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TABULATION RACK

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This invention relates to the design of tabulation racks for printing machines such as typewriters. More particularly, this invention relates to the design of a tabulation rack which is improved both in regard to cost and in regard to functioning.

Tabulation racks for use in a tabulation operation are well known in the typewriter and related arts. The tabulator mechanisms permit the machine operator to quickly position printing means relative to paper at a predetermined point on the writing line by depressing a "tab" keybutton. Movement is initiated by the keybutton, and the movement usually is terminated in response to the 20 movement carrying a member into contact with a stop located properly on a tabulation rack. A tabulator is used in typing columns of figures, indenting paragraphs, and any other operation that requires positioning the printing means to a specific point each time. 25

In many typewriters the tabulator stop member terminates tabulation by physically blocking and absorbing the momentum of a moving carriage. In other machines, however, notably those similar to the series 72, single type element machine marketed in large quantities in various forms by the assignee of this invention, the tabulator stop member merely positions controlling members which stop movement without substantial impact on the tabulator stop member. For reasons having to do with the dimensions of the parts used in this invention, this invention is designed for use in a tabulation system in which the tabulation stops do not absorb large amounts of kinetic energy.

The prior art, notably the single element machine mentioned above, includes at least one teaching of the idea of using gripping friction to hold the position of tabulation stops. In the prior art an ear extends from an annular ring. A plurality of such rings are fitted into grooves of a bar, each ring being located at a predetermined position along the bar which corresponds to a tabulation position. The bar carrying the rings is the tabulation rack of this prior art system. The ear of a selected ring may be located in juxtaposition to a top and a bottom projection. In response to a keyboard operation, the bar is rotated to carry the ear upward. The ear of the selected ring encounters the top projection, causing the ring to slip in its groove. Upon restoring of the bar to its normal position, the ear is then positioned operatively to act as a tabulation stop. The position is maintained by friction between the ring tending to tightly close around the groove in which it fits. To clear a set tabulation stop the above operation is repeated with the exception that the ring is rotated in the opposite direction to bring the ear into abutment with the bottom projection. It has also been suggested elsewhere to eliminate the gripping friction by substituting a viscous material which acts as a heavy drag against any tendency for the rings to move. This invention uses friction positioning, but the ring and ear are replaced by a useful, flexible, and low cost configuration and closing or gripping friction is not used.

It is an object of this invention to provide a tabulation rack which can be fabricated without the cost disadvantages imposed by a multitude of tightly fitting parts.

It is a further object of this invention to provide a tabulation rack which can be fabricated from stampings.

It is another important object of this invention to provide a tabulation rack which allows more variation in structure than allowed when rings carrying ears are used. It is a more specific object of this invention to provide a tabulation rack which can be set to a plurality of escapement pitch settings.

In accordance with this invention each tabulation stop is the end of a twisted, thin strip made of resilient material. These strips are each fitted between the teeth of a comb-like structure. The fit is not a press fit; it is the recovery torque of the twisted strips which set up friction producing forces along the sides of the comb. The ends of the strips are joined to a rocking member, and upper and lower projections or abutments are provided by the printing machine as in the prior art. Rocking of the structure brings the end of a selected strip into contact with the projection or abutment. Each thin strip yields along its length and remains in the new position under the influence of friction at the comb.

In accordance with this invention the entire tabulation rack assembly can be fabricated from stampings at signifi-20 cantly reduced cost. Furthermore, the structures do not dominate the available space as the angular rings of the prior art do. Two or more of the strip and comb structures can be anchored on the same rocking member to be swung into position to provide different tabulation 25 pitches on the same machine.

FIG. 1 shows the tabulation rack and related structures in accordance with this invention.

FIG. 2 shows an intermediate used to make the slotted frame and which has preferably been formed by a stamp-30 ing operation.

FIGS. 3a and 3b illustrate the efficient fashioning of the twisted stop fingers.

FIG. 4 shows a side view of an alternative system utilizing the principle of FIG. 1 and also providing a dual
35 escapement pitch capability.

FIG. 5 illustrates the system of FIG. 4 with further environmental structures.

FIG. 6 is a detail of the means provided in accordance with FIG. 5 to rotate the selected group of stop fingers into operative position.

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

⁴⁵ The preferred embodiment of this invention is designed for use with the series 72, single element printer developed several years past and sold in large quantities by the assignee of this invention. For a detailed description of a preferred environment for use with this invention

- 50 of a pieteried environment for use with this invention reference is therefore made to "IBM Customer Engineering Series 72 Instruction Manual," Form 241-5032-0, copyright, 1961. It is illustrative of the efficient structures provided by this invention that no change in structure of
- the printer is required except changes actually at the tabulation rack. The print element carrier of the series 72 machine remains exactly the same, and it is that carrier which contains top and bottom projections or abutments for use with the tabulation stops and also contains the trip mechanism to free the escapement pawl. It is the
 - trip mechanism to free the escapement pawl. It is the escapement pawl entering the escapement rack which terminates tabulation movement in the machine.

For an understanding of the preferred form of the basic structures of this invention, reference is made to FIG. 1. The rocking member 1 connects by means of crank 3 and linking member 2 to the tab set and clear keybutton in the manner of the prior art. Thus, for a tab set operation the rocking member 1 moves counterclockwise. For a tab clear operation the rocking member 1

70 moves clockwise. To provide this movement the angled rocking member 1 fits into a tab set and clear crank 3 having an angled slot to receive and hold the angled rock-

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ing member 1. The angled rocking member 1 fits into the slot of crank 3 without substantial slippage. The remainder of the structures causing rocking are substantially the same as that of the series 72 machine above mentioned.

Rocking arm 1 is an extension of and integral with slotted frame or comb 5. The slotted frame 5 may originally be stamped to form a flat comb-like structure as illustrated in FIG. 2. It is then formed into a semicircular configuration. (See FIG. 1.) The widths of the slots in frame 5 are 0.029 ± 0.002 inch.

Connected to the slotted frame 5 is a spring steel plate 7, firmly anchored by a mounting strap 8. Plate 7 has previously undergone a stamping and twisting operation which has created a plurality of fingers 9. The ends of steel plate 7 is preferably 0.025 ± 0.001 inch so as to avoid a press fit into the slots of frame 5.

The invention as shown in FIG. 1 functions with complete and optimum efficiency. To bring the end of a finger 9 into a set position operative to stop the carrier, the carrier is first positioned so that the top and bottom projections or abutments 10' and 10" carried by the carrier are positioned over and under the ends of a selected finger 9. A manual operation at the keyboard then moves linking member 2 and moves crank 3 counterclockwise. This moves rocking arm 1 counterclockwise. One finger 9 is in operative location with respect to the top and bottom projections or abutments 10' and 10". That finger 9 is prevented from substantial movement by the top projection or abutment 10'. Instead, the selected finger 9 bends throughout its length and thus assumes a new position relative to the slotted frame 5. The new position, of course, will be operative in the future to trip the stop mechanisms of the carrier. The twisted status of each finger 9 results in a torque in the spring steel of which the finger 9 is made. This torque is operative against the sides of the slots of frame 5 and results in each finger being held by friction where it is position. In the FIG. 1 two fingers designated 9' are shown in the lower, tab stop position assumed in response to a counterclockwise rocking as above described. To clear a selected tab stop, the rocking arm 1 is moved clockwise while the selected finger is abutted by the bottom projection or abutment 10" carried by the carrier. After a clear operation operative on one of the fingers 9', that finger would then be in line with the other fingers 9.

To understand the full economies and efficiencies realized in accordance with this invention, an understanding of the materials and processes used is desirable. The slotted frame 5 can be fabricated in an efficient stamping and forming operation. A progressive operation appears to be preferable at this time, including one stamping step and one or two forming steps. FIG. 2 is illustrative of the intermediate formed by stamping and FIG. 1 illustrates the stamped and formed final product. The material of slotted frame 5 is low carbon steel. Frame 5 is case hardened after fabrication so that the spring steel fingers 9 will not gouge the sides of the slots of frame 5.

Reference is made to FIGS. 3a and 3b, which illustrate a one step forming operation practiced on spring steel 60 plate 7. Previously to the step illustrated in FIGS. 3a and 3b the plate 7 has been stamped into the required, fingered configuration. This can be a one step operation. The steel used was pre-tempered blue stock. The material of one successful, full size model of the invention was a medium carbon steel having a hardness of 40-45 on the Rockwell C scale. In the preferred embodiment it was desirable to lower the longitudinal resilience of the fingers 9 in their middles so that they would bend easily to the proper position. Each finger 9 therefore was stamped to be wide at the distant end and reduced in width at the narrow, intermediate portion.

The twisting operation on plate 7 is under control of slotted grips 20. The fingers 7 fits snugly in the slots 22 of the grips 20. The grips 20 each carry a toothed pinion 75 initial adjustment. After the dual tabulation rack is ro-

24. A rack 26 moves across all of the pinions 24 a distance proper to fashion a one-half turn twist in a single movement. The twisted assembly of plate 7 is then dropped into a meshing relationship with the slots of frame $\overline{5}$ and the grips 20 are then removed.

Since the structures in accordance with this invention may be unusually small, the actual dimensions of the preferred embodiment will be commented upon here. The wide stop end of each finger is 0.062 inch wide. The reduced middle portion is 0.032 ± 0.004 inch wide. The wide, 10 stop end of each finger is 0.187 inch in length. The narrow, middle portion of each finger is 0.250 inch in length. The wide, stop end of the fingers are separated by a gap of 0.038 ± 0.003 inch. As above mentioned, the spring these fingers 9 function as the tabulation stops. Spring 15 steel plate is 0.025 ± 0.001 inch in width. This provide a strength substantially greater than is needed for tabulation stop and friction setting. However, this extra strength prevents the fingers from being deformed or broken by return movements of the carrier which are possible, but improper in the preferred utilization. Provision of a posi-20tive interlock to prevent such an improper and unnecessary return of the carrier would significantly reduce the required width of the steel plate used.

FIG. 4 is illustrative of a very attractive alternative embodiment of this invention. In accordance with this alternative embodiment two sets of fingers are provided, each having a different displacement to thereby provide the immediate availability of two tabulation racks of different escapement pitch.

In FIG. 4 there is a first slotted frame 30 and a second 30 slotted frame 32. Similarly, there is a first spring plate 34 and a second spring plate 36, each carrying one set of fingers; spring plate 34 carries set of fingers 38 and spring plate 36 carries the second set of fingers 40. The unit is

positioned by a spacer 42. The unit can be rocked from the 35 keyboard in the manner described. Furthermore, a manual setting is available for positioning the entire assembly. As shown in FIG. 4 the spring 36, frame 32, and finger 40 combination is in operative position to control the tabula-

tion of the carrier, and is in proximity to projections or 40 abutments 43' and 43". With the unit rotated sufficiently counterclockwise, the spring 34, frame 30, and finger 38 combination is operative with the same carrier to provide a new tabulation pitch in the machine.

FIG. 5 illustrates the system of FIG. 4 along with its 45 structural environment. The linking member 2 and crank 3 of FIG. 1 are in the form of linking member 51 and a crank 50 of design to allow the rotation of the entire tabulation rack assembly in relation to the crank 50. The rocking arm 52 is integral with the tabulation rack and per-50 forms the identical function as rocking arm 1 in the basic embodiment.

In FIG. 5 and FIG. 6 the rotating means are illustrated in detail. A manual knob 54 extends from the assembly where it can be grasped by the machine operator. The knob positions a canted shoe 56, which is integrally connected to knob 54 by shaft 58. The opening in crank 50 is semicircular to hold rocking arm 52 in two positions without substantial slippage. The opening has a fulcrum salient 60 upon which rocking arm 52 rides.

In operation the operator merely rotates knob 54 to select the desired group of stop fingers and thus the desired escapement pitch. Shoe 56, being rigidly held at an angle, forces rocking arm 52 to pivot on fulcrum 60 and to assume a new permanent position in relation to crank 50. As is clear from FIG. 6, knob 54, shaft 58, and shoe 56 must move upwardly when knob 54 is rotated. Means to hold the assembly in place after such rotation for tabulation operation as herein described are a matter of choice to those skilled in the art. A rotating assembly with locking 70 means is shown in United States Patent 1,380,455. Generally, it will be necessary to move the carrier or other printing means to a distant position so that it will not block the relatively large rotation of the tabulation rack during

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tated, however, the operation is identical to that above described with respect to FIG. 1. The rocking arm 52 responds to bellcrank 50 to set the stop fingers in the manner described.

Although the operation of the system during tabulation 5 is extremely similar to the prior art, a synopsis of that operation will be given here, without, however, undue detail. In order for the preferred tabulator operation to take place, several basic things must occur. The stopping point must be determined. The escapement and backspace pawls 10 must be released to allow carrier movement, and the pawls must be latched in the released position to continue the movement. Furthermore, the speed of the carrier must be controlled, and this is done with a governor arrangement. Since the typewriter which is a preferred environment 15 for use with this invention is described in detail in "IBM Customer Engineering Series 72 Instruction Manual," Form 241-5032-0, copyright, 1961, the following terminology will closely follow the terminology used in the manual so that a quick understanding to those in the art 20 will be made possible.

The rack of tab stop fingers is located just to the rear of the escapement rack, the tab set and tab clear button located on the keyboard may be rocked forward or back to set or clear a tab stop as discussed more fully above 25 specifically with reference to rocking member 1 and crank 3. When one side of the button is depressed, the set and clear arm in the machine operates to rotate the tab rack up. A tab stop finger 9 strikes a projection or abutment 10' on the carrier bracket blocking movement of the finger. 30 As the rack continues to rotate, the finger 9 is forced to rotate inside the slots of the slotted frame 5. When the set and clear button on the keyboard is released, the tab rack is restored to the rest position leaving the set tab finger lower than the others. A reverse operation causes a 35 lowered tabulating stop finger 9 to strike a stud or abutment 10" at the bottom of the carrier blocking the movement of the finger 9 while the rack is rotated further. When the set and clear button is released, the tab rack is restored to the rest position leaving the tab stop finger 9 40 even with the others in the unset or cleared position. Because it is the projections or abutments 10' and 10" on the carrier that sets or clears the tab fingers, the carrier must be positioned at the desired stopping point before an individual set or clear operation can occur. The tab rack 45 is restored to rest from either the set or clear operation by spring biasing means provided within the machine.

When the tabulation keylever is depressed, a link operating through a bellcrank moves a tab torque bar which results in the escapement pawl and the backspace pawl of 50 the machine being latched out of their respective racks. The carrier begins to move freely, controlled in speed however by a governor mechanism associated with the carrier. When the carrier reaches the desired stopping point, the escapement pawl must be allowed to re-enter 55 the escapement rack and stop the movement of the carrier. A tab lever on the carrier is mounted in an elongated hole at its pivot point. An extension spring holds the tab lever to the right. As the carrier moves toward the right, the tip of the tab lever contacts a set tab stop finger 9 and 60 is prevented from moving further. The carrier continues to the right carrying the pawl and the tab latch with it. Movement is allowed by the elongated hole at the tab lever pivot. As the escapement pawl moves to the right in relation to the tab lever, a notch in the pawl allows it to 65drop off a lug of the tab lever and restore to the escapement rack. Further movement of the carrier moves a tab latch to the right out of its notched relationship with the tab lever. The tab lever then restores and allows the backspace pawl to re-enter its rack. Re-entry of the escape- 70 ment pawl into the escapement rack shortly before effects termination of the movement of the carrier in a small amount of further movement of the carrier.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, 75 it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention. I claim:

1. A tabulation rack assembly comprising:

anchoring means,

a slotted frame structure,

- thin strips of twisted, resilient material fitted in the slots of said frame structure and anchored by said anchoring means at a distal point from said slots, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough relative to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation,
- abutment means positioned on the side of said slotted frame structure away from said anchoring means, and
- means mounting said anchoring means and said slotted frame structure for relative rocking with respect to said abutment means to push said strips to set and clear positions for tabulation.

2. A tabulation rack assembly comprising:

anchoring means,

- a slotted frame structure,
- thin strips of twisted spring steel fitted in the slots of said frame structure and anchored by said anchoring means at a distal point from said slots, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough relative to the strip fitted in the slot to allow each strip to bend throughout its legnth to assume both set and clear positions for tabulation,
- abutment means positioned on the side of said slotted frame structure away from said anchoring means, and
- means mounting said anchoring means and said slotted frame structure for relative rocking with respect to said abutment means to push said strips to set and clear positions for tabulation.
- 3. The combination as in claim 1 wherein said strips are narrower than said slots.
- 4. The combination as in claim 2 wherein said strips are narrower than said slots.
 - 5. A tabulation rack assembly comprising:

a rotatable member,

- a first slotted frame structure anchored on said rotatable member,
- a first set of thin strips of twisted resilient material fitted in the slots of said first frame structure and anchored at a distal point from said slot on said rotatable member, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough relative to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation,

a second slotted frame structure,

- at least a second set of thin strips of twisted resilient material fitted in the slots of said second frame structure and anchored at a distal point from said slots on said rotatable member, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough relative to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation, and
- means to change the angular position of said rotatable member to at least two positions at which rocking means for said tabulation rack assembly are operative.

6. A tabulation rack assembly comprising:

- a rotatable member,
- a first slotted frame structure anchored on said rotatable member,
- a first set of thin strips of twisted spring steel fitted in 5 the slots of said first frame structure and anchored at a distal point from said slots on said rotatable member, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough rela- 10 tive to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation,
- a second slotted frame structure,
- at least a second set of thin strips of twisted spring 15 steel fitted in the slots of said second frame structure and anchored at a distal point from said slots on said rotatable member, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long 20 enough relative to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation, and
- means to change the annular position of said rotatable member to at least two positions at which rocking 25 means for said tabulation rack assembly are operative.

7. The combination as in claim 5 wherein said strips are narrower than said slots.

- 8. The combination as in claim 6 wherein said strips 30 are narrower than said slots.
 - 9. A tabulation rack assembly comprising:
 - a rotatable member,
 - a first slotted frame structure anchored on said rotatable member,
 - a first set of thin strips of twisted resilient material fitted in the slots of said first frame structure and anchored at a distal point from said slots on said rotatable member, the twist of each strip creating 40 a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough realtive to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation,
 - at least a second slotted frame structure having a dis- 45 tance between the slots different from the distance between the slots of said first frame structure and anchored on said rotatable member,
 - at least a second set of thin strips of twisted resilient material fitted in the slots of said second frame struc- 50 ture and anchored at a distal point from said slots on said rotatable member, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough relative to the strip fitted in the slot 55 to allow each strip to bend throughout its length to assume both set and clear positions for tabulation, and
 - means to change the angular position of said rotatable member to at least two postions at which rocking 60 means for said tabulation rack assembly are operative.
 - 10. A tabulation rack assembly comprising:
 - a rotatable member,
 - a first slotted frame structure anchored on said rotat- 65 able member,
 - a first set of thin strips of twisted spring steel fitted in the slots of said first frame structure and anchored at a distal point from said slots on said rotatable member, the twist of each strip creating a torque 70 operative against the sides of the slot to hold each strip by friction, each slot being long enough relative to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation,

- at least a second slotted frame structure having a distance between the slots different from the distance between the slots of said first frame structure and anchored on said rotatable member,
- at least a second set of thin strips of twisted spring steel fitted in the slots of said second frame structure and anchored at a distal point from said slots on said rotatable member, the twist of each strip creating a torque operative against the sides of the slot to hold each strip by friction, each slot being long enough relative to the strip fitted in the slot to allow each strip to bend throughout its length to assume both set and clear positions for tabulation, and
- means to change the angular position of said rotatable member to at least two positions at which rocking means for said tabulation rack assembly are operative.

11. The combination as in claim 9 wherein said strips are narrower than said slots.

- 12. The combination as in claim 10 wherein said strips are narrower than said slots.
- 13. The process of forming a tabulation rack comprising the steps of:
- stamping a unitary thin, flat plate of resilient material into a plate having a plurality of fingers, then
- substantially simultaneously twisting said fingers about one-half turn in a fixture especially adapted for said simultaneous twisting, then
- positioning said fingers in the slots of a slotted frame, each slot being long enough relative to the finger positioned in it to allow the finger to bend throughout its length to assume set and clear positions for tabulation, and
- anchoring said plate at a point distal from said fingers. 14. The process as in claim 13 wherein said plate is
- made of spring steel.

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- 15. The process of forming a tabulation rack comprising the steps of:
- stamping a unitary thin, flat plate of resilient material into a plate having a plurality of fingers, then
- inserting a plurality of said fingers in gripping means, then
- twisting said gripping means about one-half turn under the control of a single, controlled movement to substantially simultaneously twist said fingers about onehalf turn, then
- positioning said fingers in the slots of a slotted frame, each slot being long enough relative to the finger positioned in it to allow the finger to bend throughout its length to assume set and clear positions for tabulation, and
- anchoring said plate at a point distal from said fingers. 16. The process as in claim 15 wherein said plate is
- made of spring steel.
 - 17. A tabulation rack assembly comprising:
 - a rotatable member,
 - a first set of tabulation stop fingers, said fingers being anchored to said rotatable member and comprising thin, yieldable strips extending away from said rotatable member in one direction,
 - a first slotted frame structure anchored to said rotatable member, said first set of fingers being fitted in the slots of said first frame structure at positions away from said rotatable member, said slots of said first frame structure being adapted to frictionally hold said fingers of said first set of fingers to positions operative for tabulation,
 - a second set of tabulation stop fingers anchored to said rotatable member and comprising thin, yieldable strips extending away from said rotatable member in another direction so that said two sets of fingers diverge and terminate in separate radial positions each displaced sufficiently from the other position to permit one set of fingers to act independently for tabulation,

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- a second slotted frame structure anchored to said rotatable member, said second set of fingers being fitted in the slots of said second frame structure at positions away from said rotatable member, said slots of said second frame structure being adapted to 5 frictionally hold said fingers of said second set of fingers to positions operative for tabulation, and
- means to change the angular position of said rotatable member.

18. A tabulation rack assembly comprising:

a rotatable member,

- a first set of tabulation stop fingers, said fingers being anchored to said rotatable member and comprising thin, yieldable strips extending away from said rotatable member in one direction,
- a first slotted frame structure anchored to said rotatable member, said first set of fingers being fitted in the slots of said first frame structure at positions away from said rotatable member, said slots of said first frame structure being adapted to frictionally 20 hold said fingers of said first set of fingers to positions operative for tabulation,
- a second set of tabulation stop fingers anchored to said rotatable member and comprising thin, yieldable strips extending away from said rotatable member 25 in another direction so that said two sets of fingers diverge and terminate in separate radial positions each displaced sufficiently from the other position to permit one set of fingers to act independently for tabulation, 30
- a second slotted frame structure anchored to said rotatable member, said second set of fingers being fitted in the slots of said second frame structure at positions away from said rotatable member, said slots of said second frame structure being adapted to 35 frictionally hold said fingers of said second set of fingers to operative positions for tabulation, and
- means to change the angular position of said rotatable member to at least two positions at which rocking means for said tabulation rack assembly are opera- 40 tive.

19. A tabulation rack assembly comprising:

- a rotatable member,
- a first unitary plate formed into a set of yieldable tabulation stop fingers, said plate being anchored at the 45 side distal from said fingers to said rotatable member so that said fingers extend away from said rotatable member in one direction,
- a first slotted frame structure anchored to said rotatable member, said fingers of said first unitary plate being 50 fitted in the slots of said first frame structure at positions away from said rotatable member, said slots of said first frame structure being adapted to frictionally hold said fingers of said first unitary plate to positions operative for tabulation, 55
- a second unitary plate formed into a set of yieldable tabulation stop fingers, said plate being anchored to said rotatable member so said fingers extend away from said rotatable member in another direction so that said two sets of fingers diverge and terminate in 60 separate radial positions each displaced sufficiently from the other position to permit one set of fingers to act independently for tabulation,

a second slotted frame structure anchored to said rota-

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table member, said fingers of said second unitary plate being fitted in the slots of said second frame structure at positions away from said rotatable member, said slots of said second frame structure being adapted to frictionally hold said fingers of said second unitary plate to positions operative for tabulation, and

means to change the angular position of said rotatable member.

20. A tabulation rack assembly comprising:

a rotatable member,

- a first unitary plate formed into a set of yieldable tabulation stope fingers, said plate being anchored at the side distal from said fingers to said rotatable member so that said fingers extend away from said rotatable member in one direction,
- a first slotted frame structure anchored to said rotatable member, said fingers of said first unitary plate being fitted in the slots of said first frame structure at positions away from said rotatable member, said slots of said first frame structure being adapted to frictionally hold said fingers of said first unitary plate to positions operative for tabulation,
- a second unitary plate formed into a set yieldable tabulation stop fingers, said plate being anchored to said rotatable member so that said fingers extend away from said rotatable member in another direction so that said two sets of fingers diverge and terminate in separate radial positions each displaced sufficiently from the other position to permit one set of fingers to act independently for tabulation,
- a second slotted frame structure anchored to said rotatable member, said fingers of said second unitary plate being fitted in the slots of said second frame structure at positions away from said rotatable member, said slots of said second frame structure being adapted to frictionally hold said fingers of said first set of fingers to positions operative for tabulation, and
- means to change the angular position of said rotatable member to at least two positions at which rocking means for said tabulation rack assembly are operative.

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