

April 22, 1952

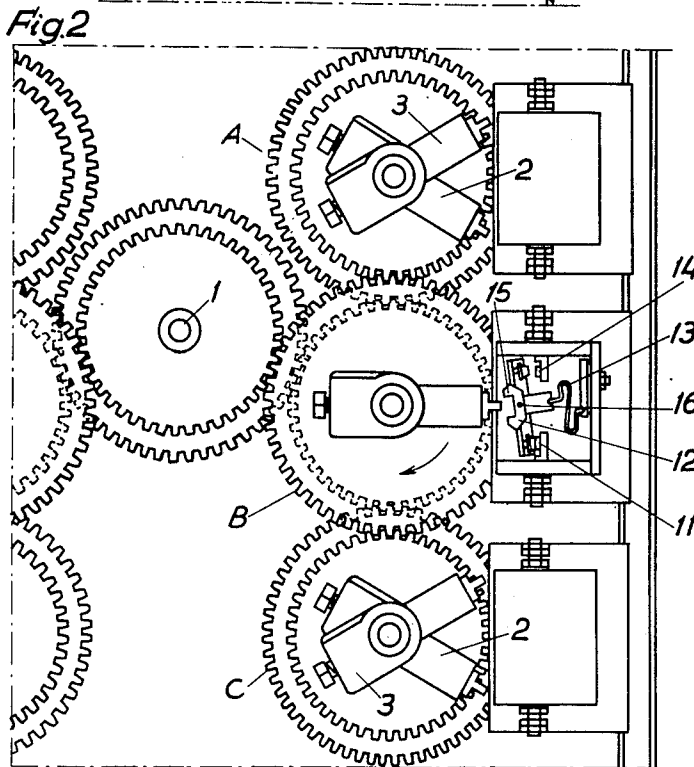
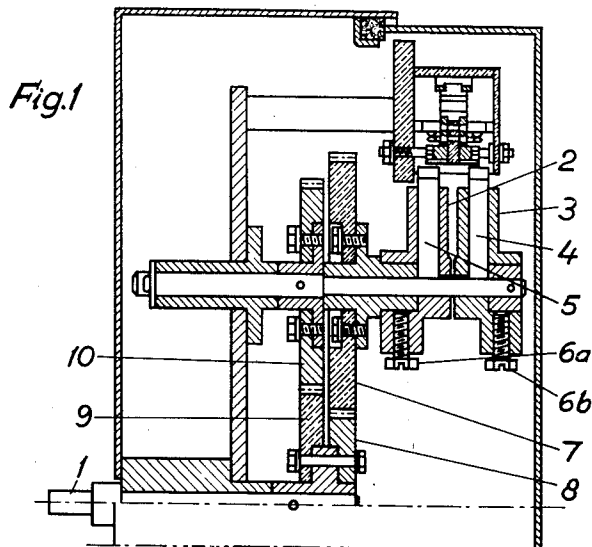
J. E. CARLSSON ET AL

2,593,844

LEVELING DEVICE FOR MINE HOISTS AND OTHER ELEVATORS

Filed Nov. 30, 1949

3 Sheets-Sheet 1



INVENTORS
Johan Eric Carlsson, Frans Landau
and Eugen Tornros
BY
E. A. Aiken
Attorney.

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Fig.3

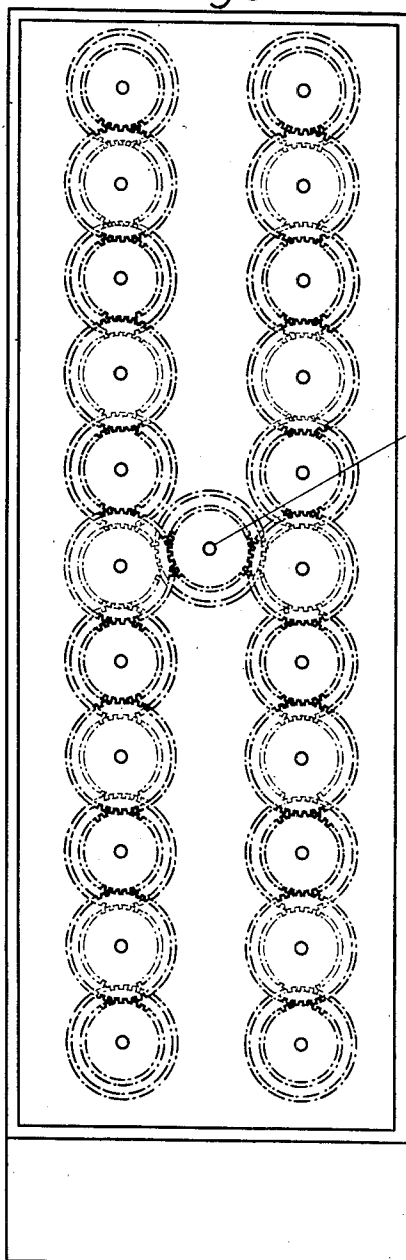
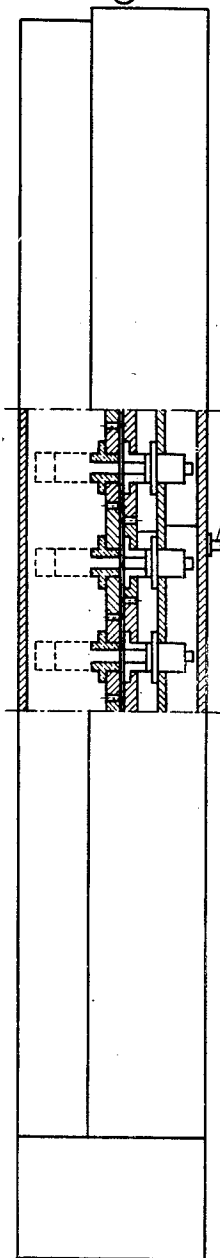


Fig.4



INVENTORS
Johan Eric Carlsson, Frans Landau
and Eugen Tornros

BY

James Dixon
Attorney.

April 22, 1952

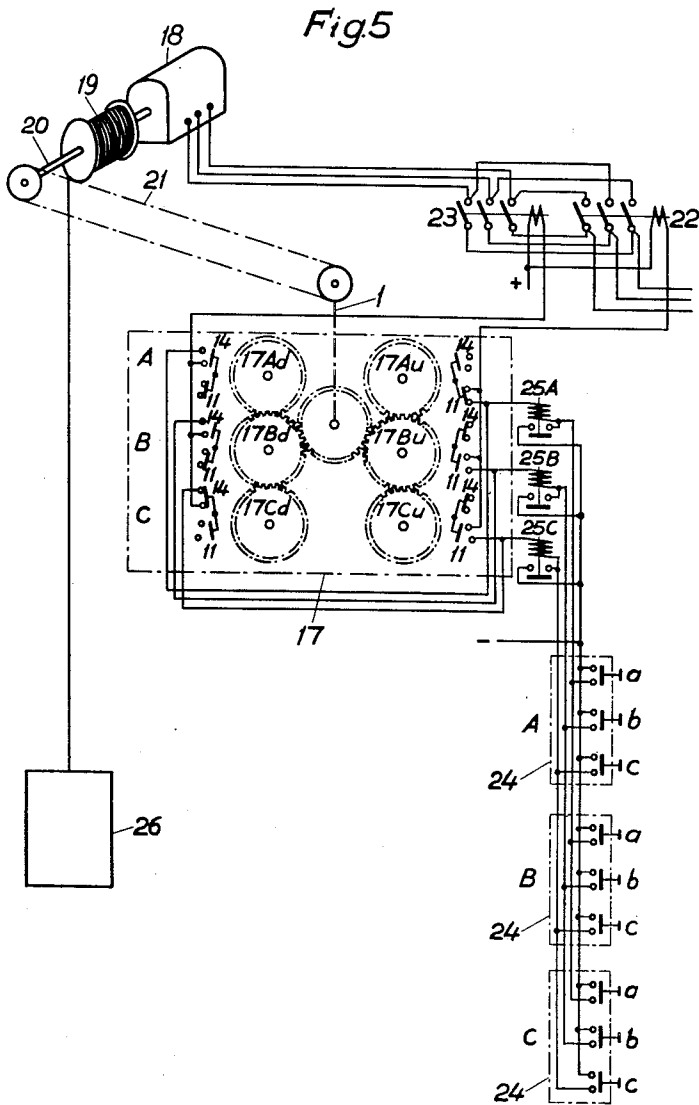
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Johan Eric Carlsson, ^{INVENTORS} Frans Landau
and Eugen Tomros

BY

Eugene Aiken
Attorney.

UNITED STATES PATENT OFFICE

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LEVELING DEVICE FOR MINE HOISTS AND
OTHER ELEVATORS

Johan Eric Carlsson, Frans Landau, and Eugén
Törnros, Vasteras, Sweden, assignors to All-
manna Svenska Elektriska Aktiebolaget, Vas-
teras, Sweden, a Swedish corporation

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In mine hoists and elevators levelling devices are used which in the neighbourhood of the different levels actuate retarding devices so that the hoist cage is stopped in the right position in relation to the levels. These devices often consist of a floor selector which is driven from the hoist motor and contains a sufficient number of levelling devices which are actuated one after the other after a certain number of revolutions of the motor corresponding to a certain travelling distance of the cage in the shaft.

At each level there are two levelling devices, one for the motion upwards and one for the motion downwards. In a known arrangement, the levelling devices are operated by cams. In order to attain a sufficient accuracy of the contact movement, a slow running cam, running less than one turn during the whole travelling way, is combined with a more rapidly running cam, running a plurality of turns during the whole travelling way. The slow running cam acts in such a way that it sets the operating arm of the levelling device in operating position, whereas the operation itself is performed by means of the rapid running cam. The speed relation between the slow running and the rapid running cams is limited by the fact, that the slow running cam must set the operating arm of the levelling device in the operating position during a time less than one revolution of the rapid running cam. Due to the fact that the contact is operated mechanically and must withstand a comparatively large number of operations in one hour, it is necessary that the cams will receive a comparatively large diameter, as the demand for accuracy is great, and therefore the whole arrangement will require a considerable space.

Generally the levelling devices are arranged in two horizontal rows, the slow running and the rapid running cams being arranged above each other, all slow running cams being operated by a common shaft, and the rapid running cams being operated by another common shaft. The shafts are connected by tooth gears driven by the hoist motor.

In order to adjust the position of the cage in relation to the different levels, and in order to compensate for deviations caused by an extension of the wire, the cams are adjustable, for instance by providing adjustable projections on the cams. This adjustment is, however, combined with difficulties because the assembly of cams is generally not accessible around the whole circumference, especially when the number of levelling devices is large, and thus there is a great number of cams.

In the levelling device according to the present

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invention, two rotating members, each carrying its contact actuating member, are driven by the hoist motor over two parallel tooth gears with different ratio, which contact actuating members in a certain position actuate a contact member for the actuation of the hoist motor. The ratio of the parallel tooth gears is so chosen that the contact operating members only one time during the whole hoisting way will come in such a position that a contact closing is made possible. By choosing a small difference in the ratio of the gears, the contact operating members have to rotate a plurality of revolutions during the hoisting way. By this fact, a larger accuracy is attained than in hitherto known levelling devices. The accuracy is only limited by the difference in angle between the contact actuating device after one revolution and by the maximum rotating speed which can be allowed with respect to a reliable contact actuation. As the contact actuation can be arranged electro-magnetically and the contact thus is not exposed to any mechanical actuation, the operating speed can be chosen considerably higher than if the actuation is pure mechanical.

In order to operate the necessary number of levelling devices, two for each level, one for running upwards and one for running downwards, the levelling devices are so constructed that the tooth wheel of one levelling device directly engages the tooth wheel of another, and thereby that one or a plurality of levelling devices are driven by two tooth wheels on a shaft connected with the hoist motor. In order to facilitate the supervision, all levelling devices for running upwards are arranged above each other with the levelling device for the uppermost level being arranged at the top, and the levelling device for the lowermost level being arranged at the bottom. In an analogous manner are arranged all levelling devices for running downwards.

On the accompanying drawings one form of the invention is shown, where the contact actuating members are provided with permanent magnets.

Fig. 1 shows a levelling device with an incoming shaft 1.

Fig. 2 shows three connected levelling devices seen from that side where the contact actuating members are arranged.

Fig. 3 shows a front view of the cubical containing the levelling devices for a plant of the above mentioned kind. All the levelling devices are driven from the shaft 1.

Fig. 4 shows the same cubical from the side partly sectioned in order to show three levelling devices.

Fig. 5 shows schematically the application to

a mining hoist of the device according to the present invention. According to the drawing, it is assumed that the hoist shall be controlled from three different levels designated A, B and C.

Referring to the drawings, the arrangement according to Figs. 1 and 2 is schematically indicated in Fig. 5 and is designated 17.

In Fig. 5, 17Au designates the contact device for lifting corresponding to level A, and 17Ad designates the contact device for lowering corresponding to level A. The contact devices for the other levels are designated in a corresponding manner. Contacts 11 and 12 (which are also shown in Fig. 2) are designated by the same reference numerals in both figures. 18 designates a lift motor having a drum 19, and 26 designates the cage of the hoist. The shaft 1 for the device 17 is driven from the shaft 20 of the drum by means of a chain drive 21. 22 and 23 designate switches controlling the motor 18 for running in one direction or the other. Switch 22 connects the motor for lifting and switch 23 connects the motor for lowering. 24 designates the press button boxes at the levels A, B and C, respectively. By means of the press buttons a, b, c at the different levels, the lift is called to or from the different levels A, B or C in a manner which is more fully described in connection with the description of the operation of the arrangement. 25A, 25B and 25C are locking relays which, after the press button has returned to its open position, maintain closed the current circuit which initially has been closed by one of the press buttons.

From the incoming shaft 1, Fig. 1, the contact actuating members 2 and 3 are driven. The member 2 is driven over the tooth wheels 7 and 8. The member 3 is driven over the tooth wheels 9 and 10. From the wheels 7-10 on Fig. 1, it is clear that the contact actuating member 3 will rotate faster than the member 2. For actuating the contacts, the contact actuating members 2 and 3 must be in the same angular position as indicated by Fig. 1. It is necessary that this position will be attained only one time during the whole hoisting way. The number of revolutions for the shaft 1 during the whole hoisting way may not be chosen so large that the member 3 rotates more than one revolution above the revolutions of the member 2, but may be chosen nearly so large. The contact actuating members with the permanent magnets 4 and 5, Fig. 1, are shown in the same position as shown at B in Fig. 2. At the continued motion in the direction of the arrow, Fig. 2, the difference of the angle will be small when the permanent magnets will come in under the armature 12, so that this is attracted the armature then turning around its shaft 16 and opens the contacts at 11 and closes the contacts at 14. When the magnets have passed the armature, the contacts are retained in the new position by the spring 13. When the magnet 4, Fig. 1, has turned nearly a revolution and has reached the armature 15, the difference in angle has become so large that the armature 15 cannot be actuated. When the shaft 1 reverses and runs in opposite direction, the magnets will revert to the position shown in Fig. 1 and in B in Fig. 2. At the continued motion in the same direction, the magnets will come in the same relation to the armature 15 as described before in connection with the armature 12, said armature being attracted so that a switching to the original position takes place.

As seen from Figures 2 and 3 it is clear that

the contact actuating members 2 and 3 will be equally easily accessible. At the adjustment of the plant, the cage of the hoist is driven to the position where the contact giving is desired. The screws 6, 6a and 6b, Fig. 1, are loosened and the contact actuating members 2 and 3 are moved until contact giving is reached. If afterwards, at a testing drive, it will be evident that the hoist cage will not stop in the desired position, an adjustment may easily be performed.

When the lift is moving upwardly and approaches a level, the contact 11 interrupts the current to the coil on the switch 22. This contact is again closed when the lift is running downwardly and passes the said level. When the lift is moving downwardly and approaches a level, the contact 14 interrupts the current to the coil on the contactor 23. This contactor is again closed when the lift is moving upwardly and passes the said level. If it be assumed that the lift is at the level B and is called to the level A by the pressing of the button Aa, the circuit through the coil of the switch 22 is closed from + over contact 11 on 17Au, the coil on the relay 25A and the press button to -. When the relay is closed, its contact connects its coil directly to -. The motor 18 is then started and drives the hoist until it comes to the level A, when the contact 11 is open, so that the relay 25A and the switch 22 fall and the motor stops.

If the hoist is called from level B to level C, by a pressing of the button Cc, the current circuit through the coil of the switch 23 is closed from + over contact 14 on 17cd, the coil on relay 25C and the press button to -. The operation will be the same when the hoist is moving upwardly from level B.

We claim as our invention:

1. Control means for a mine hoist or other elevator, comprising contact devices for the control of an operating motor to accurately arrest the motion of the elevator cage at different levels after predetermined numbers of revolutions of the shaft of said motor, two parallel gear trains of different speed ratios, means for driving both said gear trains from the motor shaft, two rotating members driven at different predetermined speeds, one by each of said gear trains, and means whereby said contact devices are actuated by said rotary members to arrest the motion of the cage when the said rotary members are in a predetermined position in relation to each other.

2. Control means according to claim 1 in which the contact actuating means consist of permanent magnets.

3. Control means according to claim 2 comprising a spring for the contact device actuated by the permanent magnets, the spring being so arranged that such contact is dependent upon the direction of rotation of the contact actuating means.

4. Control means according to claim 1 in which the gear trains of one levelling device directly engage the gear trains of another levelling device whereby at least one levelling device is driven from two gear trains on a shaft coupled to the hoisting motor.

JOHAN ERIC CARLSSON.
FRANS LANDAU.
EUGEN TÖRNROS.