Feb. 10, 1931. A. KOTTMANN 1,791,675

DRIVE FOR THE STEPPED DRUMS OF CALCULATING MACHINES

Original Filed Nov. 23, 1926

Fig. 1.

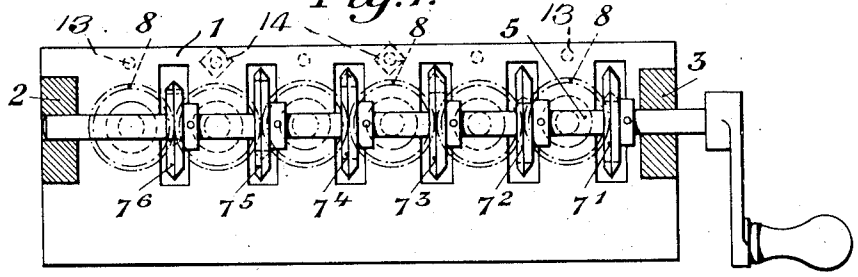


Fig. 2.

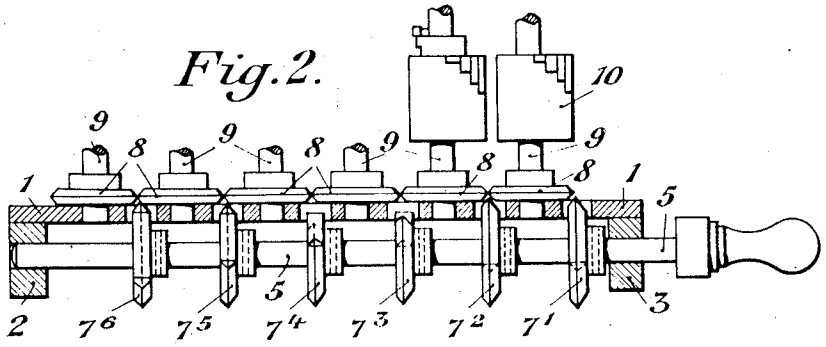


Fig. 3. Fig. 4. Fig. 5.

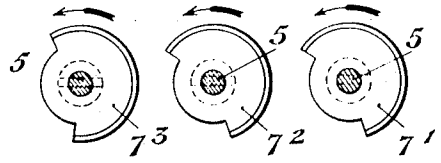


Fig. 6. Fig. 7. Fig. 8.

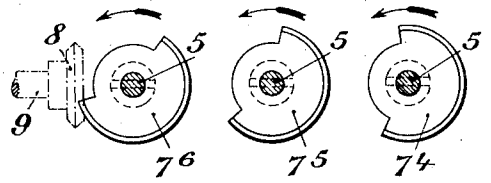
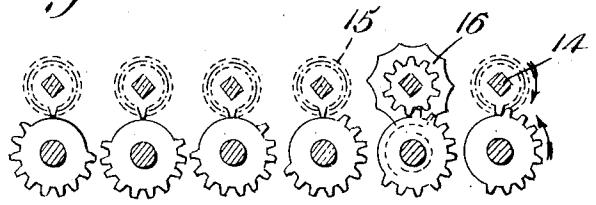


Fig. 9.



INVENTOR

August Kottmann

by Locke, Kehlenbeck & Farley

Attorneys.

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UNITED STATES PATENT OFFICE

AUGUST KOTTMANN, OF SOMMERDA, GERMANY, ASSIGNOR TO RHEINISCHE METALLWAAREN UND MASCHINENFABRIK SÖMMERDA AKTIENGESELLSCHAFT, OF SOMMERDA, GERMANY

DRIVE FOR THE STEPPED DRUMS OF CALCULATING MACHINES

Original application filed November 23, 1926, Serial No. 150,331, and in Germany December 10, 1925. Divided and this application filed May 13, 1927. Serial No. 190,993.

This invention relates to calculating machines having stepped drums and refers more particularly to the driving mechanism of calculating machines as described and claimed in my patent application Ser. No. 150,331 filed November 23, 1926, of which the present application is a division. According to the construction shown in this application the stepped drums of the calculating machine are divided into groups and the groups of drums are rotated by the main drive in such a manner that the left hand group always lags the adjacent right hand group for an angle of so many tooth pitches as tens transfer teeth are provided in the last mentioned group. To obtain this drive, shafts driving the separate groups must be provided. Intermediate shafts are in such a case required between the main driving shaft and the shafts driving the groups and these intermediate shafts are rotated by the main shaft by means of toothed segments.

In the calculating machine according to the invention each group of stepped drums and each group of tens transfer cams consists of one unit (stepped drum, tens transfer cam) so that the driving shafts for the groups may be omitted. The main drive shaft in this case extends, as in the usual bevel gear drive for stepped drums, through the whole machine and directly drives, by means of bevel gear segments, the several groups (in the present case it can also be said the several single stepped drums as each group consists of a single unit). These bevel gear segments are all of the same construction, but fixed to the shaft in such a manner that the one arranged to the left always lags the adjacent one to the right for an angle of one tooth pitch. These bevel gear segments engage with bevel gears which are directly keyed to the shafts of the stepped drums. The bevel gears and bevel gear segments have an equal number of teeth, so that the groups of stepped drums make one revolution at each revolution of the main drive shaft.

In the accompanying drawings one mode of carrying out the invention is shown diagrammatically by way of example.

Fig. 1 is an elevation of the new drive for the stepped drums,

Fig. 2 is a top plan view of the drive shown in Fig. 1,

Figs. 3–8 are detail views showing the relative positions of the bevel gear segments, and

Fig. 9 shows diagrammatically the tens transfer mechanism associated with the stepped drums.

In the construction shown in Figs. 1–8 the driving shaft 5 is journalled in bearings 2 and 3 at the front wall 1 of the machine. The shaft 5 carries the bevel gear wheel segments 7^1—7^6 which are keyed in staggered relation in such a manner, that always the left hand segment lags the right hand segment for an angle of one pitch, except the two segments 7^1 and 7^2 arranged at the right which are not staggered relative to each other, because the lowermost denomination of the calculating machine has no tens transfer cam.

As described in the application Ser. No. 150,331 the stepped drums as well as the tens transfer cams of the upper denominations of the counting mechanism which are not driven by stepped drums may be driven in groups. The definitions "stepped drum" and "group of stepped drums" therefore coincide. For this reason in the following description there will be no longer any reference made to groups of stepped drums and groups of tens transfer cams, but simply to stepped drums and tens transfer cams respectively.

The main drive shaft 5 is arranged close to the front ends of the stepped drum shafts 9, the bevel gear wheel segments of the main drive shaft 5 extend through the wall 1 and engage the bevel gear wheels 8. The bevel gear wheels 8 are fixed to the shafts 9 which carry also the stepped drums 10 and the sectors 11 provided with the tens teeth 12. In holes 13 in the front wall 1 are journalled square shafts 14 upon which are arranged the adjusting wheels 15 and the tens sleeves provided with the star discs 16 tens transfer cams or in the upper denominations of the counting mechanism the tens transfer cams only.

The stepped drums have a compass of 12

pitches, 9 pitches for the stepped teeth, one pitch for the tens transfer cam and one pitch each for play before and after engagement with the adjusting wheel. The bevel gear wheels 8 of the shafts 9 as well as the bevel gear wheel segments 7^1—7^6 of the main drive shaft have 12 teeth.

If all the stepped drums were to start simultaneously, the tens transfer cams of all denominations would act simultaneously. As this is not admissible, the arrangement is such that the stepped drum situated at the left hand side always lags for an angle of one pitch the adjacent drum to the right. This is obtained by staggered arrangement of the bevel gear wheel segments 7^2—7^6 of the main drive shaft 5. As shown in Figs. 2, 4 and 5, the gear segments may be in phase and engage their associated gear wheels simultaneously, the lowermost drum having no transfer mechanism.

For machines having n denominations the bevel gear wheel segments are parts of complete bevel gear wheels of a compass of $12+(n-1)$ pitches, 12 pitches for the teeth engaging the teeth of wheels 8 and $(n-1)$ pitches as play for the $(n-1)$ tens transfer. For the machine shown by way of example in Figs. 1–8 the segments therefore are parts of complete bevel gear wheels having a compass of $12+(6-1)=17$ pitches (a play before and after engagement was already provided at the stepped drums and need therefore not to be provided again).

If now the shaft 5 is rotated from the zero position, the bevel gear wheel segments 7^1 and 7^2 come first into engagement with the bevel gear wheels 8 of the two lowermost denominations. If these wheels have been turned through an angle corresponding to one pitch the bevel gear wheel segment 7^3 also comes into engagement and after rotation for a further pitch also the segment 7^4 and so on. The stepped drum situated at the left hand side together with the associated tens transfer cam therefore always lags the adjacent drum to the right for an angle of one pitch. The tens transfer teeth therefore come into engagement one after the other in the same succession. The tens transfer is therefore actuated as required from the right to the left through the several denominations of the machine although the stepped drums have the small compass of only 12 pitches.

The advantage of this construction with regard to that of the older application resides in the fact that the compass of the stepped drums has the smallest possible value and the drive is considerably simplified as all group driving shafts and intermediate shafts are dispensed with.

Calculating machines are already known in which the stepped drums are driven in such a manner that always the stepped drum arranged at the left hand side is started only when the adjancent drum to the right has been stopped. These machines have the disadvantage that the bevel gear wheel segments of the main drive shaft reach large dimensions, i. e. such large dimensions, that it is impossible to arrange the main drive shaft close in front of the ends of the stepped drums. In these machines, therefore, the main drive shaft is arranged in a lower plane and connected to the stepped drums 9 by means of intermediate bevel gear wheels. Also with regard to such machines the drive according to the invention is to be considered as a substantial simplification as considerably smaller segments are required and the intermediate bevel gear is dispensed with.

What I claim is:

1. In a drive for the stepped drums and tens transfer mechanisms of calculating machines, in combination, a drive shaft, gear wheels associated with said drums and tens transfer mechanisms, gear segments on said drive shaft adapted to mesh with said gear wheels for driving said drums and transfer mechanisms, the segments associated with the two lowermost drums being in phase and the remaining segments and their associated drums being so arranged that the drum or transfer mechanism at the left hand side lags the adjacent drum or transfer mechanism to the right for an angle of one tooth pitch.

2. In a drive for the stepped drums and tens transfer mechanisms of calculating machines, in combination, a drive shaft, gear wheels associated with said drums and tens transfer mechanisms, gear segments on said drive shaft adapted to mesh with said gear wheels for driving said drums and transfer mechanisms, the segments associated with the two lowermost drums being in phase and the remaining segments and their associated drums being so arranged that the drum or transfer mechanism at the left hand side lags the adjacent drum or transfer mechanism to the right for an angular interval sufficient for the completion of the tens transfer from the preceding denomination.

3. In a drive for the stepped drums and tens transfer mechanisms of calculating machines, in combination, a drive shaft, gear wheels associated with said drums and tens transfer mechanisms, gear segments on said drive shaft adapted to mesh with said gear wheels for driving said drums and transfer mechanisms, the segments and their associated drums being so arranged that the drum or transfer mechanism at the left hand side lags the adjacent drum or transfer mechanism to the right for an angular interval sufficient for the completion of the tens transfer from the preceding denomination.

In testimony whereof I have affixed my signature.

AUGUST KOTTMANN.