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APPARATUS FOR ANALYZING ROTARY MOTION

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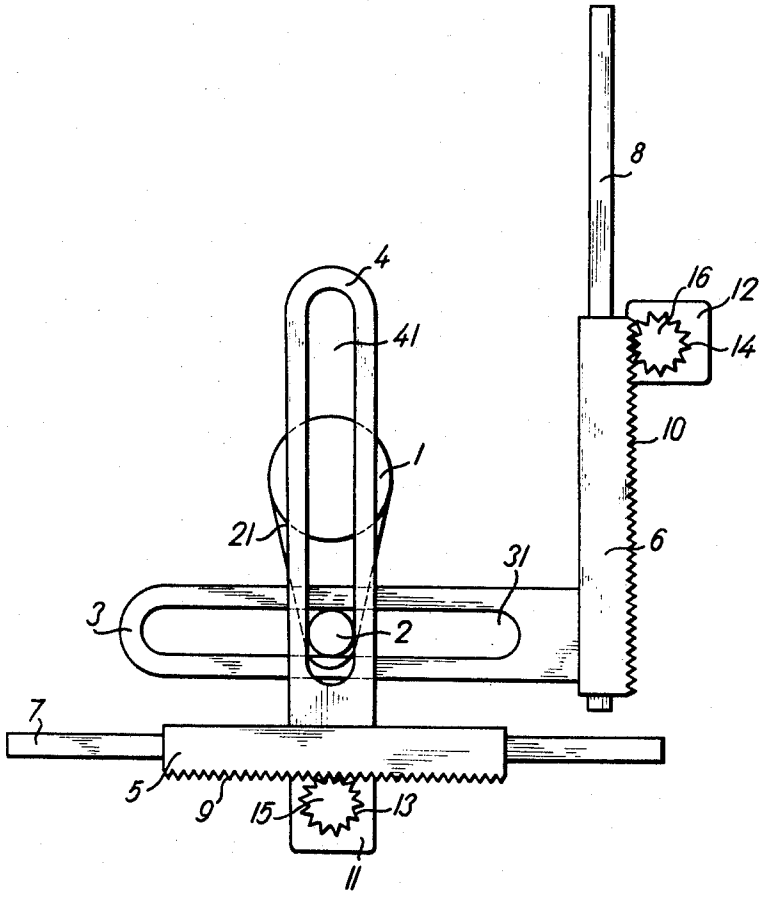

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APPARATUS FOR ANALYZING ROTARY MOTION

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U.S. Cl. 74—29 6 Claims

ABSTRACT OF THE DISCLOSURE

The rotary motion of a body about an axis is analyzed in terms of rectangular Cartesian coordinates by slides guided in paths perpendicular to each other and to the axis of rotation and each fixedly carrying an engaging arm formed with a slot enlongated at right angles to the path of the associated slide. An eccentric coupling pin on the body whose motion is to be analyzed is simultaneously received in both slots. A rack on each slide engages a pinion on the input member of a selsyn so that the output signals of the selsyns are indicative of the position of the pin in Cartesian coordinates.

BACKGROUND OF THE INVENTION

This invention relates to the analysis of rotary motion in terms of Cartesian coordinates, and particularly to apparatus for generating signals indicative of the position of a body moving in an arcuate path relative to a system of Cartesian coordinates.

The problems which can be solved by such apparatus are examplified by the milling machine for milling crankshafts disclosed in the copending, commonly assigned application of Frantisek Rozanek et al., filed on or about Jan. 24, 1968, in which a milling cutter is moved in a circular path by means of a supporting head arranged to move the cutter in two directions perpendicular to each other, while the crankshaft to be machined rotates about its axis.

SUMMARY OF THE INVENTION

The apparatus of the invention may consist mainly of two guides which define respective rectilinear paths extending in the direction of the desired Cartesian coordinates which are transverse of the axis of rotation of the body to be analyzed and transverse of each other. Actuator members respectively guided in these paths carry fixedly fastened engaging elements each of which engages the same eccentric coupling member on the rotating body in such a manner that the engaging element moves with the coupling member in the direction of the path of the associated actuator member while permitting the coupling member to move freely relative to the engaging element in the direction of the path of the other actuator member. The actuator members each operate a signal generator which produces a signal in response to the position of the connected actuator member in the path thereof.

The exact nature of this invention as well as other features, objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawing.

BRIEF DESCRIPTION OF THE DRAWING

The sole figure of the drawing shows the analyzing apparatus of the invention in fragmentary elevational view.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The body **1** whose rotary motion is to be analyzed is a crankshaft **1**, not shown in detail, on which an eccentric,

cylindrical coupling pin **2** is attached by means of a radial arm **21**. Two elongated arms **3**, **4** are attached at right angles to elongated slides **5**, **6** respectively which are guided on respective guide bars **7**, **8** in rectilinear paths perpendicular to each other and perpendicular to the axis of rotation of the shaft **1**. The guide bars **7**, **8** are fixed elements of a supporting frame of the machine, not otherwise shown, in which the shaft **1** is journaled in a non-illustrated conventional manner.

The arms **3**, **4** have respective longitudinal slots **31**, **41** whose longitudinal walls are spaced apart approximately by the diameter of the pin **2**. The pin **2** is simultaneously received in both slots **31**, **41** in abutting engagement with the faces of the longitudinal walls, the arms **3**, **4** being superimposed in the direction of the axis of the shaft **1**.

Racks **9**, **10** respectively cut into longitudinal faces of the slides **5**, **6** mesh with pinions **13**, **14** respectively mounted on the input shafts **15**, **16** of two selsyns **11**, **12** fixedly arranged on the stationary support structure for converting the rectilinear movement of the slides **5**, **6** into angular movement of the shafts **15**, **16**.

When the shaft **1** rotates clockwise from the position shown in the drawing, the coupling pin **2** slowly moves the engaging arm **3** and the slide **6** upward, as viewed in the drawing, whereby the input shaft **16** of the selsyn **12** is turned clockwise. Simultaneously, the pin **2** moves at a higher speed longitudinally in the slot **31**, but this movement has no effect on the position of the input shaft **16**.

Also, the arm **4** on the slide **5** is moved toward the left, as viewed in the drawing, by the pin **2**, and the input shaft **15** of the selsyn **11** is moved counterclockwise. The free longitudinal movement of the pin **2** in the slot **41** does not affect the position of the selsyn **11**.

The output signals of the selsyns **11**, **12** are amplified in a conventional manner and fed to two servomotors in the aforementioned milling machine which shift the milling cutter along respective paths perpendicular to each other. If the two servomechanisms are identical, the milling head is moved thereby in a circle in synchronization with the circular movement performed by the pin **2** during rotation of the shaft **1**.

It will be appreciated that the apparatus illustrated may readily be modified to analyze the rotary motion of the shaft **1** in terms of oblique Cartesian coordinates if the two rectilinear movements of the milling machine head are obliquely inclined relative to each other. Servomechanisms of the type specifically described above permit the output signals generated by the selsyns **11**, **12** in response to the positions of the actuating slides **5**, **6** to be modified in a simple manner by conventional electronic controls on the associated amplifiers, and electronic or electrical signal generators are therefore preferred. The slides **5**, **6** may be employed in an obvious manner for actuating mechanical, hydraulic, or pneumatic signal generators in an obvious manner to produce signals indicative of the position of the pin **2** in Cartesian coordinates.

It should be understood, therefore, that the foregoing disclosure relates only to a preferred embodiment of the invention, and that it is intended to cover all changes and modifications of the example of the invention chosen herein for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What is claimed is:

1. In an apparatus for analyzing the rotary motion of a body about an axis in terms of two Cartesian coordinates transverse of said axis and transverse of each other, in combination:

(a) two guide means defining respective rectilinear paths extending in a direction of said coordinates respectively;

(b) two actuator members respectively mounted on

said guide means and guided by the associated guide means in said paths;

(c) a coupling member spaced on said body from said axis for circular movement of the coupling member about said axis during said rotary motion of said body;

(d) engaging means fixedly fastened to each of said actuator members and engaging said coupling member for movement of the engaging means with said coupling member in the direction of the path of the associated actuator member while permitting said coupling member to move freely relative to said engaging means in the direction of the path of the other actuator member; and

(e) two signal generating means operatively connected to said actuator members respectively for generating signals in response to the positions of the connected actuating members in the paths thereof.

2. In an apparatus as set forth in claim 1, said paths being perpendicular to each other and to said axis.

3. In an apparatus as set forth in claim 1, said engaging means each having two abutment faces oppositely spaced in the direction of said path of the associated actuator member and extending in the direction of said path of the other actuator member, the spacing of said faces being substantially equal to the dimension of said coupling member in the last-mentioned direction, the coupling member being received between said faces.

4. In an apparatus as set forth in claim 3, each engaging means including an engaging member formed with an opening elongated in the direction of said path of the other actuator member, said faces extending in said opening.

5. In an apparatus as set forth in claim 1, motion transmitting means interposed between each actuator member and the associated signal generating means for converting the rectilinear movement of said actuator member into angular movement of said signal generating means, the signal generating means including an angularly movable input member connected to said motion transmitting means for operation thereby.

6. In an apparatus as set forth in claim 5, said motion transmitting means including a rack on said actuator member, and said input member carrying a pinion meshing with said rack.

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