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A. NECTOUX

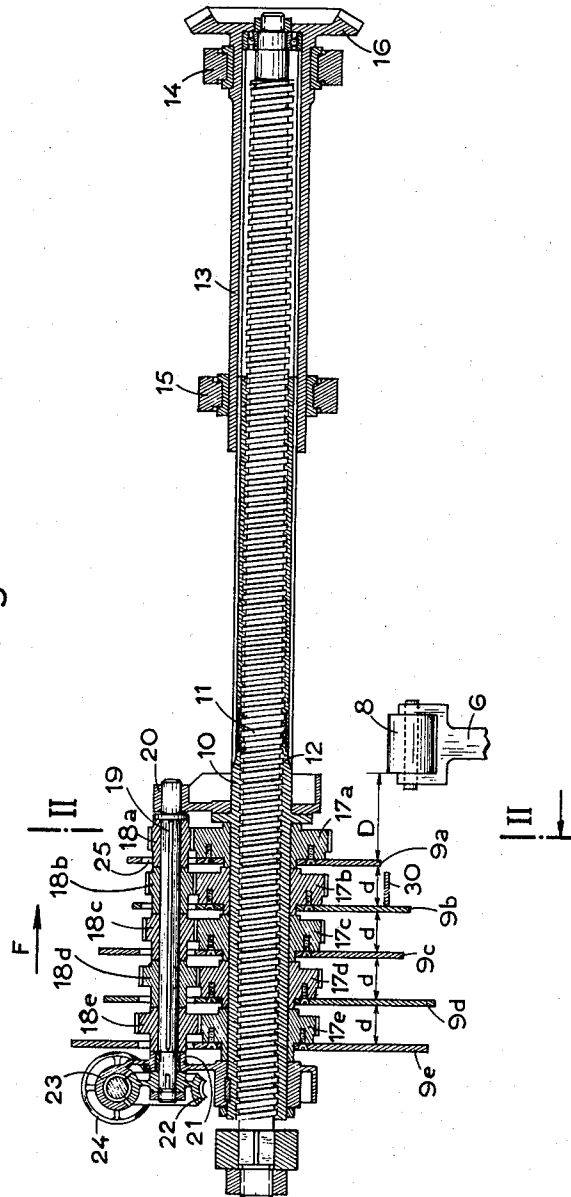
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LEVEL SELECTOR FOR A MULTIPLE-LEVEL HOISTING MACHINE

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2 Sheets-Sheet 1

Fig. 1



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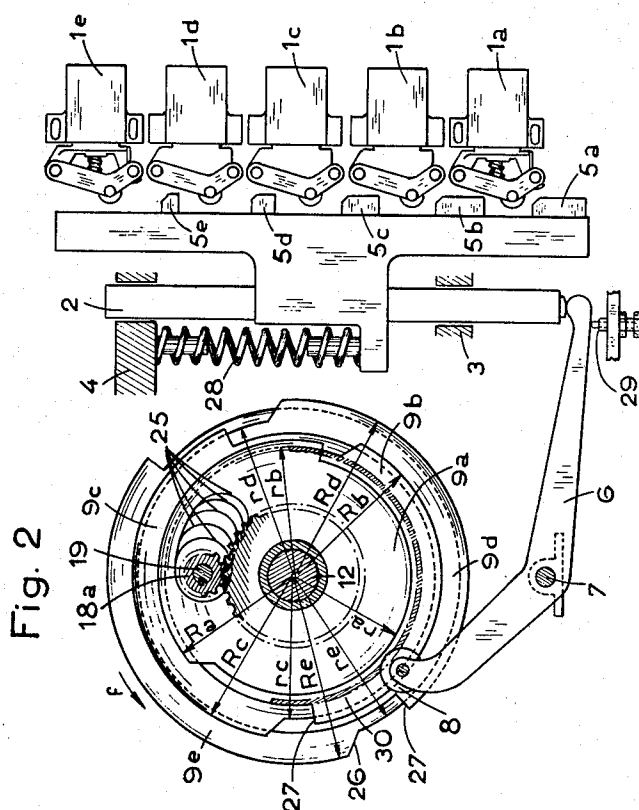
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LEVEL SELECTOR FOR A MULTIPLE-LEVEL HOISTING MACHINE

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The present invention relates to a level selector for a multiple-level hoisting machine, and more particularly for hoisting machines comprising a control device subject to the positions of the hoisting cages and assuring automatically the control of the different speeds to be established (accelerations, normal running speeds, decelerations); the level selector controlling for this purpose the action of an auxiliary source of energy on the control device.

The level selector according to the invention comprises a plurality of cams moved along a supporting shaft and in rotation by the shaft which shaft is rotated by the rotation of the hoisting machine. The said cams are offset axially from one another on their shaft in function of the distances separating the levels in the mine to be served by the hoisting cage in such a manner as to act successively on a plurality of contact mechanisms each of which is associated with one of the levels and selectively controlled by a preselector. The cams are mounted on the said shaft with an adjustable angular offset in function of the wear of the grooves of the pulleys of the hoisting mechanism.

The accompanying drawings illustrate one particular embodiment of a level selector according to the invention as described hereinafter.

In these drawings:

FIGURE 1 is a longitudinal section along the axis of the control shaft of the cams of the level selector, and

FIGURE 2 is a cross section on the line II—II of FIGURE 1 showing the angular disposition of the cams.

In the drawings there is illustrated a level selector cooperating with a plurality of electrical contactors, one of which is selectively energized by a pre-selector.

For a five-level machine, for example, controlled by the level selector, five contactors 1a, 1b, 1c, 1d, 1e are controlled by a slider member 2 guided in the fixed supports 3 and 4 and comprising five ramps 5a, 5b, 5c, 5d, 5e, offset from one another in such a manner that the said contactors are actuated successively when the slider member 2 is raised, abutting one of the ends of a lever 6 pivotally mounted on a fixed axle 7, the other end of which lever carries a roller 8. The ramps 5a, 5b, 5c, 5d, 5e have such different heights that the corresponding contactors reached by the ramps when the slider member 2 is raised, will remain subject to the action of the ramps up to the moment when the slider member 2 falls back and releases the same.

The swinging of the lever 6 is controlled by a group of five cams 9a, 9b, 9c, 9d, 9e brought successively in front of the roller 8 owing to movement along shaft 12 in the sense of the arrow F, and driven at the same time by a rotary movement in the sense of the arrow f (FIGURE 2).

For this purpose the cams 9 are integrated, for axial movement and for rotation, with a sleeve 10. This sleeve comprises an internal screw thread constantly in mesh with a screw-threaded portion 11 of a fixed spindle or shaft 12, and has external splines constantly in engagement with internal splines of a hollow shaft 13 which is journaled in bearings 14 and 15 and is integral with a bevel pinion 16 actuated by a shaft (not shown) coupled to a rotating shaft of the hoisting machine.

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The cams 9a, 9b, 9c, 9d, 9e are respectively integral with pinions 17a, 17b, 17c, 17d, 17e, mounted idly on sleeve 10, and are respectively in mesh with pinions 18a, 18b, 18c, 18d, 18e keyed to a common shaft 19 centered in two supports 20 and 21 integral with the sleeve 10. At one of its ends the shaft 19 carries a worm gear wheel 22 in mesh with a worm 23 having a self-locking thread mounted on the support 21, the rotation of said worm being controlled by the aid of a hand wheel 24.

Owing to the irreversibility of the worm 23 and to the self-locking of the latter, the group of cams 9a—9e is driven rotationally at the same speed as the sleeve 10.

Openings 25 are provided in each of the cams 9 providing a passage for the hubs of the pinions 18 to permit angular adjustment of cams 9 with respect to the sleeve 10.

It must be understood that, viewed in the sense of the arrow F, the pinions 18 have diminishing diameters as from one pinion to the other and rotation of the worm 23 has accordingly the effect of imparting different angular movements to the pinions, and consequently to the cams.

Each of the cams 9 has two profiles constituted by cylindrical elements of different radii R and r (FIGURE 2). Considering the cams as viewed in the direction of the arrow F, the respective radii R and r diminish from one cam to the other, the radii Rd, Rc, Rb and Ra being, respectively, slightly greater than the radii re, rd, rc and rb.

On the other hand the profile radii R and r of one and the same cam are connected to one another by an inclined ramp 26 and by a radial step 27.

Finally the slider member 2 is biased by a spring 28 towards its lower position in which the lever 6 abuts an adjustable stop 29.

The functioning of the level selector is as follows:

Referring to FIGURE 1, which shows the level selector in position for the at rest position of the hoisting machine with the cage at the top level, a distance D separates the roller 8 from the first cam 9a.

Assuming movement of the pre-selector to energize contactor 1c, corresponding to the third level reached by the descending hoisting cage; when the hoisting machine is put in motion, the group of cams 9 moves in the direction of the arrow F, and cam 9a first at a pre-determined moment moves with its profile of the radius ra in front of the roller 8. Owing to the rotation of the group of cams 9, roller 8 meets the profile of radius Ra of the cam 9a, and swings lever 6 so that the ramp 5a of the slider member 2 acts on the contactor 1a. Contactor 1a is not "live" or energized, and hence no control impulse is transmitted to the automatic control device of the machine.

Contact of roller 8 with the profile of the radius Rb of the cam 9b moves ramp 5b against the contactor 1b which is not "live" and the action of the ramp 5a on the contactor 1a is continued.

When the cam 9c comes into contact with the roller 8 with its profile of the radius Rc, the ramp 5c acts on the contactor 1c which is energized by the pre-selector, and a control impulse is transmitted to the control device of the hoisting machine (not shown), the action of the contactor 1c being continued as long as the profile of the radius Rc remains in contact with the roller 8. When the hoisting machine is set in motion in the opposite direction, the roller 8 is successively disengaged from the cams 9c, 9b and 9a, which finally allows the slider member 2 to return to its initial position in which none of the contactors 1 are engaged by the ramps 5.

The profiles of radius R of the five cams 9 may have equal angular amplitudes calculated in such a manner that each of the corresponding contactors intervenes when the hoisting cage has arrived at a predetermined distance from the selected mine level, and thus actuates the control device of the hoisting machine at the beginning of the period of deceleration if the cage is being lowered, while during

the lifting of the cage the acceleration period ceases when the action of the cam on the contactor terminates.

It suffices accordingly, as the different cams 9 have initially the same angular position, to give the distances d separating the cams such values that the contactors 1 intervene each at a pre-determined distance between the hoisting cage and the corresponding level of the mine.

In the embodiment illustrated the distances d between the cams are equal which corresponds to equal distances between the mine levels to be served, and when these distances are unequal, the distances d must be modified in function of the actual distances between the levels, for example by the insertion of shims (not shown) between the cams 9 and between the pinions 17, 18.

The wear of the pads lining the bottom of the grooves of the pulleys of the hoisting mechanism, which would cause the premature action of the contactors, is compensated according to the invention by change of the relative offset of the different cams 9, by means of a hand wheel 24. It is evident that the ratios between the pinions 17 on the one hand, and of the pinions 18 on the other hand have to be calculated in such a manner as to take into account the wear of the pads since wear increases in the wound-off length of the hoist cable at the different levels.

It must be understood the level selector described hereinabove may be modified or supplemented by any suitable accessory member within the scope of the invention.

For example in order to obviate unnecessary movements of the slider member 2, which would result from the roller 8 dropping back onto the profile of the radius r of each cam when the group of cams 9 were arranged to make at least two revolutions for making two adjacent cams act, the larger one of them may comprise a rim, such as indicated at 30 in chain-dotted lines in FIGURES 1 and 2, on the cam 9b the outer radius of which has the value rb .

On the other hand, instead of using electric contactors as described above, the level selector may be used in combination with any other type of distributor of energy,

for example an hydraulic or pneumatic one, put in play by the pre-selector.

What I claim is:

1. A level selector for multi-level hoisting machines for mine hoisting cages comprising a rotatable threaded shaft, a sleeve mounted on and engaging the threads of said shaft for rotation on and by said shaft and for movement along said shaft, a plurality of cams of differing radii mounted on said sleeve, means for spacing said cams from one another on said shaft, a plurality of contact mechanisms adjacent said cams, a single selector, means actuated by said cams for selectively energizing one of said contact mechanisms and for moving said selector into engagement with said contact mechanisms and manually actuated means coupled to and rotating said cams with respect to said shaft for adjusting the angular spacing of said cams on said shaft.

2. A level selector for multi-level hoisting machines as described in claim 1 in which said manually actuated means includes a plurality of pinions, a shaft for said pinions rotating with and about said first named shaft, a pinion for and integral with each of said cams mounted idly on said first named shaft and engaging one of said first named pinions and manual means for rotating said pinion shaft, the difference in diameters of an associated pair of pinions being different from one pair of associated pinions to the other.

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