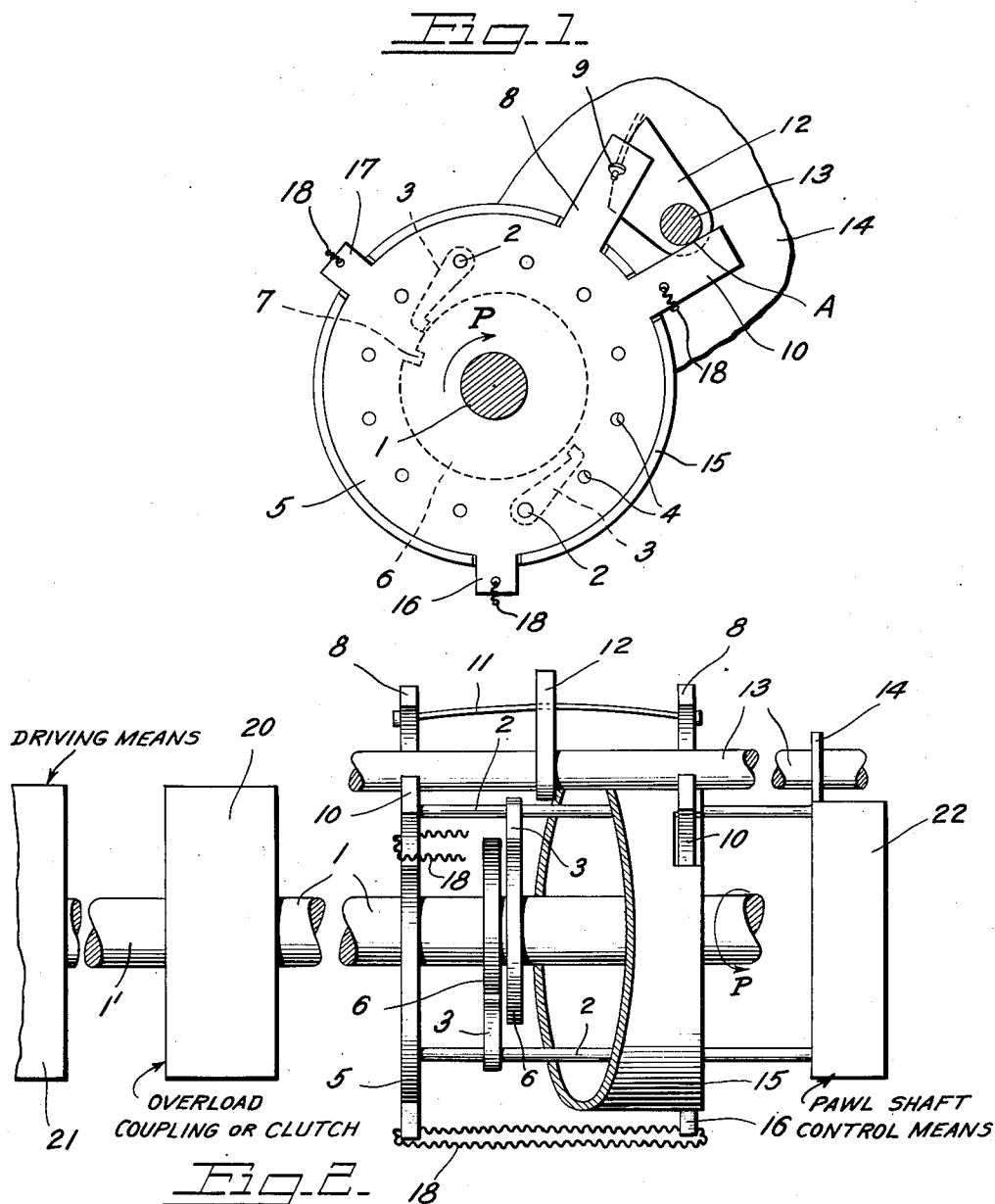


Nov. 4, 1952

J. M. UNK ET AL
SHAFT POSITIONING MECHANISM

2,616,299

Filed Jan. 28, 1949



Inventors

JACOB MARINUS UNK
WILHELMUS LAMBERTUS VERVEST

BY *Fred M. Vogel*
AGENT

UNITED STATES PATENT OFFICE

2,616,299

SHAFT POSITIONING MECHANISM

Jacob Marinus Unk and Wilhelmus Lambertus Vervest, Eindhoven, Netherlands, assignors to Hartford National Bank and Trust Company, Hartford, Conn., as trustee

Application January 28, 1949, Serial No. 73,272
In the Netherlands February 23, 1948

10 Claims. (Cl. 74-10.2)

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For the purpose of accurately positioning a rotary element, for instance a tuning element of a radio transmitter or receiver, it is known to couple this element with a device comprising a shaft which is adapted to be locked in one or more predetermined positions by means of one or more movable pawls arranged at the side of the shaft. For this purpose, the shaft to be locked, referred to hereinafter as the main shaft, is provided with locking elements, for example discs or rings, each having a profiled edge. By the engagement of a pawl with a locking element the main shaft, when rotating in one direction, is locked accurately in a position determined by the position of the locking element relatively to the main shaft.

The pawls which must be movably arranged in order that one of them at will may co-operate with the locking element on the main shaft, are supported in the known devices by a shaft which is substantially parallel to the main shaft a single shaft being adapted to support all the pawls or as the case may be each pawl being associated with a separate shaft. In the first case each of the pawls is free to rotate about the single shaft, in the other case the pawls may each be adapted to rotate about the shaft by which it is supported or be secured to it, it then being necessary for each of these shafts to be adapted to rotate. A shaft serving to support one or more pawls is referred to hereinafter as "pawl shaft."

In devices as described above it is frequently desirable that the main shaft should rapidly occupy the desired position. This can be realized by a high speed of rotation of the main shaft when moving to the new position. There is, however, a limitation in that, the higher the speed of movement, the heavier is the shock which the pawl, which engages a locking element on the main shaft on reaching the new position, has to sustain. This shock may exert such a force on the pawl and the locking element that damage is unavoidable.

The invention has for its object to provide an improved construction of a device of the kind described above in which provision is made to reduce the force exerted on the pawl which engages when the movement of the main shaft is locked. According to the invention, a pawl shaft is adapted to move in a direction which corresponds at least partly with the direction of the force exerted by the main shaft, upon being locked, on the pawl supported by the pawl shaft; against this direction the movement of the pawl

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shaft is limited by a stop, the pawl shaft being held by resilience in the extreme position determined by the said stop. On the main shaft being locked, the shock is borne by the pawl and transferred by the latter to its pawl shaft and the support for the latter. The pawl shaft will thus be moved in a direction opposite to that of the force of the spring which holds the pawl shaft in the extreme position determined by the stop. Resilience brakes the movement of the main shaft. The latter is thus stopped, whereupon both the pawl shaft with the pawl and the main shaft with the elements coupled therewith are resiliently urged back until the aforesaid stop prevents any further retracting movement of the pawl shaft. The main shaft is thus eventually locked in a predetermined position which is determined by the locking element which co-operates with the pawl when in engagement and by the extreme position to be occupied by the pawl shaft. Due to the fact that on the pawl coming into action the shock is resiliently borne, that is to say due to the fact that the rotary movement of the main shaft is braked over a finite path, the force exerted on the pawl during this braking by the locking element is lower than in the absence of movement over this braking path. The improved construction permits of adjusting the main shaft at a high rate without any fear that the pawls and their support will be damaged and without the need to reinforce the various parts subjected to the locking forces, a reinforcement by which the whole of the device would be enlarged.

In a preferred embodiment of the device according to the invention, in which each pawl is seated on a separate pawl shaft, the pawl shafts which are arranged to surround the main shaft, are rotatably supported in two spaced plates which are arranged at right angles to the main shaft and are rotatably supported by the main shaft and the system formed by the plates and the pawl shafts is kept with the use of at least one spring in a direction opposite to the direction of rotation of the main shaft in engagement with a fixed part. No pawl shaft in this embodiment is resiliently supported singly, but the pawl shafts are housed together in a structure formed by plates at right angles to the shaft and adapted to move about the shaft, the structure being kept in its extreme position by at least one spring.

In an alternative preferred embodiment, each of the plates is provided with an extension which is urged by the spring against the same fixed part

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of the device and the plates are movable relatively to one another, at least to a limited extent, about the main shaft. The possibility of a relative rotary movement of the plates ensures that both of them invariably take up the extreme positions to be occupied, so that the position of the pawl shafts is undubiously determined. This is particularly important if great accuracy and reproduceability of the positions in which the main shaft is adapted to be locked is required.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying drawing, in which

Fig. 1 is a diagrammatic front view of a device according to the invention, and

Fig. 2 is a diagrammatic side view of this device.

Surrounding a shaft 1 required to be locked, which is adapted to rotate in the direction indicated by the arrow P, are arranged parallel thereto a plurality of pawl shafts 2—in the embodiment shown twelve—each of which supports a pawl 3, only two sets of the pawl shafts and pawls being shown. Each pawl shaft 2 is parallel to the main shaft 1 and is rotatably supported in an aperture 4 provided in either of two spaced identical plates 5 which are at right angles to the shaft 1. The two plates 5 are adapted to rotate about the shaft 1 and are supported thereby. The apertures 4 in these plates are arranged in a circle concentric to the shaft 1 and are evenly distributed about this circle.

Seated on the shaft 1 in known manner are a number of disc-shaped locking elements 6, each having a recess 7 at its edge. By movement of the corresponding pawl shaft the edge of each disc 6 is enabled to engage one of the pawls 3. For this purpose, the pawls 3 exhibit a relative shift in the direction of the shaft 1. Only one of the discs 6 is shown, viz. that which the pawl 3 shown in Figure 1 is adapted to engage. However, two of the discs 6 are shown in Figure 2 in order to illustrate their relationship along the shaft 1.

Each plate 5 is provided at its edge with an extension 8 which exhibits an aperture 9 and with a second extension 10 spaced away from the first. The apertures 9 of the plates receive the ends of a stressed wire spring 11 by which the two plates are linked. The centre of the spring 11 exerts a force on a projecting lug 12, which is secured to a bar 13, which passes between the extensions 8 and 10 of the plates 5. As a result of the spring 11 being stressed the two plates 5 are subjected to a couple of forces opposite to the direction of rotation of the shaft 1. However, movement of the plates as a result of this couple of forces is prevented by the extensions 10 engaging the bar 13 at A. The edge of the lug 12 which engages the spring 11, does not extend concentrically to the bar 13. The bar 13 is held by the frame plates 14 of the device, one of them being shown in part in Fig. 1. The bar 13 is adapted to rotate about its axis and the lug 12 is carried along therewith, so that the spring 11 may be stressed to a greater or smaller extent. The space between the plates 5 is sealed by a sleeve 15 which engages the edge of the plates. The sleeve 15 shields the pawls arranged about the shaft 1 and also keeps the plates 5 spaced apart. The edge of the sleeve comprises recesses, from which the extensions 8, 10, 16 and 17 of the plates project. The recesses are chosen to be of such ample size in a tangential direction that the two plates 5 can be rotated

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relative to one another. The movability of the plates relative to one another thus realized results in that the extension 10 of each plate is constantly urged against the bar 13, so that the position of the pawl shafts is determined in an undubious manner. The plates 5 are kept linked up by the flexible wire linkages 18, which are taken through apertures provided in the extensions 10, 16 and 17.

The device described operates as follows. For locking the shaft 1 rotating in the direction P with the use of a pawl 3, the end of this pawl is kept in engagement with the edge of the disc 6 arranged under the pawl by rotation of the shaft 2 on which the pawl is seated. The particular pawl shaft 2 to be rotated may be selectively actuated by pawl shaft control means 22. Such means shown diagrammatically in Figure 2 of the drawings may be of the type shown in U. S. Patent No. 2,530,795 issued November 21, 1950, to J. M. Unk, one of the co-inventors in the present application. On the recess 7 reaching the end of the pawl 3, this pawl snaps in and further relative rotation between the shaft 1 and the pawl 3, and hence also between the shaft 1 and the system formed by the plates 5 and supporting all the pawl shafts is prevented. However, the shaft 1, together with the elements coupled therewith has some kinetic energy and by the intermediary of the pawl 3 this causes the plates 5 with the associated pawl shafts to perform a movement in the direction of rotation of the shaft 1. However, this movement is counteracted by the spring 11, which is stressed still further by this movement. Consequently, the spring locks the moving part of the device comprising the shaft 1 and the structure formed by the plates 5 and coupled with the shaft by the pawl 3 and then urges this part backwards until the extensions 10 again engage the bar 13.

When the movement of the shaft 1 is being braked consequent upon the pawl 3 snapping in, the edge of the recess 7 exerts on this pawl a force which, since braking is effected against the couple of forces exerted by the spring 11 through a given path, is considerably smaller than the force which the pawl would have to bear, if the structure formed by the plates 5 had not been rotatable and the braking path were determined solely by resilient deformation of the pawl and its support.

The spring 11 exhibits such rigidity and such a bias that the braked part of the device, and hence also the shaft 1, is returned to the position in which the extensions 10 engage the bar 13, a position which consequently is fully determined and reproduceable. The bias of the spring 11 depends on whether or not the shaft 1 remains subjected to a couple of driving forces. The shaft 1 may, for example, be driven by a driving shaft 1' connected to the shaft 1 through a clutch 20 which on exceeding a given countercouple is released, a driving couple remaining continuously exerted, on the shaft by the use of springs in the said clutch. The driving shaft 1' may be driven by driving means 21 of conventional design, such as an electric motor, for example. A clutch or overload coupling of such type construction and which may be utilized for the clutch shown diagrammatically in Fig. 2 of the drawings, is shown in copending application Serial No. 51,604 filed September 28, 1948, for a Device for Coupling a Driving Shaft with a Driven Shaft and Comprising a Coupling Which is Disengaged Upon Overloading, by J. M. Unk, one of the co-inventors of the present application. In this case, for re-

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turning the braked part of the device, the spring 11 must be capable of overcoming the couple of driving force which still acts on the shaft. The bias of the spring 11 may, as described above, be adjusted by rotation of the bar 13 and the lug 12 secured thereto, so that in accordance with the direction of rotation of the bar, the spring is bent to a greater or less extent and thus a greater or less great counter-couple is obtained. Thus, the resilience of the spring may be adapted to the nature of the drive of the shaft 1 to be locked.

What we claim is:

1. Shaft positioning mechanism comprising a control shaft to be positioned, a plurality of stop members mounted on said control shaft, a plurality of rotatable stop pawls each adapted to engage selectively with a corresponding one of said stop members, a separate pawl shaft supporting each of said pawls, supporting means for said pawl shafts, said supporting means permitting rotative movement of said pawl shafts in a body about said control shaft upon engagement of any pawls with its corresponding stop member on said control shaft, resilient means for restraining such bodily rotative movement of said pawl shafts about said control shaft and stop means for checking said pawl shafts in extreme position under influence of said resilient means.

2. Shaft positioning mechanism comprising a control shaft, a plurality of stop members mounted on said control shaft, a plurality of rotatable pawls, each mounted on a different one of a plurality of pawl shafts arranged in parallel relation with said control shaft, said pawls being adapted to engage with a corresponding stop member on said control shaft for arresting said control shaft in predetermined positions, supporting means for said pawl shafts, said supporting means permitting rotative movement of said pawl shafts in a body about said control shaft upon engagement of one of said pawls with its corresponding stop member on said control shaft, resilient means restraining such movement of such pawl shafts and stop means for checking said pawl shafts in extreme position under influence of said resilient means.

3. Shaft positioning mechanism comprising a control shaft, a plurality of stop members mounted on said control shaft, a plurality of rotatable pawls, each mounted on a different one of a plurality of pawl shafts arranged in parallel relation with said control shaft, said pawls being adapted to engage with a corresponding stop member on said control shaft for arresting said control shaft in predetermined positions, common supporting means for said pawl shafts, said common supporting means permitting rotative movement of all of said pawl shafts in a body about said control shaft upon engagement of one of said pawls with its corresponding stop member on said control shaft, resilient means restraining such movement of all of said pawl shafts and stop means for checking all of said pawl shafts in extreme position under influence of said resilient means.

4. Shaft positioning mechanism comprising a control shaft, a plurality of stop members mounted on said control shaft, a plurality of rotatable pawls, each mounted on a different one of a plurality of pawl shafts arranged in parallel relation with said control shaft, said pawls being adapted to engage with a corresponding stop member on said control shaft for arresting said control shaft in predetermined positions, support-

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ing means for said pawl shafts, said supporting means comprising two spaced plates which are at right angles to said control shaft and rotatably supported thereby, such rotation occurring upon engagement of one of said pawls with its corresponding stop member on said control shaft, resilient means restraining such rotation of said two plates and stop means for checking said two plates in extreme position under influence of said resilient means.

5. Shaft positioning mechanism comprising a control shaft, a plurality of stop members mounted on said control shaft, a plurality of rotatable pawls, each mounted on a different one of a plurality of pawl shafts arranged in parallel relation with said control shaft, said pawls being adapted to engage with a corresponding stop member on said control shaft for arresting said control shaft in predetermined positions, supporting means for said pawl shafts, said supporting means comprising two spaced plates which are at right angles to said control shaft and rotatably supported thereby, such rotation occurring upon engagement of one of said pawls with its corresponding stop member on said control shaft, resilient means restraining such rotation of said two plates, each of said plates having an extension thereon, means interconnecting said plates for permitting limited movement relative to each other, and stop means engageable by said extensions for checking said two plates in extreme position under influence of said resilient means.

6. Shaft positioning mechanism comprising a control shaft, a plurality of stop members mounted on said control shaft, a plurality of rotatable pawls, each mounted on a different one of a plurality of pawl shafts arranged in parallel relation with said control shaft, said pawls being adapted to engage with a corresponding stop member on said control shaft for arresting said control shaft in predetermined positions, supporting means for said pawl shafts, said supporting means comprising two spaced plates which are at right angles to said control shaft and rotatably supported thereby, such rotation occurring upon engagement of one of said pawls with its corresponding stop member on said control shaft, resilient means restraining such rotation of said two plates, means for adjusting the strength of the restraining effect of said resilient means, each of said plates having an extension thereon, means interconnecting said plates for permitting limited movement relative to each other, and stop means engageable by said extensions for checking said two plates in extreme position under influence of said resilient means.

7. Shaft positioning mechanism comprising a control shaft, a plurality of stop members mounted on said control shaft, a plurality of rotatable pawls, each mounted on a different one of a plurality of pawl shafts arranged in parallel relation with said control shaft, said pawls being adapted to engage with a corresponding stop member on said control shaft for arresting said control shaft in predetermined positions, supporting means for said pawl shafts, said supporting means comprising two spaced plates which are at right angles to said control shaft and rotatably supported thereby, such rotation occurring upon engagement of one of said pawls with its corresponding stop member on said control shaft, resilient means restraining such rotation of said two plates, means for

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adjusting the strength of the restraining effect of said resilient means, said adjusting means comprising a movable lug having a camming surface cooperating with said resilient means, each of said plates having an extension thereon, means interconnecting said plates for permitting limited movement relative to each other, and stop means engageable by said extensions for checking said two plates in extreme position under influence of said resilient means.

8. Shaft positioning mechanism comprising a control shaft, a plurality of stop members mounted on said control shaft, a plurality of rotatable pawls, each mounted on a different one of a plurality of pawl shafts arranged in parallel relation with said control shaft, said pawls being adapted to engage with a corresponding stop member on said control shaft for arresting said control shaft in predetermined positions, supporting means for said pawl shafts, said supporting means comprising two spaced plates which are at right angles to said control shaft and rotatably supported thereby, such rotation occurring upon engagement of one of said pawls with its corresponding stop member on said control shaft, resilient means restraining such rotation of said two plates, said resilient means comprising a flexible element which extends in the direction of said control shaft and is mounted on said two plates, means for adjusting the strength of the restraining effect of said resilient means, said adjusting means comprising a movable lug having a camming surface cooperating with said resilient means, said movable lug being mounted on means which are stationary relative to said plates, each of said plates having an extension thereon, means interconnecting said plates for permitting limited movement relative to each other, and stop means for checking said pawl shafts in extreme position under influence of said resilient means.

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9. A device comprising a rotatable main shaft, a rotatable pawl shaft arranged beside said main shaft and substantially parallel thereto, a pawl mounted on said pawl shaft for movement therewith, pawl receiving means mounted on said main shaft for movement therewith and positioned in operative relationship with respect to said movable pawl, movable mounting means for said pawl shaft, means for resiliently stopping movement of said mounting means in one direction of rotation of said main shaft, and other means for positively stopping movement of said mounting means in the other direction of rotation of said main shaft.

10. A device comprising a rotatable main shaft, a plurality of rotatable pawl shafts arranged around said main shaft and substantially parallel thereto, a pawl mounted on each of said pawl shafts for movement therewith, a plurality of pawl receiving means mounted on said main shaft for movement therewith and each positioned in operative relationship with respect to one of said movable pawls, mounting means for said pawl shaft rotatively mounted on said main shaft, means for resiliently stopping movement of said mounting means in one direction of rotation of said main shaft, and other means for positively stopping movement of said mounting means in the other direction of rotation of said main shaft.

JACOB MARINUS UNK.

WILHELMUS LAMBERTUS VERVEST.

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