United States Patent [19]

Münchbach

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[54] **APPARATUS FOR POSITIONING A SHEET METAL COIL IN A COILHOLDER**

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[73] Assignee: **Irma Ungerer,** Pforzheim-Brotzingen, Germany

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July 23, 1971 Germany 2136791

[52] **U.S. Cl.** **242/79,** 242/58.6

[51] **Int. Cl.** **B21c 47/24**

[58] **Field of Search** ..... 242/78.6, 79, 58.6; 214/130 C

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Assistant Examiner—Edward J. McCarthy
Attorney, Agent, or Firm—Edwin E. Greigg

[57] **ABSTRACT**

In a coil holder for supporting a sheet metal coil for unwinding purposes, there is provided an optical gate device which generates a light beam extending coaxially with the coil supporting drum of the coil holder. As the coil is being lifted to the height of the holder drum by a hoisting trough, a timing relay is actuated at the moment when the light beam may pass unobstructed through the central coil opening. The timing relay stops the upward motion of the hoisting trough after the latter moves additionally through a distance that is identical to the radius of the coil opening. In this manner the coil is automatically brought into axial alignment with the coil holder drum.

7 Claims, 8 Drawing Figures

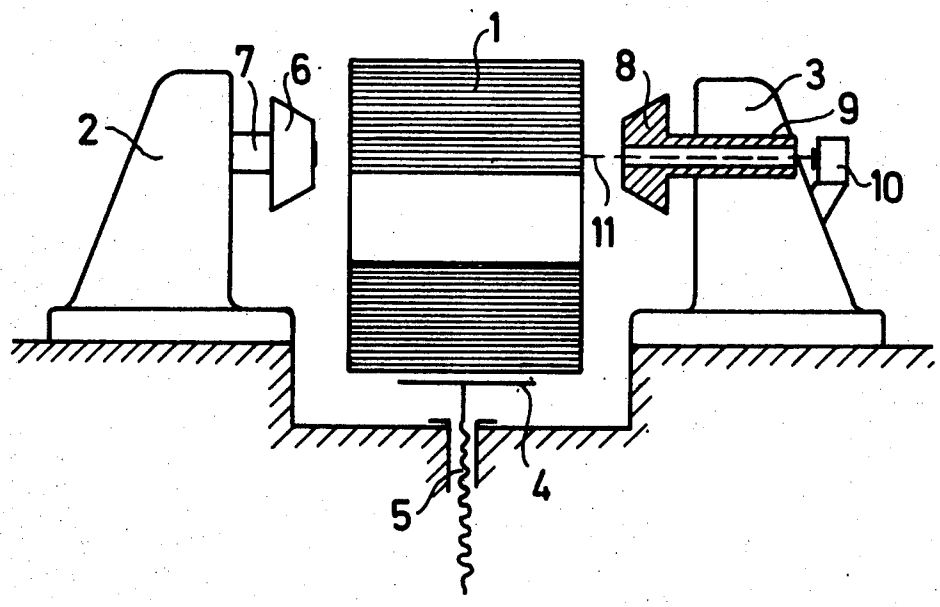


Fig.1

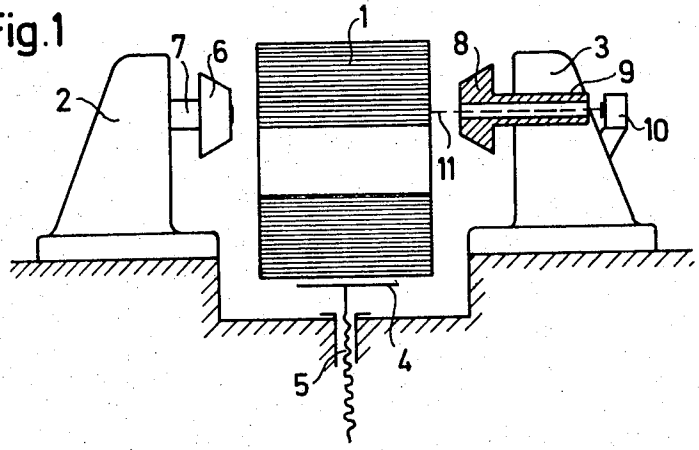


Fig. 2

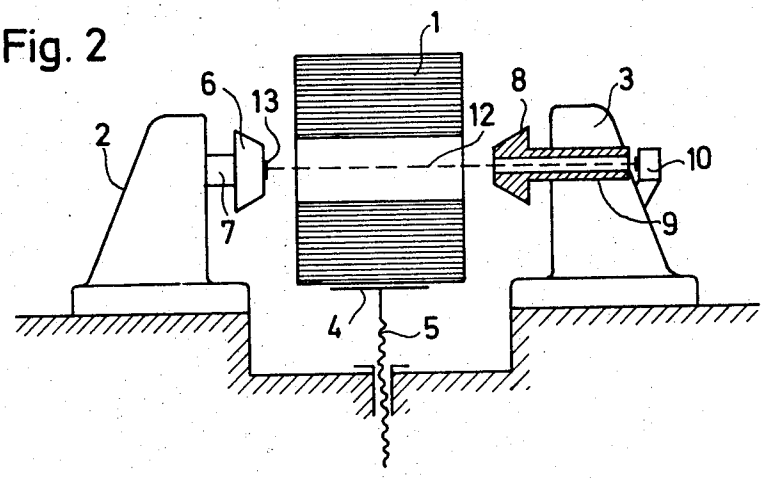


Fig. 3

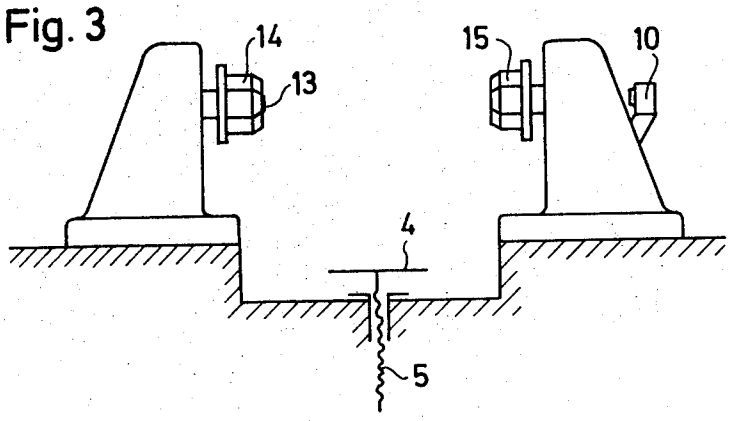


Fig. 4

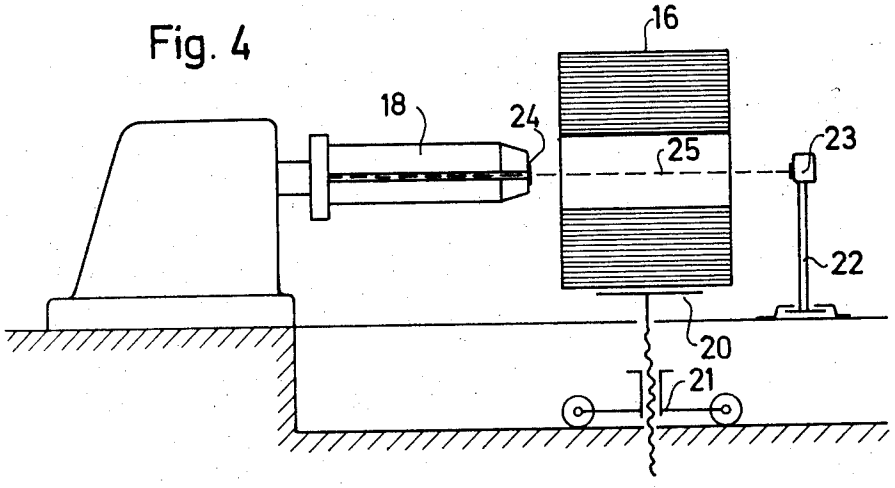
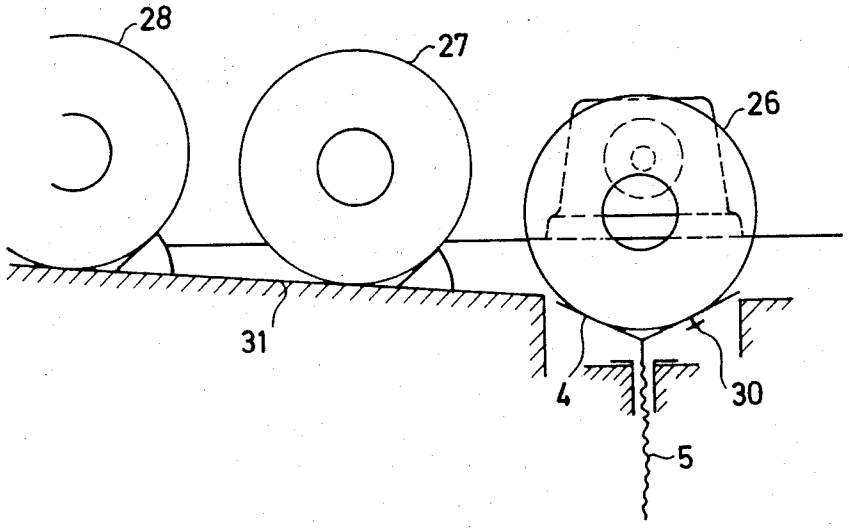


Fig. 5



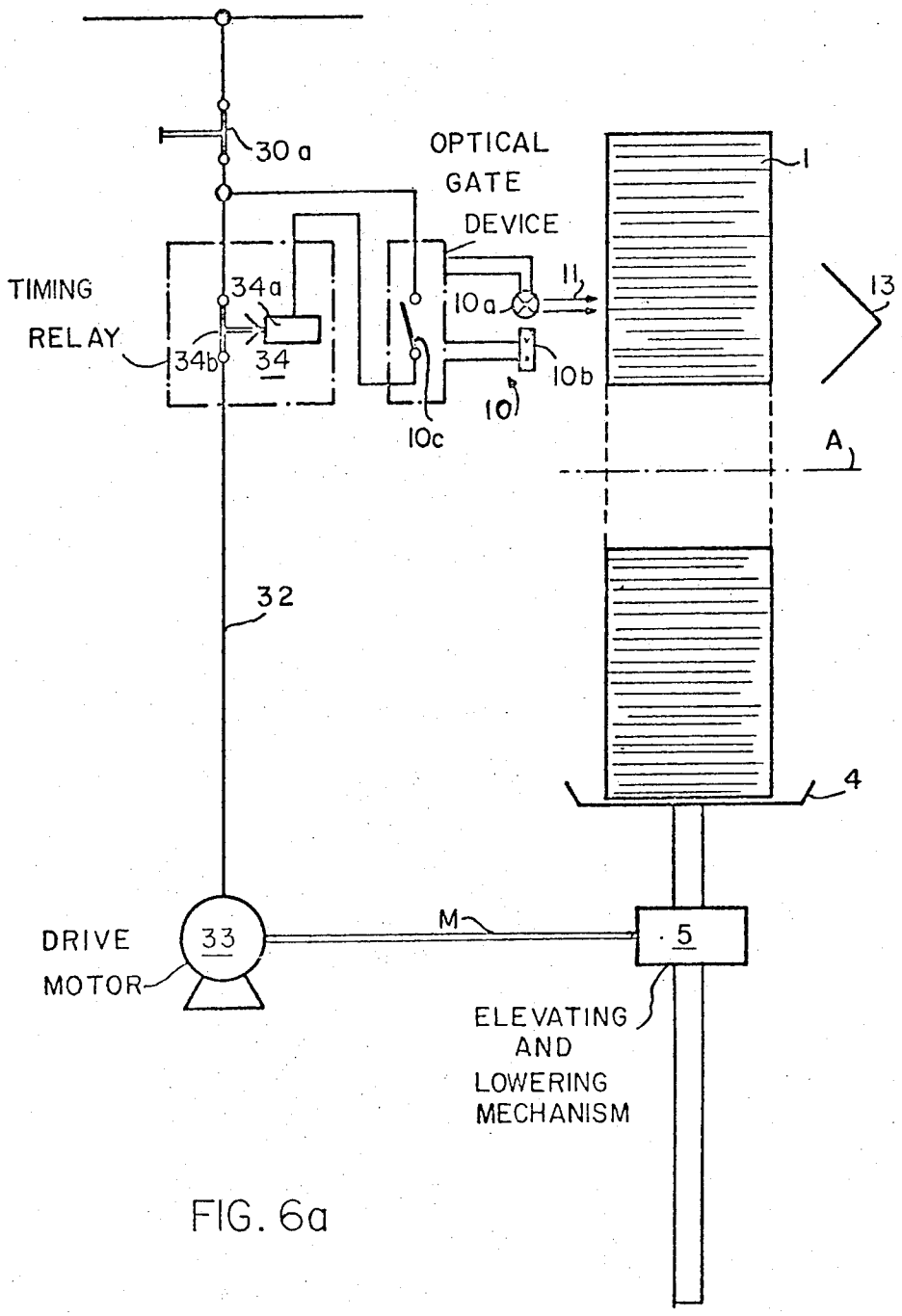

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FIG. 6a

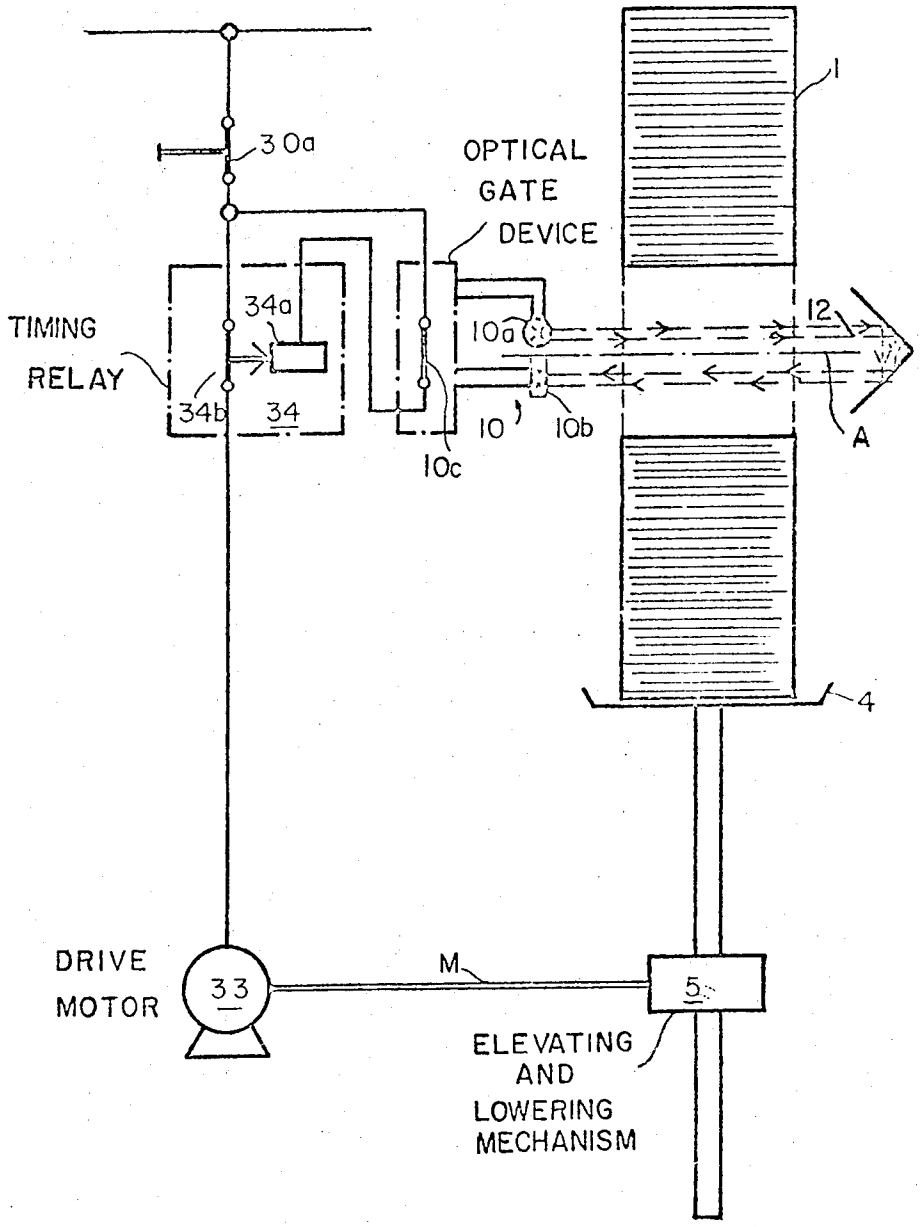
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FIG. 6b

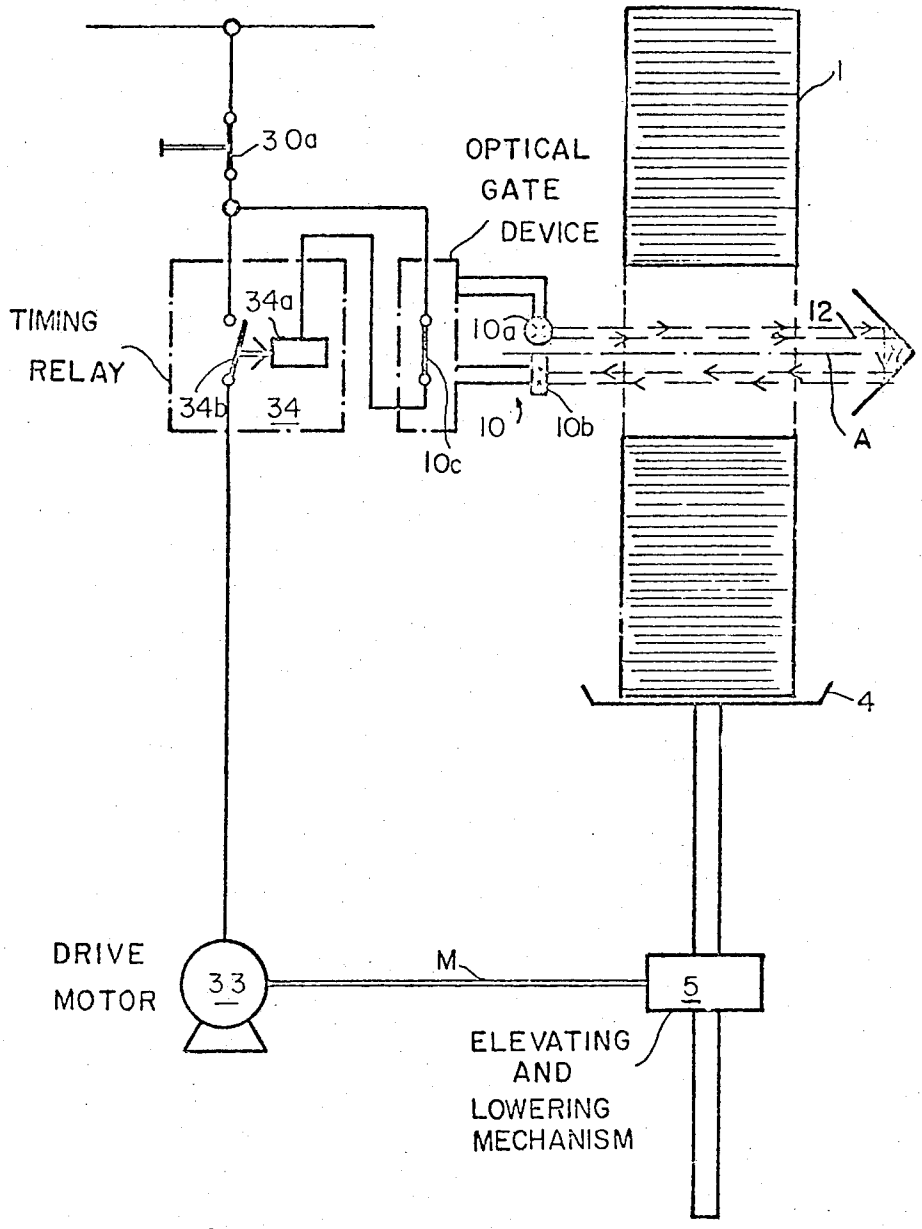
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FIG. 6c

APPARATUS FOR POSITIONING A SHEET METAL COIL IN A COILHOLDER

BACKGROUND OF THE INVENTION

This invention relates to an apparatus associated with the loading — for the purpose of unwinding — a sheet metal coil on a coil holder by means of a hoisting trough which lifts the coil to a height where the central coil opening is in alignment with the drum or similar coil supporting compoment of the coil holder.

Conventionally, steel, heavy metal or light metal sheets obtained from rolling mills or the like are wound into coils. For further processing the sheet metal, the coil has to be unwound; for this purpose it is suspended from a coil holder. Although the coils wound on one and the same winch or the like have a central circular opening of identical diameter, their outer diameter varies because of the different lengths of the metal sheet. When a coil holder is loaded, particular care has to be taken that the central opening of the coil is axially aligned with the coil holder drum; the insertion of the coil onto the drum has to be effected without lateral contacting because otherwise some of the initial turns of the coil may be damaged. Such an occurrence may adversely affect the proper positioning of the coil on the drum.

The correct position of the coil immediately prior to its insertion onto the holder drum has been determined heretofore exclusively by the visual judgment of an attendant.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved loading apparatus of the aforenoted type wherein the alignment of the coil opening with the holder drum is effected automatically without any interference by an attendant.

Briefly stated, according to the invention, there is provided an optical gate device that generates a light beam which is coaxial with the holder drum axis and which is directed to a mirror disposed normal to, and intersected by the holder drum axis. The optical gate device is associated with a timing relay by means of which the lifting of the coil is controlled when the light beam passes through the central coil opening.

By means of the invention it is possible to load a coil holder with a sheet metal coil independently from the diameter of the central opening or the outer diameter of the coil in a fully automatic manner without encountering the aforenoted difficulties.

The invention will be better understood and further objects and advantages become more apparent from the ensuing detailed specification of several exemplary embodiments taken in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a schematic side elevational view, partially in section, of a first embodiment of the invention in which the coil is out of alignment with the holder drum;

FIG. **2** is a view similar to FIG. **1**, showing the coil in alignment with the holder drum;

FIG. **3** is a schematic side elevational view of a second embodiment of the invention;

FIG. **4** is a schematic side elevational view of a third embodiment of the invention;

FIG. **5** is a schematic front elevational view illustrating a storage ramp and a hoisting trough and

FIGS. **6***a*, **6***b* and **6***c* schematically illustrate a circuit diagram of the invention showing three successive positions of the coil with the associated switching state of the circuit.

DESCRIPTION OF THE EMBODIMENTS

Turning to FIGS. **1** and **2**, the coil holder shown therein comprises two oppositely arranged stands **2** and **3** which include supports for respective shafts **7** and **9**. Each shaft carries, in a face-to-face orientation, axially aligned respective cones **6** and **8** from which the sheet metal coil **1** is suspended. In FIG. **1** the coil is shown positioned on a hoisting trough **4** which is vertically movable by means of an elevating and lowering mechanism **5**. Further, FIG. **1** shows the coil **1** in a position in which the central coil opening is out of alignment with the holder cones **6** and **8**.

The holder stand **3** carries adjacent one end of the hollow shaft **9**, an optical gate device **10** which emits a light beam that passes coaxially through the hollow shaft **9** and the hollow cone **8** in the direction of the oppositely located cone **6**. The latter carries a mirror **13** arranged centrally and perpendicularly with respect to its axis of rotation. In the position illustrated in FIG. **1** the light beam **11** is interrupted by the lateral, radial edges of the windings of the coil **1**, while in the centered or aligned position of the coil **1** in FIG. **2**, the emitted light beam **12** is uninterrupted and is thus adapted to impinge on the mirror **13**.

As illustrated in FIG. **5**, the coils **26**, **27**, **28** are held blocked on a sloping storage ramp **31** and are allowed, in sequence, to roll by gravity onto the hoisting trough **4**. As shown in FIG. **6***a*, the coil positioned on the latter actuates, by virtue of its weight, a switch **30**, **30***a*, whereby the energizing circuit **32** of a drive motor **33** associated with the lifting mechanism **5** is closed. The drive motor **33** which is provided with a braking mechanism, starts and drives through a mechanical connection M and by means of a stepdown gear (not shown), a vertical spindle of the hoisting mechanism **5** to thus perform the hoisting step. In this manner the coil **1** is lifted. In this initial phase of the lifting operation the light beam **11** emitted by a light source **10***a* of the optical gate device **10** does not impinge on the photo-diode **10***b*. The latter is in a circuit with a switch **10***c* which forms part of the optical gate device **10** and which is in its open position. The switch **10** controls an energizing circuit of a timing relay **34**. The lowest position of the hoisting trough **4** for receiving the individual coils is chosen in such a manner that for any coil, independently from its outer diameter, the upper edge of the central coil opening is at least 40 – 50 millimeters below the light beam extending coaxially with the shaft **9**. In this manner the light beam is interrupted by the radial edge faces of the windings in the coil **1**.

Turning now to FIG. **6***b*, at the moment the light beam **12** is allowed to pass through the central opening of the coil **1**, it will be received by the photodiode **10***b* and, as a result, the switch **10***c* will close. This occurrence starts a timing mechanism **34***a* which is connected to a presently closed switch **34***b* in the motor circuit **32**. The timing mechanism **34***a* and the switch **34***b* form part of the timing relay **34**. At the moment the timing mechanism **34***a* of the timing relay **34** is started, the continuously rising coil **1** is at a distance

from its desired terminal position that is identical to the radius of the central coil opening. Thus, the timing mechanism **34***a* is adjusted in such a manner that after a delay during which the coil is additionally lifted a distance that corresponds to the radius of the central coil opening, the timing mechanism **34***a* opens the switch **34***b*, whereupon the energizing circuit **32** of the drive motor **33** is interrupted to stop the elevating and lowering mechanism **5**. This instant is depicted in FIG. **6***c*. At this moment the coil is located in axial alignment with the cones **6, 8** and consequently, the latter may be moved axially towards one another to project into the central coil opening and to engage the coil on both sides without the danger of damaging the inner coil windings. Since the hoisting speed is independent from the weight of the coil due to the electrically or hydraulically operated drive means, the delay needed for the aforenoted additional upward travel of the hoisting trough carrying the sheet metal coil can be very accurately determined.

The coil holder assembly illustrated in FIG. **3** differs from that shown in FIGS. **1** and **2** only in that instead of cones **6** and **8** short-length, radially expanding cylindrical drums **14** and **15** are used. The loading step proceeds in a manner identical to that described in connection with the embodiment shown in FIGS. **1** and **2**.

The aforedescribed manner of controlling the loading process may also be practiced with a coil holder which, according to FIG. **4**, includes a long, radially expanding cylindrical drum **18**. Here the loading of the coil **16** is effected by means of a dolly **21** which is movable parallel to the axis of the coil holder and on which there is mounted a vertically movable hoisting trough **20**.

To the radial face of the holder drum **18** there is centrally secured a mirror **24** which reflects a light beam **25** emitted by an optical gate device **23**, when the coil **16** is lifted by the hoisting trough **20** to such an extent that the light beam may pass through the central coil opening. The optical gate device **23** is mounted on a displaceable upright **22** by means of which the device **23** may be so adjusted that the light beam **25** is aligned with the mirror **24** and thus travels coaxially with the holder drum **18**.

In the embodiment according to FIG. **4** the sheet metal coil **16** situated on the hoisting trough **20** is transported on rails by means of the dolly **21** to the immediate vicinity of the holder drum **18**. There the dolly **21** is stopped by a terminal switch, not shown. As the dolly **21** is arrested, the drive means for the displaceable upright **22** is, by means of a further switch, also not shown, energized for a duration until the upright **22** is in a position in which the light emitter of the optical gate device **23** is aligned with the axis of the holder drum **18**. As the displacement of the device **23** is terminated, the hoisting of the coil **16** is started by the hoisting trough **16**, actuated by a conventional and not illustrated follow-up control circuit. As soon as the light beam passes unobstructed through the coil opening, the timing relay associated with the optical gate device **23** becomes operational until the central position of the coil **16** is achieved, as it was discussed in connection with the embodiment according to FIGS. **1** and **2**.

Follow-up controls may control the insertion of the coil **16** over the expanding drum **18**. Similarly, the spreading of the expanding drum, the lowering of the hoisting trough, the withdrawal of the upright with the optical gate device and the reverse travel of the empty dolly **21** may also be controlled by the aforenoted follow-up controls. It is to be further understood that such follow-up controls may also find application in the embodiments discussed in connection with FIGS. **1–3**.

If in a rolling mill the rolled metal sheet is wound into coils on drums of different diameters, then the central coil openings will be different in diameter. In the practice of unwinding the coils, instead of two types of coil holders with different drum diameters only one coil holder is used that has a drum for the smaller coil opening. For coils of a larger central opening an adapter is provided which is inserted on the holder drum. In order to avoid the necessity of changing the setting of the timing relay for the other opening diameter, for each diameter of coil opening there are used permanently set separate timing relays.

I claim:

1. In a coil holder of the type that supports a coil of sheet material and has (a) a holder drum extending axially into the central opening of the coil for supporting the same, (b) a vertically movable hoisting trough for lifting said coil to the height of said holder drum and (c) a lifting and lowering mechanism for moving said hoisting trough, the improvement comprising,

A. a timing relay connected with said lifting and lowering mechanism for stopping, after a determined period running from the actuation of said timing relay, the upward travel of said hoisting trough and

B. an optical gating device having

1. means emitting a light beam coaxially with said holder drum,
2. means receiving said light beam subsequent to its travel through said central coil opening, said last-named means being connected with said timing relay for actuating the same upon receipt of said light beam and,

wherein said holder drum is formed of two spaced parts disposed on either side of said coil, each drum part is carried by axially aligned separate shafts, one of said shafts is hollow; said means emitting a light beam is disposed externally of the last-named shaft adjacent to its end remote from its associate drum part.

2. An improvement as defined in claim **1**, including a mirror disposed on said holder drum in the path of said light beam; said means emitting a light beam and said means receiving the same being disposed on the same side of said central coil opening and said mirror being disposed on the other side thereof.

3. An improvement as defined in claim **1**, including a plurality of timing relays operatively arranged to constitute selectively and individually the first said timing relay, each of said timing relays being permanently set according to a determined, different diameter of said central coil opening for stopping the upward travel of said hoisting trough after a delay that permits, from the moment of the timing relay actuation, to lift said coil an additional distance equalling the radius of said center coil opening, only one of said plurality of timing relays being in circuit at any given time.

4. In a coil holder of the type that supports a coil of sheet material and has (a) a holder drum extending axially into the central opening of the coil for supporting the same, (b) a vertically movable hoisting trough for

lifting said coil to the height of said holder drum and (c) a lifting and lowering mechanism for moving said hoisting trough, the improvement comprising,

A. a timing relay connected with said lifting and lowering mechanism for stopping, after a determined period running from the actuation of said timing relay, the upward travel of said hoisting trough,

B. an optical gating device having

1. means emitting a light beam coaxially with said holder drum,

2. means receiving said light beam subsequent to its travel through said central coil opening, said last-named means being connected with said timing relay for actuating the same upon receipt of said light beam,

C. an elongate cylindrical component constituting said holder drum,

D. a dolly displaceable parallel to the axis of said holder drum and carrying said hoisting trough, and

E. an upright carrying said means emitting a light beam and being shiftable out of and into alignment with the holder drum axis.

5. An improvement as defined in claim **4,** including a mirror disposed on said holder drum in the path of said light beam; said means emitting a light beam and said means receiving the same being disposed on the same side of said central coil opening and said mirror being disposed on the other side thereof.

6. An improvement as defined in claim **4,** including a plurality of timing relays operatively arranged to constitute selectively and individually the first said timing relay, each of said timing relays being permanently set according to a determined, different diameter of said central coil opening for stopping the upward travel of said hoisting trough after a delay that permits, from the moment of the timing relay actuation, to lift said coil an additional distance equalling the radius of said center coil opening, only one of said plurality of timing relays being in circuit at any given time.

7. In an apparatus having a hoisting trough for handling the unrolling of a reel having an associated shaft, which trough lifts a coil having a coil aperture to the height of the reel shaft, which apparatus is provided with a reflex light beam device and a reflector located at the opposite sides of the coil, the improvement comprising:

means for arranging said reflex light beam device with its light beam aligned with said axis of said reel shaft;

a reflector arranged axially with respect to said reel shaft; and

an adjustable time relay, coupled from said reflex light beam device and responsive to signals therefrom, which relay controls the delayed stopping of the hoisting of the coil in response to passing the light beam through the coil aperture;

whereby the reel may be hoisted to and stops at that level at which the light beam passes centrally through the coil aperture.

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