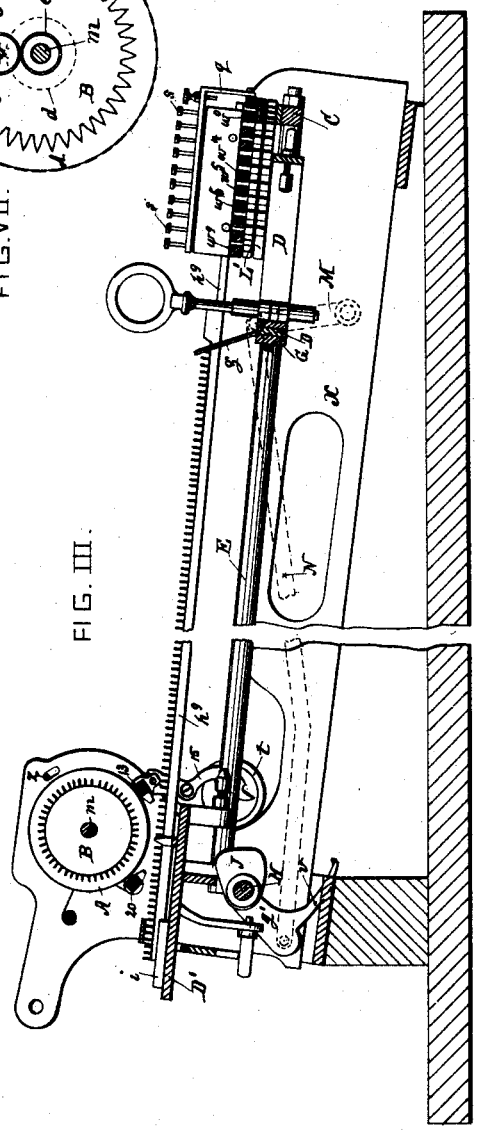

FIG. III.

WITNESSES

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4 Sheets—Sheet 4.

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CALCULATING MACHINE.

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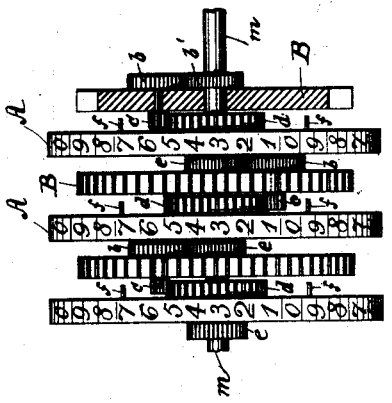

FIG. IX.

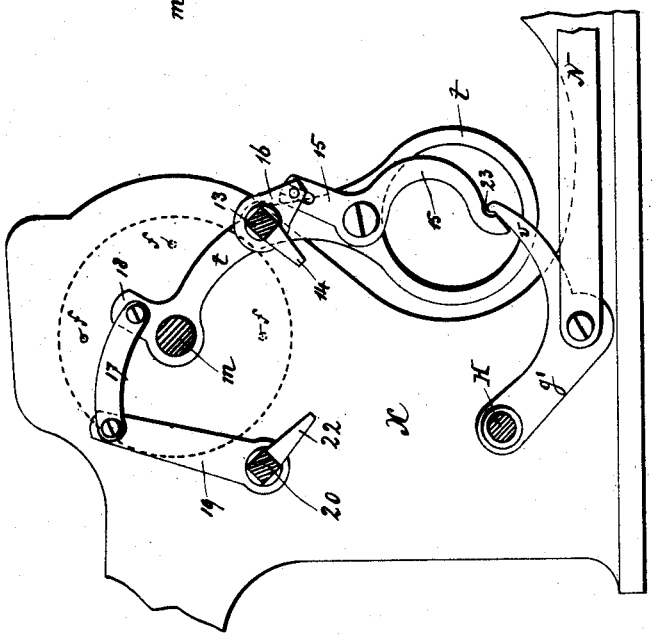

FIG. VIII.

WITNESSES

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UNITED STATES PATENT OFFICE.

EDWARD SELLING, OF WURZBURG, BAVARIA, GERMANY.

CALCULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 420,667, dated February 4, 1890.

Application filed May 21, 1886. Serial No. 202,931. (No model.) Patented in France April 12, 1886, No. 175,412; in Germany April 16, 1886, No. 39,634; in England July 8, 1886, No. 8,912; in Austria-Hungary August 2, 1886, No. 31,289; in Belgium August 4, 1886, No. 74,104, and in Italy September 30, 1886, XX, 20,326.

To all whom it may concern:

Be it known that I, EDWARD SELLING, of Wurzburg, Germany, have invented a new and Improved Calculating-Machine, (which has been patented in the following countries: in England, No. 8,912, dated July 8, 1886; in Germany, No. 39,634, dated April 16, 1886; in France, No. 175,412, dated April 12, 1886; in Austria-Hungary, No. 31,289, dated August 2, 1886; in Belgium No. 74,104 B, dated August 4, 1886; in Italy, No. 20,326, dated September 30, 1886,) of which the following is a specification.

This invention relates to a machine for facilitating the solution of arithmetical problems; and it consists in the various features of improvement, more fully pointed out in the claims and specification.

In the accompanying drawings, Figure I is a top view of the machine before operation. Fig. II is a top view of the same, showing a position during operation. Fig. III is a longitudinal vertical section at line *a a*, Fig. I. Fig. IV is a side view of part of one of the racks and pins at an enlarged scale. Fig. V is an end view of the same. Fig. VI is a side view of one of the gear-wheels B, and Fig. VI^a is a side view of disks A. Fig. VII is a side view of the disks A, with gearing. Fig. VIII is a cross-section at line *y y*, Fig. I, on an enlarged scale. Fig. IX is a front view of some of the disks A and gear-wheels B, with connecting-gearing, on an enlarged scale, partly in section.

Upon a fixed shaft *m*, supported in the frame X of the machine, a number of disks A and gear-wheels B are placed loosely, connected together, as follows: The gear-wheels B carry a wheel *b* on one side and a pinion *c* on the other side, meshing into a wheel *d*, fast on one side of the disk A, and which said disk has a wheel *e*, fastened on its opposite side, meshing into the wheel *b* of the adjoining gear-wheel B. The wheel *b* on the outer or first gear-wheel B meshes into a wheel *b'*, attached to the shaft *m*. The wheel *b* and pinion *c* are fast on a shaft passing through the wheel B, and capable of turning independent of said wheel B.

The disks A have raised figures, from 0 to 9, four times repeated upon their periphery, and the gearing is so arranged that a continual motion is communicated from one disk to the next adjoining disk equal to one-tenth of the motion of the units-wheel. On one side of the disks A four projecting pins *f* are arranged.

Upon the shaft *m* levers *t* are placed, held in position by a spring *n*, wound around the shaft *m*. These levers *t* carry a bar 13, provided with projections 14, capable of passing close to the sides of the disks A and to be brought in contact with the projections *f* on the sides of said disks. (See Fig. VIII.) The outer or end lever *t* is provided with an elongation forming a handle, to which a lever 15 is centered, connected to an arm 16, fast to the bar 13. An upper arm 18 of the lever *t* is connected through rod 17 with an arm 19, attached to a bar 20, placed behind the disks A, and provided with projections 22, similar to the projections 14 on the bar 13.

During the operation of the machine the projections 14 and 22 are in the position represented in Fig. VIII, so that the disks A may revolve freely without their projecting pins *f* coming in contact with these projections.

When it is desired to operate with the machine, the disks A must be moved in such a position that all the figures 0 are in a straight line. This is produced by turning the bar 13 by means of lever 15 and its connecting arm 16, whereby the projections 14 on the bar 13 are moved in such a position that said projections 14 will come in contact with the projections *f* on the disks A. The lever 15 is then retained in that position and moved together with the lever *t* around its supporting-shaft *m*, carrying thereby the bar 13 around the periphery of the disks A, and thus moving, whenever one of the projections 14 comes in contact with a projection *f*, the corresponding disk in such a position that at the end of the motion of lever *t* the figures 0 on the periphery of all the disks are in a straight line. By this motion of the lever *t* the bar 20 will at the same time be turned through its arm 19 and connecting-rod 17, so

that the projections 22 will be moved toward the centers of the disks. By this arrangement another set of the projections *f* on the face of the disks A will come in contact with said projections 22 when the disks A have been turned by the action of the bar 13, and thus the disks will be prevented from moving beyond the required point.

Near the front of the machine a shaft C is supported in bearings in the frame X. This shaft is capable of turning in its bearings and likewise of sliding sidewise. To this shaft C rods E E are attached, carrying a frame D, capable of sliding on said rods. Near the rear end of the machine a frame D′ is connected to these rods.

L L′ are two sets of lazy-tongs or extensible frames. Each set of lazy-tongs consists of a series of levers crossed as usual and having ten pivotal connecting-points marked 0 1 2 3 4 5 6 7 8 9. The levers are connected together by cross-bars w^0 w', &c. The bar w^0, connecting the points 0 0 of the lazy-tongs, is attached to the shaft C, while the bar w^9, that connects the points 9 9 of the lazy-tongs, is fastened to the frame D. By this arrangement and connection of the lazy-tongs and frame D an extensible frame is obtained. A scale F is placed above the lazy-tongs L, and is attached on one end to the shaft C and at the other end to the frame D′.

To the frame D a sliding pointer G is attached capable of being moved into the recesses 1 2 3, &c., on the scale-plate F. In Fig. II this pointer is represented as being moved into the recess 2 on the scale-plate.

Above the cross-bars w^0 w', &c., bars h' h^2 h^3, &c., are arranged, the rear ends of which form racks capable of meshing into the gear-wheels B. These bars h' h^2 h^3, &c., are guided in a plate *g*, attached to the frame D, as well as between suitable guiding-plates *i*, attached to the frame D′.

Above the forward ends of the bars h' h^2 h^3 small frames r' r^2 r^3 are arranged, attached to these bars and containing ten pins *s* each. Instead of marking each pin, a surrounding plate *q* is marked on the sides from 0 to 9. These pins *s* (see Fig. V) are provided with a cam-shaped collar *p*, acted upon by a coiled spring *k*, surrounding the bottom of each pin, and by a spring-plate *k′*, attached to the side of the bars *h′*, &c. By this arrangement the pressing downward of any one of these pins will cause the spring-plate *k′* to move outward by the action of its cone-shaped collar *p*, relieving thereby the cam-shaped collar of any other spring which was previously held downward by said spring-plate, when its corresponding spiral spring *k* will force said pin upward, in consequence of which there will never be two pins down at one and the same time. The pressing down of one of the pins in frame r' connects the bar h' with the cross-bars corresponding with the number of the pressed-down pin, and the pressing down of a pin in the frame r^2 connects the bar h^2 with the cross-bar corresponding with the number of the pressed-down pin.

Below the frame D′ a shaft H is arranged, provided with one or more cams J, acting against the under side of the frame D′, so as to lift the same upward and bring thereby the racks on the bars h' h^2, &c., into gear with the teeth of gear-wheels B.

Upon the shaft H an arm g' is placed, connected through a rod N with a lever M, centered on the frame X near the front of the machine, by the action of which the shaft H can be turned, so as to cause its cams J to act upon the frame D′ to lift the same and bring the racks into gear or to allow said frame to fall downward, and thus bring the racks clear of the gear-wheels B. The arm g' is provided with an extension *v*, which, when said arm is moved so as to bring the racks into gear, engages a small recess 23 on the lever 15, or it comes against the end of said lever, thereby locking the same and preventing the shaft 13 from being turned or moved during the operation of the machine.

The operation of the machine is as follows: The cams J are first moved so as to allow the frame D′ to fall downward to bring the racks h' h^2, &c., clear of the gear-wheels B. The disks A are then set to zero in the manner described.

To ascertain the exact position and likewise to facilitate the reading of any number on the disks after the completion of the operation, a line or cord *z* is stretched from side to side of the frame in front of the disks A. (See Figs. I and II.) The lazy-tongs L L′ are then closed and the frame D is moved toward the front of the machine, so as to bring all the corresponding pins *s* in a line and directly over their corresponding cross-bars w' w^2, &c. The pins in line 0 are then pressed downward, whereby all other pins which may before have been pressed downward will be moved upward in consequence of the action of the spring-plates *k′* and coiled spring *k*, as above described. The pressing down of the pins in the line 0 connects all the frames r' r^2, &c., and the bars h' h^2, &c., with the cross-bar w^0. In this position the machine is ready for operation.

Suppose we wish to add four hundred and twenty-three to one hundred and ninety-two. Press down pins 4, 2, and 3 in three adjoining frames, as shown in the drawings in frames r^4, r^3, and r^2, whereby the respective bars h^4, h^3, and h^2 will be connected with the cross-bars w^4, w^3, and w^2, respectively. Then move lever M to raise frame D′, and bring thereby the racks in gear with their gear-wheels B. Then move frame D, extending thereby the lazy-tongs until the pointer G comes opposite recess 1 on scale F and lock the frame in that position. Then turn the levers M so as to bring the racks clear of the gear-wheels B, move pointer G back again, and close the lazy-tongs. Now press pins 1, 9, and 2 upon the same frames r^4, r^3, and r^2, whereby the re-

spective bars h^4, h^3, and h^2 will be connected with the cross-bars w' w^9 w^2, respectively. By this operation the pins 4, 2, and 3 will move upward on account of their respective springs, as above described. The racks are then moved again into gearing with their gear-wheels B, the lazy-tongs again extended until the pointer comes opposite recess 1 on the scale, and the sum 615 will appear on the face of the disks A above the line of cord *z*. The machine is then moved again into its normal position, and the disks A placed at zero, when the same is ready for the next operation.

To multiply, say, four hundred and twenty-three by two, press down pins 4, 2, and 3 upon any adjoining frames. Move the racks into gear with their gear-wheels B, and move frame D, extending thereby the lazy-tongs until the pointer G will be opposite recess 2 in the scale F, and the product 846 will appear upon the face of the disks A above the line or cord *z*. (See Fig. II.)

What I claim is—

1. The combination of a series of disks with a series of racks adapted to be thrown into gear with said disks, and with an extensible frame and pins for connecting the racks to the extensible frame, substantially as specified.

2. The combination of a series of disks with a shaft upon which said disks are placed, and with a series of racks, an extensible frame, and pins for locking the racks to the extensible frame, and with a cam for raising the rear end of the racks, substantially as specified.

3. In a calculating-machine, the combination of a pair of lazy-tongs L L′ with cross-bars w' w^2, &c., connecting their fulcrums with sliding frame D, and with bars h' h^2, having frames r' r' and pins *s*, as and for the purpose described.

4. The combination, with gear-wheels B and disks A, placed alternately side by side on a shaft *m*, of the gearing *b* and *c* on the gear-wheels B, and gearing *d* and *e* on the disks A, substantially as described.

5. The combination of a series of disks with a series of engaging racks and with an extensible frame, and a set of pins provided with cam-shaped collars, and springs for causing an engagement between the racks and the extensible frame, substantially as set forth.

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

EDWARD SELLING.

Witnesses:

DÜERKE SCHEÖLER,

FRIEDRICK SCHWEITZER.