

operating with a mechanism connected to the minuend indicator, the gear 78 cooperating with a mechanism connected to the subtrahend indicator and the gear 73 cooperating with a mechanism connected to the remainder indicator, each in mesh with the racks on their respective longitudinally arranged bars. In working a problem in subtraction where there is no greater number in the subtrahend than the number directly above it or in the same column, the respective keys on each the minuend and subtrahend sides are depressed bringing the same in locking engagement with the mechanism so that the portions 39 Fig. 2 are in the paths of the pins 29 Fig. 2, the locking pins 64 Fig. 4, are racked out of locking engagement with the pins 29 Fig. 4, by the contact of the lugs 43 Fig. 4 against the horizontal pins 68 Fig. 2, so that the bars 26 Fig. 2 corresponding with the columns of figures depressed on the keys are free to move. The crank 54 is drawn forward and the bars 26 Fig. 2 free to move are drawn forward by reason of their connection to the crank shaft 55 Fig. 2 by means of the rods 56 connected to the coil springs 57 Fig. 20 which in turn are connected to the rods 26 Fig. 2 as at 89 Fig. 2. The bars 26 Fig. 2 freed to move, as above stated, will be brought forward until they are stopped by the portions 39 Fig. 2 coming in contact with the pins 29 Fig. 2 which are so arranged and connected up with the disks 48 Fig. 2 that the figures on the same will be registered directly underneath the openings 52 in the top of the casing 25 Fig. 5.

With the moving forward of the bars 26 and racks 27, the gear mechanism shown in Figs. 6 and 7 rotates as follows. The gears 70 and 71 secured to the shaft 72 rotate forward with the bars 26 and racks 27 on the minuend side and the gears 78 rotate forward with the bars 26 and racks 27 on the subtrahend side, and so long as both these sets of gears rotate together no other gears rotate, excepting that the pinion gears 76 attached to the walls of the gears 78 rotate around the gears 74. When the forward movement of the bars 26 and the racks 27 on the subtrahend side are stopped by the parts 39 Fig. 2 of the depressed keys in the subtrahend side coming in contact with the rods 29 Fig. 2 on the bars 26, the gears 78 Fig. 7 stop rotating and the gears 70 Fig. 7 keep on rotating until the higher numbers in the minuend side are reached. Just to the extent that the minuend gears are rotated forward after the subtrahend gears are stopped, the remainder gears 73 Fig. 7 rotate backward, this backward movement being effected by the gears 71 Fig. 6 in mesh with the pinion gears 76 Fig. 6 rotating the pinion gears 76 forward and the pinion gears 76 being in mesh on the

opposite side with the gears 74 Fig. 7 which rotate the gears 74 Fig. 7 backward and these gears being secured to the same tubular shafts 75 with the gears 73 Fig. 7 rotate the gears 73 Fig. 7 backward carrying the racks 27 R—Fig. 7, backward taking the bars 82 Fig. 2 with them. This backward movement has the effect of registering the remainder figures on the disks 81 Fig. 2 directly underneath the openings 86 Fig. 5 in the top of the casing 25—Fig. 5. Thus there exists underneath the openings on the top of the casing 25 Fig. 5 at the left the figures in the minuend columns, at the center the figures in the remainder columns and at the right the figures in the subtrahend columns. Inasmuch as it often happens that in the lower columns of the subtrahend figures are of a higher denomination than in the minuend columns directly in alinement with them provision is made for the borrowing or transferring process from the figure in the next higher column as follows: Attached to the sides of the bars 26 and horizontal therewith on the subtrahend side S Fig. 2 except as to the one corresponding with unit columns, are plates 90 Fig. 2, the same being secured by hinges 91 Fig. 9, lugs 92 Fig. 11 attached to the racks 27 Fig. 11 which are brought into engagement with projections 93 Fig. 11 on the plates 90. Attached to the tubular shafts 75 Fig. 11 (being the same shafts shown in Figs. 6 and 7) are fingers 94 Fig. 11 so adjusted thereto as to have the effect hereinafter stated.

The locking engagement of the lug 92 and projections 93 Fig. 11 is what holds the bars 26 in relative adjustment with their respective racks 27 Fig. 11. When the figure in the subtrahend is of a higher denomination than the one in the minuend directly above it, it will be seen that the subtrahend gear 78 Fig. 7 will be rotated farther than the gear 70 Fig. 7 on the corresponding minuend side. This of course rotates the rod 82 Fig. 7 forward to give the correct number on its relative disk 81 Fig. 2 under the openings 82 Fig. 2, to the full effect as if ten had been borrowed from the column ahead in the minuend the result being shown on the bend of the disks 81 Fig. 2, but it leaves the ten in the next column above in the remainder unless taken out. This ten is taken out in the following manner: The finger on the tubular shaft is rotated upwardly by the forward movement of the rack 27 R against the plate 90, tipping the same upwardly and releasing the lug 92 from the projection 93 on the rack of the next higher column of the subtrahend thereby breaking the longitudinal locking engagement of the bar 26 with its rack 27 Fig. 11. The bars 26 Fig. 2 have in their bottoms slots 94 Fig. 2, through which screws 95 Fig. 2 pass, the same engaging the

UNITED STATES PATENT OFFICE.

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INSULATOR.

1,060,886.

Specification of Letters Patent.

Patented May 6, 1913.

Application filed October 30, 1911. Serial No. 657,540.

To all whom it may concern:

Be it known that I, JOHN E. BICKNELL, a citizen of the United States, and a resident of Findlay, in the county of Hancock and State of Ohio, have invented a certain new and useful Insulator; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to insulators for supporting electric wires or conductors, and particularly to that class of insulators known as divided insulators and made up of two parts or pieces between which the conductors are clamped. Insulators of this type have in the past been made in two styles or classes, one class having a top or cap fitted to a base, the parts not being interchangeable, while the other class comprises duplicate-interchangeable parts. The use of the first class requires workmen, when installing, to have an equal number of separated tops and bottoms, and the manufacturer when shipping is required to count out an equal number of tops and bottoms and separately pack them, adding expense as well as oftentimes confusion, especially when some of either parts become lost or broken. To overcome this disadvantage, several insulators of the second class have been placed on the market, but in all cases, so far as I am aware, it has been necessary to fit the top and bottom pieces together with the wire-receiving grooves of each or at least that of the bottom piece, in perfect alinement with the wire the pieces are intended to grip. As it is quite often necessary to install insulators in elevated positions, on ceilings and in places where workmen have a limited range of action, difficulty is experienced in getting the knobs or pieces properly attached, and this difficulty is augmented by the necessity of bringing the two pieces of the insulator, or at least the inner one thereof, into exact position for the groove or grooves therein to receive the wire.

The object of my invention is the provision of an improved insulator of the character described, the parts of which are alike

and interchangeable, and at the same time self-centering, so that when centered the top piece will firmly hold and grip the wire independently of the position in which it may be placed on the bottom piece, thus enhancing the practicability and commercial value thereof, and obviating the disadvantages and objections incident to the insulators heretofore used.

A further object of my invention is the provision of an insulator, which will firmly clamp a wire without injury to the insulation covering thereof, and is capable of being cheaply made and easily and quickly installed, and which is also capable of having any desired number of the parts thereof built one upon another for the purpose of firmly holding any number of cross-over wires at any desired angle of crossing, thus obviating the use of the special cross-over pieces customarily used and saving the added expense incident to their use.

The invention is fully described in the following specification, and while, in its broader aspect it is capable of embodiment in numerous forms, a preferred embodiment thereof is illustrated in the accompanying drawings, in which,—

Figure 1 is a side elevation of a three part insulator embodying my invention, with two cross-wires carried thereby. Fig. 2 is a central longitudinal section of a two-part insulator, with a single wire clamped thereby. Fig. 3 is an outer end view of Fig. 2; and Figs. 4 and 5 are bottom and top perspective views, respectively, of one of the insulator parts.

The insulator comprising my invention is composed of two or more duplicate parts or sections A, which are built or placed one upon another in proper number to clamp one or a plurality of crossing or parallel wires B thereto, and are united and clamped together to any suitable support C by a screw D. The parts A of the insulator are of porcelain, glass or other suitable insulating material, and while they may be of any suitable shape in cross-section are preferably round as shown, and are of suitable length to meet the underwriters' requirements for the spacing of wires relative to the adjacent support and to each other when more than a single wire are carried by a single insulator. Each of the parts A is provided through its longitudinal center with a hole

racks attached thereto mounted on gears, the gears adapted to rotate independently of each other, the said bars adapted for longitudinal movement along with the racks over said gears, the length of such movements being gaged by locking means effected by stops in the key bars engaging stops on the paralleling bars, a third system of bars paralleling the said sets of bars across the machine carrying racks mounted on gears, and means for changing the relative longitudinal positions of each bar with its corresponding rack.

3. In a calculating machine, the combination of a plurality of pairs of bars, paralleling each other across the machine and having racks attached thereto mounted on gears, the gears adapted to rotate independently of each other, the said bars adapted for longitudinal movement along with the racks over said gears, the length of such movements being gaged by locking means effected by stops in the key bars engaging stops on the paralleling bars, a third system of bars paralleling the said sets of bars across the machine carrying racks mounted on gears, and means for changing the relative longitudinal positions of each bar with its corresponding rack together with means for retaining said bars in relative neutral positions to register 0 in each the minuend, subtrahend and remainder systems on the numbered spaces of the registering disks, means for releasing the same and means for changing the relative longitudinal positions of each of the bars, and means for returning all bars to relative neutral positions.

4. In a calculating machine, the combination of a plurality of pairs of bars, paralleling each other across the machine and having racks attached thereto mounted on gears, the gears adapted to rotate independently of each other, the said bars adapted for longitudinal movement along with the racks over said gears, the length of such movements being gaged by locking means effected by stops on the key bars engaging stops on the paralleling bars, a third system of bars paralleling the said sets of bars across the machine carrying racks mounted on gears, one side of said first mentioned bars together with its accompanying gears representing the minuend in a problem in subtraction, the other side thereof together with its accompanying gears representing the

subtrahend and the third system of bars together with its accompanying gears representing the remainder, each of such bars being so connected up with disks having curved peripheral extensions divided into numbered registering spaces, that such disks will register before a face plate on the machine the minuend, subtrahend and remainder respectively when the bars are operated to meet the locking means with the respective numbers on the keys, together with a shaft mounted transversely of the machine carrying wheels having peripheries divided into numbered registering spaces, such wheels carrying gears meshing with racks attached to the first above mentioned sets of bars in such a manner that with the movements of the bars in registering the minuend and subtrahend such wheels register before openings in the top of the casing, duplicates of the minuend and subtrahend of the first problem in subtraction worked in a given series and adds to the same the amount of each succeeding minuend and subtrahend and registers the same as aforesaid.

5. In a calculating machine, the combination of a plurality of pairs of bars, paralleling each other across the machine and having racks attached thereto mounted on gears, together with a third system of bars, paralleling the said sets of bars across the machine, carrying racks mounted on gears, one side of said sets of gears representing the minuend side of the machine mechanism and cooperating therewith, the other side thereof representing the subtrahend side thereof and cooperating therewith and the third set representing the remainder mechanism thereof and cooperating therewith, all of the gears so connected that the minuend and subtrahend gears may rotate together in the same direction while the remainder gears stand still, and when the subtrahend gear ceases to rotate and the minuend gears continue to rotate, that the remainder gears will rotate in an opposite direction to the full extent that the minuend gears rotate after the subtrahend gears cease to rotate.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN OTTO ALMEN.

Witnesses:

H. O. ALMEN,
WILLIAM H. KAYE.