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Limberger

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[54] **COUNTER FOR WORKING CYCLES**

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[52] **U.S. Cl.** **355/50,** 355/14

[51] **Int. Cl.** **G03b 27/48,** G03b 27/50

[58] **Field of Search** 355/14, 50

[56] **References Cited**

UNITED STATES PATENTS

3,330,179 7/1967 Zerfahs et al. 355/14

3,600,085 8/1971 Altergott 355/14

FOREIGN PATENTS OR APPLICATIONS

94,028 4/1922 Switzerland 355/14

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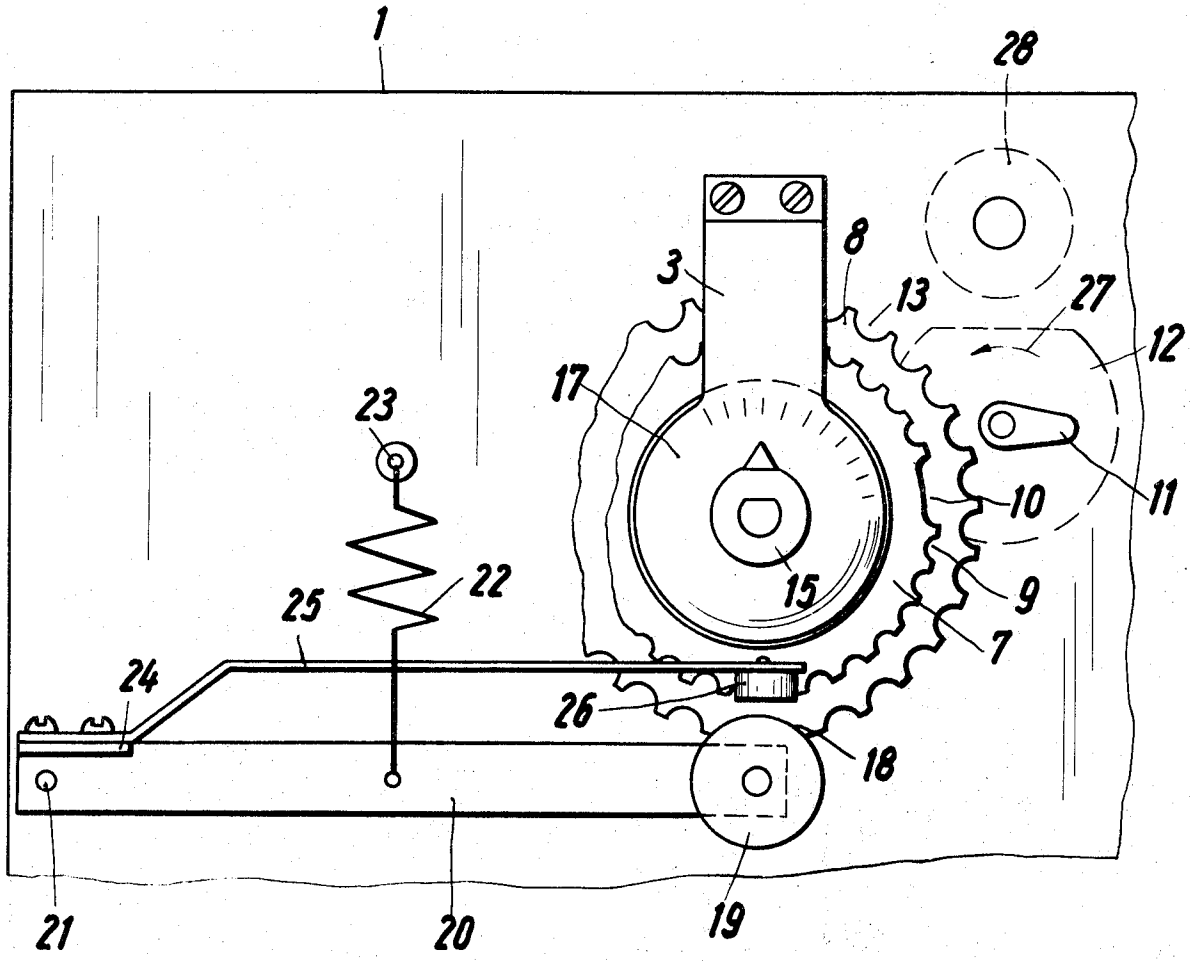
[57] **ABSTRACT**

A counting device for working cycles and more particularly for copying apparatus for counting an adjustable number of copies as a function of an element which rotates in accordance with the working cycle, comprising a drive wheel adjustable in accordance with the number of working cycles, whereby a signal is produced when a certain number of working cycles has been executed.

7 Claims, 4 Drawing Figures



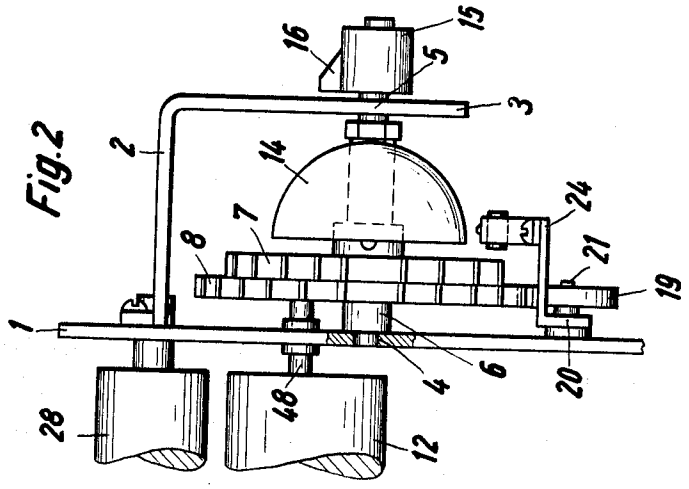


Fig.2

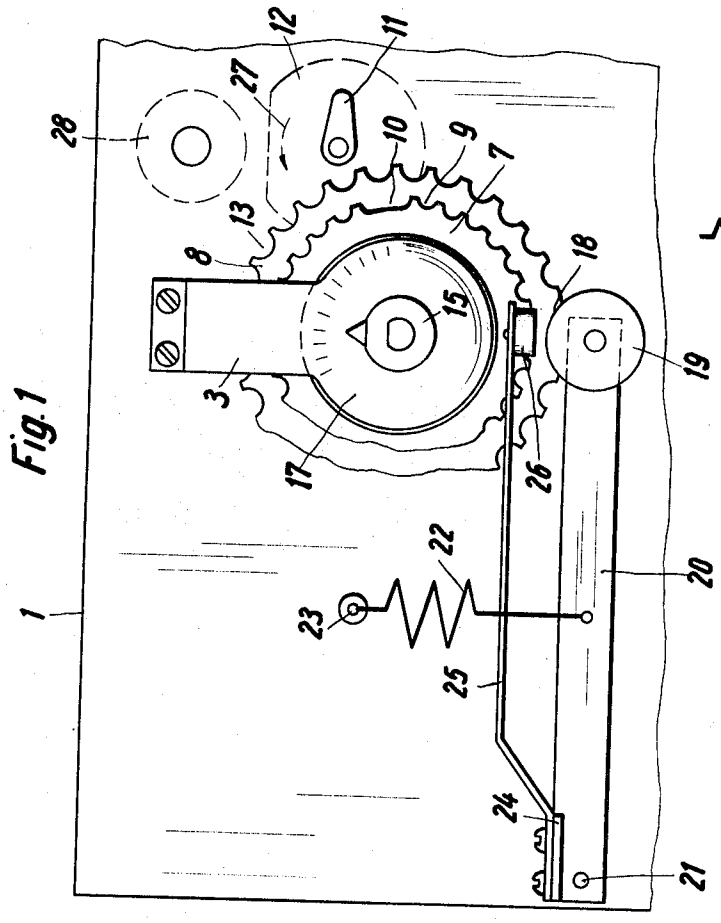


Fig.1

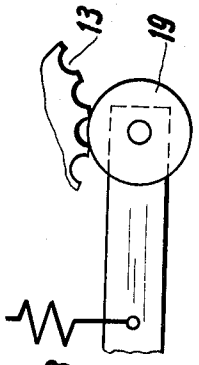
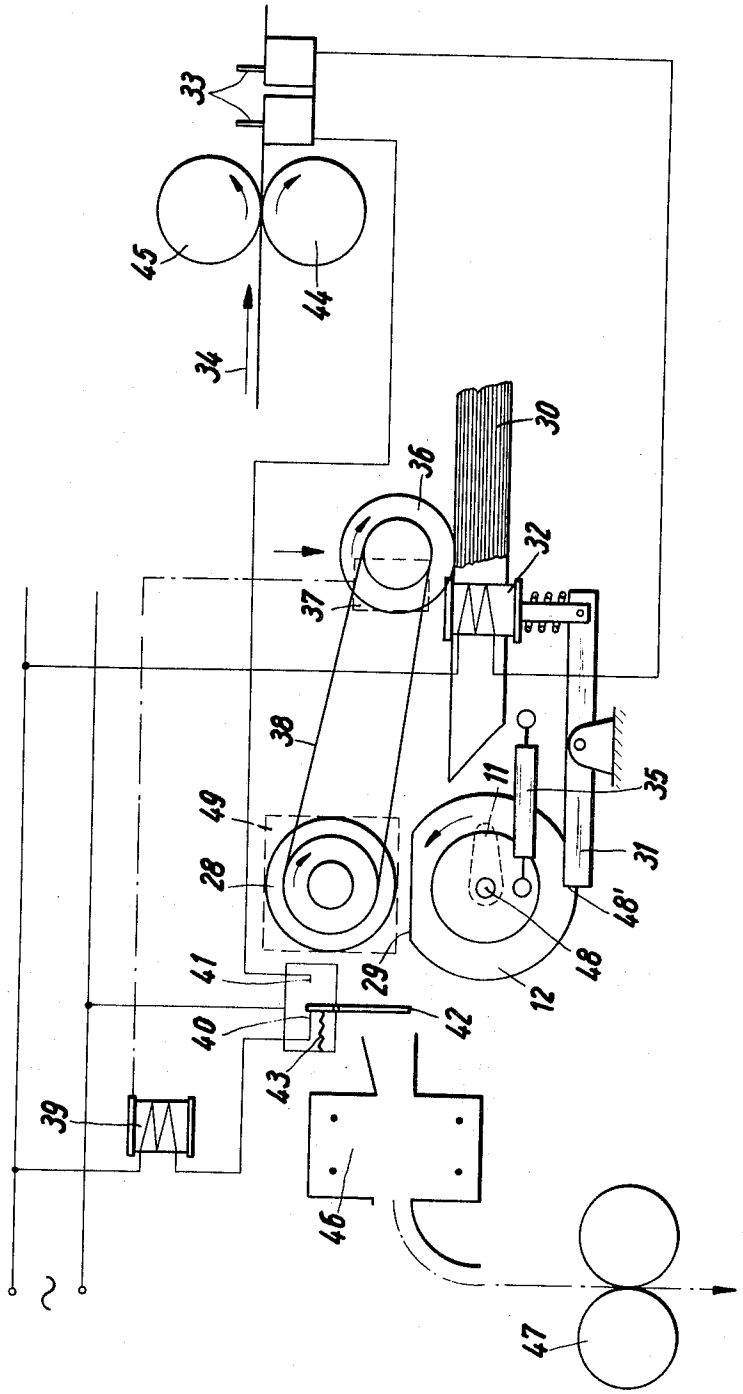


Fig.3

Fig.4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COUNTER FOR WORKING CYCLES

BACKGROUND OF THE INVENTION

A known construction of this kind comprises two locking levers which are lifted by an eccentric out of engagement with the rotating element, and thereby release a counting wheel equipped with a spring drive for step-by-step rotation. The locking levers act on a locking wheel with two cam tracks and connected to the counting wheel; a spring acting on the locking wheel is tensioned when the counting wheel is adjusted and is relieved in accordance with the release of the locking wheel with simultaneous rotation of the counting wheel towards a reset to zero position. The locking wheel cooperates with an actuating element for a signalling device which is operated when the counting wheel has reached its zero position. The signalling device may be constructed as a bell, arranged adjacent to the locking wheel or to the counting wheel.

This construction has the disadvantage that during the movement of the counting wheel an actuating spring must be tensioned increasingly, and provides not only the drive but also the operation of the signal. For this reason a comparatively large spring is necessary. In addition, this known device is comparatively large because counting and locking wheel, locking lever and bell must be mounted side by side.

Furthermore, particularly in copying apparatus, it may be necessary to make several copies from one original, for which the counting device is particularly suitable, as well as a single copy. For this reason, the proposed device requires an additional coupling with the element rotating in accordance with the working cycles. This element rotates always during the production of a copy, so that the coupling must remain engaged for manufacturing several copies, but disengaged for making only a single copy. Similar problems also arise during the counting of other working cycles, for example of processing machines with which one or several processing steps are carried out at choice.

Comparatively complicated devices are known for copiers, whereby the number of copies to be made from one original may be preset and the apparatus is automatically controlled to perform a corresponding number of working cycles. These devices are very expensive and necessitate a special arrangement of the whole control. Such devices are known both for copiers in which an original is placed on an exposure plate and remains in this position until several exposures and applications of copying materials inside the apparatus have been performed automatically. In addition, a continuous device is also known in which an original is guided repeatedly on an exposure plate and the corresponding controls are executed automatically inside the apparatus.

Particularly in copiers in which an original is reintroduced for making every copy or is guided alongside an exposure position, this automation represents an unjustifiable expenditure and for this reason the arrangement mentioned above has been proposed. It serves to eliminate the counting by the operator of the apparatus, where larger numbers of copies are to be made from the same original, or equal numbers of copies successively from several originals. In this manner, the numbers of copies may easily be controlled even at high operating rates.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an improvement of the proposed device in which an additional coupling for selectively operating the counting device is avoided, the device is smaller and comprises fewer parts, and the expenditure for spring means is reduced.

It is a further object of the invention to provide a device of the type hereinbefore mentioned, in which the rotating element is provided with a driving member for the drive wheel of a stepping unit, having an idle motion in the zero position of the counter and associated with a cam track for a signalling lever, wherein this cam track has a recess in the zone of the zero position into which the signalling lever engages in order to deliver a signal. In this manner, the counter is operated only when it has been set at zero for carrying out a count, whilst the engagement or disengagement between the rotating element and the stepping unit is no longer necessary. If the signalling lever operates under its own weight, the counting device can work without spring and the signalling device is constructed to deliver a signal pulse.

Preferably, particularly with a spring biassed signalling lever for a bell forming the signalling device, an elastic hammer is adapted to hit the bell when the signalling lever enters into the recess. Here, the counting device comprises a single spring, namely the spring acting on the signalling lever which is tensioned when the cam track is moved during the adjustment of the drive wheel in such a way that its recess is displaced out of the zone of the working end of the signalling lever. In this manner, during the adjustment of the counting device, the spring force is provided for the signal and is stored until it is released. It is, therefore, possible to use a much smaller spring than the known construction, and to provide always a definite force for signalling, apart from the fact that the moment does not change with the adjustment of the drive wheel in accordance with the selected number of working cycles.

It is a further object of the invention to provide a counting device of the kind hereinbefore mentioned in which the rotating element, and preferably the end face of a roller or of a spindle, carries an eccentric, crank-shaped operating element, in the path of which the stepping unit has a correspondingly toothed wheel, acting as drive wheel, and having in the zero position a recess allowing the said operating member to pass freely. This arrangement represents a preferred embodiment of the invention because it provides a stepping unit with few and simple elements in which the provision for the idling motion may be achieved by a simple recess. With the counter in the zero position, it is therefore possible to make single copies without having to disconnect the counting device.

The operating element may be formed, for example, by the end of a lever mounted centrally on a roller and revolving with the roller.

In a particularly preferred embodiment of the invention, the cam track is a disc and is mounted on the drive wheel, or is made integrally with the drive wheel.

The invention includes a construction in which the disc has a smooth circumference against which the operating end of the signalling lever rests under spring tension when the counting device is not in the zero position. This achieves sufficient interlocking of the step position at any given time, and this arrangement may

include the provision of means reducing the friction at the working end of the signalling lever.

It is a further object of the invention to provide a counting device of the kind hereinbefore described, in which the circumference of the disc has a profile corresponding to the drive wheel and a roller mounted on the signalling lever provides a resilient interlock in every stepping position, wherein the profiles are so narrow that the signalling lever is pivoted under the action of the spring when the roller is outside the recess. In this arrangement, the drive wheel and the disc may be in one part, and the signalling lever and the operating element may act on adjacent sections of the circumference. Preferably, however, the drive wheel and the disc have different diameters, and the recesses are angularly offset relative to each other. This provides a particularly advantageous construction, and it should be noted that the angular offset is possible only with an integral construction with the same diameters for the drive wheel and for the disc.

In a preferred embodiment, the counting device with the means outlined above has a construction in which a freely rotatable shaft carries the unit which forms the drive wheel and disc, and a pointer hub with a pointer, associated with a scale corresponding to the indexing. In the preferred embodiment with a profiled disc, the stepping position or indexing is reliably and detachably secured by the engagement of the signalling lever, and the idling motion position is secured by a residual tension of the spring acting on the signalling lever or, in a construction without spring, by the weight of the signalling lever which acts in this case from the top.

Preferably a bell is mounted firmly on the shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described, by way of example, with reference to an embodiment shown in the accompanying drawings, in which:

FIG. 1 is a side elevation of the device according to the invention on a side wall of the apparatus;

FIG. 2 is a front elevation of the arrangement of FIG. 1;

FIG. 3 is a detail of FIG. 1 in another operating position;

FIG. 4 shows diagrammatically parts of a copying apparatus co-operating with the counting device.

The drawings show merely the parts essential for the invention. In all figures identical parts are shown under the same reference numerals.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. 1 to 3, there is shown a base plate 1 which may be an assembly wall or a side wall of the housing of a copier and which carries an angle bracket 2. The free leg 3 of the bracket and the base plate 1 carry mountings 4 and 5 for a freely rotatable shaft 6. Between the leg 3 and the base plate 1, a drive wheel 7 and a disc 8 are mounted firmly on the shaft, the diameter of the disc 8 being larger than that of the drive wheel 7.

As may be seen particularly from FIG. 1, the drive wheel 7 has a circumferential toothing with arcuate, outwardly open recesses between the teeth. This toothing is interrupted at a point forming a larger recess 10. The operating member for driving the drive wheel is a lever shaped cam 11 mounted on a roller 12 of a copier, rotating through 360° as a function of every working cycle. The end 48 of the shaft 12 is extended and may pass through the base plate 1 forming the mounting means, and carries the crank-shaped cam 11 on the side of the base plate, on which the drive wheel 7 is located. The association between the drive wheel 7 and the cam 11 is such that in the position shown in FIG. 1, the free end of the cam may pass without engagement through the recess 10 (this position of the drive wheel 7 corresponds to the idle motion or zero position), or engages into a recess of the circumferential toothing 9 for the intermittent drive of the drive wheel, when the drive wheel has been rotated.

The disc 8 may have a circumferential profile corresponding to the circumferential toothing 9, but the depth of which may be different in accordance with considerations outlined further below. The circumferential toothing 13 has also the object of locking the unit, consisting of the drive wheel 7 and of the disc 8, and consequently also the shaft 6, in every position including the zero position.

In addition, the shaft 6 also carries a bell 14, located within the angle bracket 3, the outer end of this shaft carries a pointer hub 15 with a pointer 16 co-operating with a scale 17 located on the outside of the angle bracket 3. The scale corresponds to the toothing of the d rive wheel 7 or to the indexing of the circumferential profile 13.

The latter has also a recess 18. The dimension of this recess is such that it can receive a roller 19 which too large to enter into the recesses of the circumferential profile 13, which is too narrow to receive the roller. If the disc 8 is rotated out of its position shown in FIG. 1, the roller 19 is pushed out of the recess 18 and is held at a larger distance from the shaft 6 than when it is in the recess 18.

The roller 19 is mounted rotatably at the operating end of a signalling lever 20 which is pivoted about a pivot 21 on the base plate 1. A tension spring 22, not shown in FIG. 2, acts on the signalling lever, is mounted on the base plate at 23, and tends to pull the roller 19 in the direction towards the shaft 6.

A laterally projecting part 24 of the signalling lever 20 carries an elastic bell hammer 25 which is so arranged that its end carrying the hammer head 26 is located under the bell 14.

If the roller 12 is to be rotated in the direction of the arrow 27, the scale 17 will be marked as shown in the drawing. Consequently, the pointer hub 15 is moved in an anticlockwise direction as viewed in FIG. 1 in accordance with the number of copies to be made. This causes the recess 10 to be moved out of the range of the lever cam 11, and the recess 18 to be rotated away from the roller 19. During this, the roller 19 rolls on the circumferential profile 13, as shown in FIG. 3, and tensions the spring 22. The engagement into the individual profiles which is smaller than the engagement into the recess 18 gives rise to a resilient adjustment of the counting device with every step under continuing tensioning of the spring, and in the selected starting position in such a way that during the revolution of the roller 12 the cam 11 can engage without shock into a recess of the circumferential toothing 9 to effect the intermittent movement of the drive wheel 7, the disc 8, and the pointer hub 15. The crank-shaped adjusting cam 11 is arranged on the roller 12 in such a way that the cam is withdrawn from the toothing of the drive

wheel, as shown in FIG. 1 when the roller is stationary between the working cycles or copying steps. It should be noted that the circumferential toothing does not necessarily have the shape shown in the drawing, but may have another tooth-shape. The same also applies to the circumferential profile **13.** It is only essential that the recesses **10** and **18** are formed by the gap of only one tooth or one projecting profile. This point has been decisive in choosing the different diameters for the drive wheel and the disc with regard to the engaging elements **11** and **19.**

When the counting device enters the zero position after the preset number of cycles, the roller **19** enters the recess **18,** the depth of which deflects the elastic hammer **25** and rings the bell **14.** As shown in FIG. **3,** the circumferential profile is such that no pivoting of the signalling lever occurs when passing to the different parts of the profile and the bell cannot be rung.

FIG. **1** shows, of the copier with which the counting device is preferably used, the roller **12** which revolves once for the production of a copy and the mating roller **28.** Both parts may be located on one side of the base plate **1** to which end it is only necessary to extend one end of the shaft **12** for mounting the lever-shaped operating cam **11.** This is also shown in FIG. **4.**

The roller **12** is constructed as a so-called switching roller, having a flat portion **29** in front of a stack **30** of copying sheets. It is locked by a pivoting lever **31** in the position in which the flattened portion **29** faces the mating roller **28,** thereby leaving a gap between the rollers. The mating roller is continuously rotated by a main motor **49** of the appratus, and the directions of rotation are indicated by arrows.

The pivoting lever **31** may be actuated briefly by an operating magnet **32** by operating a switch **33** by means of an original pushed for exposure over the exposure plate in the direction of arrow **34,** thereby unlocking the switching roller **12,** enabling it to be rotated by a spring **35** in the direction of the arrow. This produces an operational engagement with the mating roller **28,** carrying along a sheet of copying paper. After one revolution of the switching roller **12,** the pivoting lever **31** engages again into the recess **48.**

With regard to FIG. **4** it should be noted that the crank or lever-shaped cam **11** is mounted on the end of the roller **12** remote from the spring **35** and the lever **31.**

A withdrawing roller **36** rests on the topmost sheet of the stack and may be connected to the continuous drive of the apparatus or to the mating roller **28** by means of a coupling **37** shown diagrammatically. A rope pull **38** may be provided between the coupling and the mating roller. A magnet **39** serves to operate the coupling.

The circuits for the magnets **32** and **39** pass through switching contacts **40, 41** of a changeover switch whose switching arm **42** is also connected to the power supply and is affected by a spring **43** which tends to close the circuit through the contact **40** to the magnet **39** and thus for connecting the withdrawing roller **36.** The switching arm **42** extends in front of the gap between the switching roller **12** and the mating roller **28.**

When the apparatus is switched on, the withdrawing roller **36** delivers therefore a sheet of copying paper from the stack and through the gap between rollers **12** and **28** up to the switching arm **42** which is thereby deflected. This causes the magnet **39** to be de-energised, the coupling **37** disengages and the withdrawing roller **36** stops. Simultaneously, the switching arm **42** rests on the contact **41.** When an original, introduced between the pair of transport rollers **44, 45** operates switches **33** at a certain point of the exposure device, magnet **32** may be energised, the zwitching roller **12** is released and delivers the sheet of copying paper synchronously with the transport of the original alongside the switching arm **42** into a treatment section **46** and further transport means **47** of the apparatus. Transport means **44, 45, 47** are operated by the main drive of the apparatus.

This statement serves to elaborate the description of a preferred embodiment of the invention in a copying device with an element rotating through 360° per working cycle. Such a control is known in the art.

Obviously, the counting device is not limited to such an embodiment of a copying device because the roller **12** may also be replaced by any other roller which revolves only once for every copying step and which may be used for driving the counting device.

I claim:

1. A device for counting working cycles comprising a mounting means, a drive wheel rotatably mounted on said mounting means, an actuating element rotatable in accordance with said working cycle, said drive wheel having a plurality of step parts, said actuating element being disposed to engage said step parts of said drive wheel to rotate the latter in incremental steps corresponding to the number of working cycles, adjustment means connected to said drive wheel for rotating the latter to the desired number of working cycles, said drive wheel having a zero position defined by an idle motion section, said drive wheel being movable to a position in which said idle motion section is disposed to permit rotation of said actuating element without rotating said drive wheel, a cam wheel mounted for rotation with said drive wheel, said cam wheel having a plurality of step sections and a cam section, a lever pivotally mounted on said mounting means, an engaging element on said lever, means biasing said lever to cause said engaging element to biasingly engage said step sections and said cam sections, an alarm on said mounting means, said cam section being arranged in relative correspondence to said idle motion section of said drive wheel such that when said drive wheel reaches said zero positon, said engaging element of said lever engages said cam section to cause said biasing means to pivot said lever to a position to strike said alarm, said step sections on said cam wheel being arranged to correspond to said step parts on said drive wheel such that said engaging element on said lever successively engages said step elements to provide a resilient interlock for each incremental step of said drive wheel.

2. A device according to claim **1** wherein said drive wheel is mounted on a shaft, said alarm comprising a bell mounted on said shaft, said lever having an elastic hammer mounted thereon, said elastic hammer being disposed to strike said bell when said engaging element engages said cam section.

3. A device according to claim **1** wherein said actuating element is a crank element, said step parts on said drive wheel comprising a plurality of teeth, said idle motion section being formed by an extended recess between said teeth.

4. A device according to claim **1** wherein said step elements on said cam wheel comprise teeth, said engag-

ing element on said lever comprising a roller which biasingly engages said teeth to provide said resilient interlock, said teeth and said roller being constructed and arranged such that said lever is precluded from striking said alarm bell when said roller engages said teeth, said cam section on said cam wheel being in the form of an indentation of greater depth than said teeth.

5. A device according to claim 1 wherein said drive wheel and cam wheel have different diameters and a common axis of rotation, said idle motion section on said drive wheel being angularly offset relative to said cam section on said cam wheel.

6. A device according to claim 1 wherein said drive wheel and cam wheel are mounted on a common shaft, means mounting said shaft for free rotational movement in said mounting means, said adjustment means comprising a pointer means mounted on said shaft for indicating the desired number of working cycles.

7. A device according to claim 2 including means rigidly mounting said bell on said shaft.

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