Sept. 2, 1969 B. F. TATTERSON 3,464,894

METHOD AND APPARATUS FOR SPOTTING COKE OVEN MACHINERY

Filed July 26, 1967 2 Sheets-Sheet 1

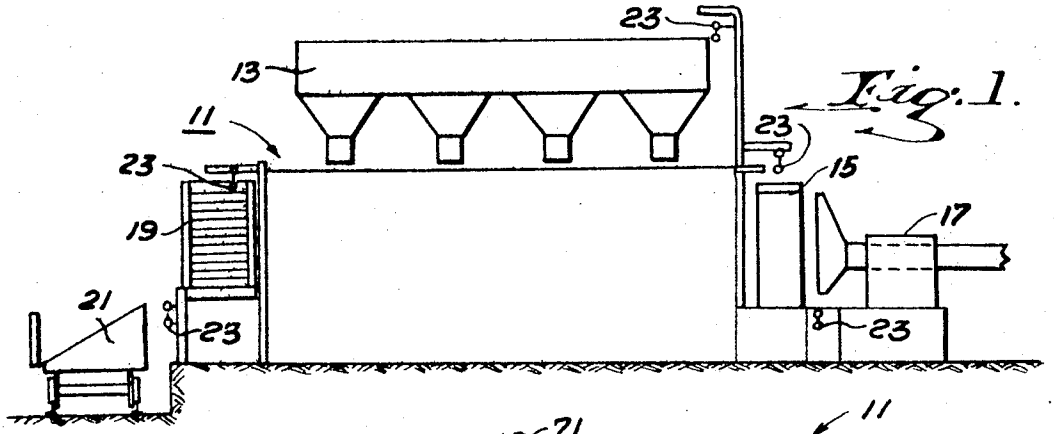


Fig. 1.

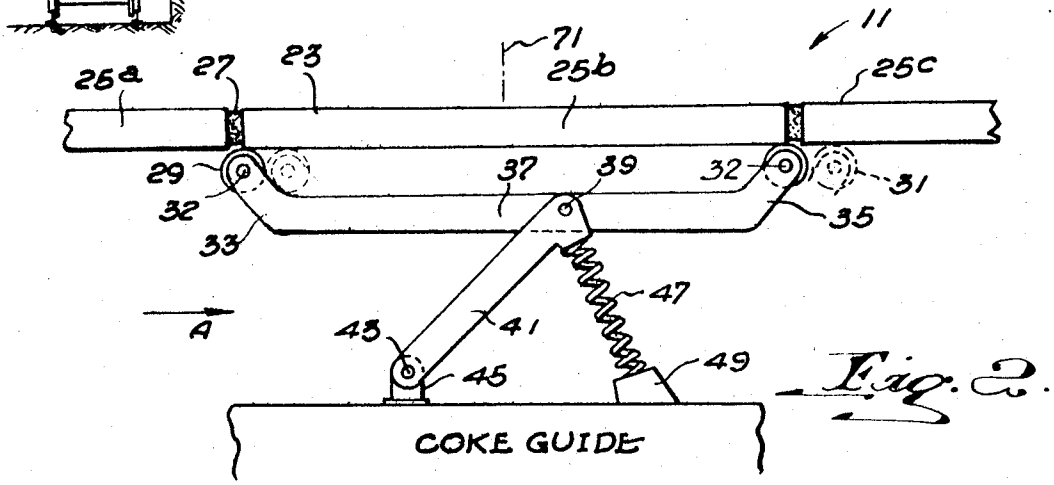


Fig. 2.

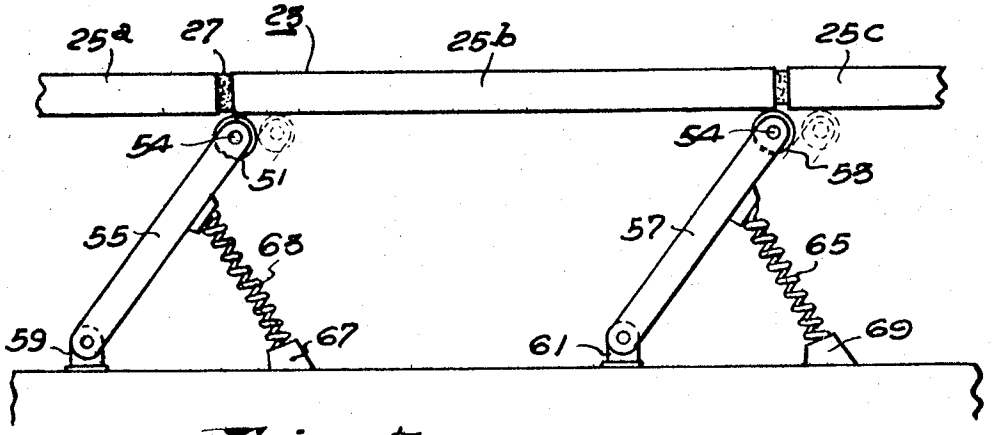


Fig. 3.

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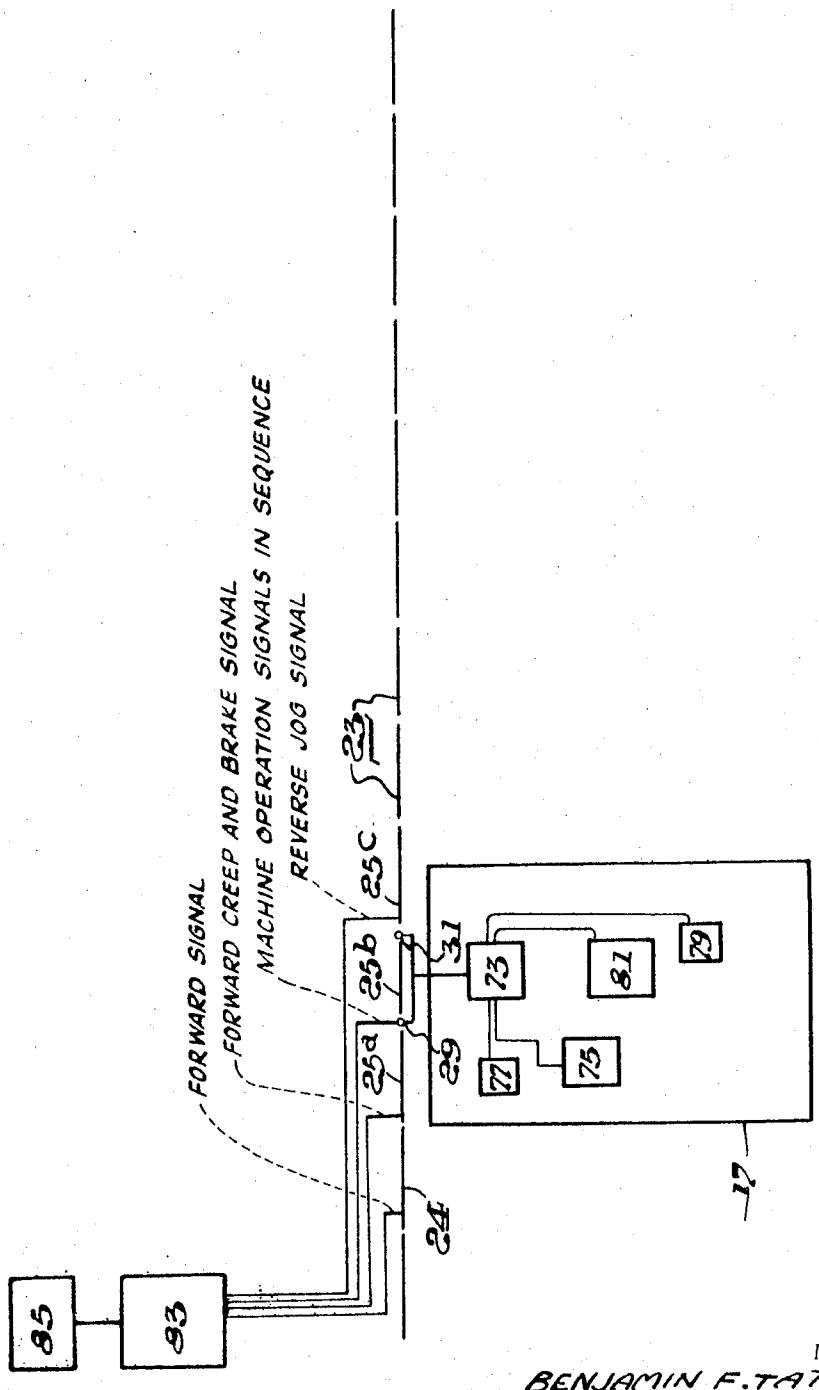


Fig. 4.

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METHOD AND APPARATUS FOR SPOTTING COKE OVEN MACHINERY

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6 Claims

ABSTRACT OF THE DISCLOSURE

A segmented electrical conductor rail is mounted to a coke oven battery and spaced apart collector shoes in contact with the rail segment are mounted to a unit of servicing machinery associated with the coke oven battery. Electronic controls receive signals from the collector shoes and transmit coordinated movement signals to the power drive of the equipment unit to achieve accurate spotting of the unit at selected locations for servicing the coke oven battery.

Background of the invention

This invention relates to control apparatus and, more particularly, to method and apparatus for accurately spotting auxiliary movable equipment associated with a coke oven battery.

A modern coke oven battery has several pieces of auxiliary equipment associated with it that perform various functions at periodic times while the coke oven battery is in operation. For example, coal is charged into each coke oven chamber from a larry car that traverses the length of the battery on rails fixed atop the battery. Coal discharges from bins on the larry car into openings in the roof of the coke ovens and it is necessary to accurately spot the larry car with respect to the charging holes in order to automatically remove and replace lids on the coal charging holes, and in order to align the gooseneck cleaner and charging sleeves. Further, along one side of the battery, known as the pusher side, travels a pusher machine and, in some cases, a door machine that removes and replaces the coke oven doors to afford access for the pusher ram on the pusher machine. Accurate spotting of the door machine, the leveler bar, and the door jamb cleaners depend upon accurate spotting of the pusher machine which is essential to the efficient and safe operation of these auxiliary pieces of equipment. Furthermore, along the opposite side of the battery, known as the coke side, travel a coke door machine, a coke guide car, and a coke quenching car. The door machine removes and replaces the coke oven doors on the coke side in the same way the door machine removes and replaces the doors on the pusher side; the coke guide car supports a guiding device for the coke as it is being pushed from the coke chamber; and the coke quenching car receives the hot coke issuing from the coke guide. The coke guide also must be accurately spotted to pass the hot coke onto the coke quenching car.

Because of the size of the coke oven battery, it is not possible for one operator to observe the placement or spotting of the larry car, the pusher side door machine, the pusher machine, the coke side door machine, the coke guide car, and the coke quenching car. It is also not feasible even for several operators to try to coordinate visible or audible signals to indicate proper spotting of the separate pieces of auxiliary equipment associated with a coke oven battery.

But, it is essential that the pusher machine, the coke guide car, and the quenching car be accurately spotted before pushing the coke from the oven; and it is also essential that the door handling machines, as well as

the larry car, be accurately spotted at their respective operating stations. If, for example, the door machine is not accurately spotted each time a door is removed and replaced, the extractor head will not properly engage the lifting lugs and the latching mechanism. The extractor head may become damaged and the door dropped and damaged so that it would not afford a tight seal for the coke oven chambers.

Similarly, if the larry car is not accurately spotted at the coal bin, the car will not engage the gate operating mechanism to receive the coal charge. It is contemplated that the oven machinery, if it can be accurately spotted, will be remotely controlled by a central programer without an operator being present.

Present coke oven machinery automatic spotting devices utilize pattern wires and direct the respective machine according to electrical tone patterns. These patterns decrease in intensity as the square of the distance between the tone receiver on the machine and the pattern wire tone source for spotting the number of segments changes; the amount of electrical wiring for accurate spotting of machinery using such a spotting system becomes excessive as it must be repeated at every coke oven chamber and at every row of coal bin hopper gates.

Some coke oven machinery makes use of distance measuring devices and counters which count the revolutions of a non-traction wheel or an idler wheel mounted on the auxiliary equipment.

In other instances, manually operated machines have targets or other visual aids to enable the machine operator to place the machine close to spotting position.

The foregoing systems for placing auxiliary equipment alongside of coke oven battery work fairly well for the control of such equipment where spotting within an accuracy of plus or minus one foot is satisfactory. Such accuracy may be acceptable for the spotting of a coke quenching car, but such accuracy is not acceptable for pushing, door removing, coal charging, coke guiding, oven leveling, larry car charging, jamb and gooseneck cleaning. Consequently, when more accuracy is required, it is necessary to employ a human operator for the spotting or final locating of each machine, and much of the potential labor saving is lost.

In contrast to the foregoing, the apparatus of the present invention can accurately spot coke oven battery auxiliary equipment within a tolerance of plus or minus one-eighth of an inch.

Summary of the invention

A segmented electrical conductor rail is mounted to a coke oven battery adjacent a movable unit of service equipment. Shoes mounted on the unit of equipment are connected in circuitry to driving motors of the unit, to a computer, and to the rail segments, whereby, as a unit approaches the spotting position, the unit at first decelerates and then creeps to the spotting position. If such unit over travels the spotting position, a creep reverse signal is sent to the motive power of that unit and the unit reverses until it is accurately spotted at the selected location.

Brief description of the drawings

In the drawings:

FIG. 1 is a schematic end view of a coke oven battery including the control apparatus of the present invention;

FIG. 2 is a schematic elevational view of one embodiment of the invention;

FIG. 3 is a schematic elevational view of another embodiment of the invention; and

FIG. 4 is a schematic wiring diagram for a typical unit of movable servicing apparatus associated with the coke oven battery of FIG. 1.

Detailed description

FIGURE 1 illustrates a conventional coke oven battery **11** with which is associated movable servicing equipment such as, a larry car **13** traversing the top of the battery, a coke oven door machine **15** and a pusher machine **17** located on the pusher side of the battery **11**, a coke oven door machine (not shown), a coke guide car **19**, and a coke quenching car **21** located on the coke side of the battery **11**.

Associated with each unit of auxiliary equipment mentioned herein is a segmented signal transmitting rail and a signal collecting or receiving device. The segmented rail **23**, shown in FIGURES 2 and 3, comprises a plurality of electrically conductive segments **25** which are individually mounted in a known manner to a fixed structure adjacent to the respective units of movable auxiliary equipment. The individual segments **25** are disposed coaxially and adjacent segments are spaced apart by means of insulating blocks **27**.

A pair of collector shoes (FIGURE 2), such as a pair of rollers **29, 31**, are journaled on axles **32** supported in a pair of divergent arms **33, 35**. The arms **33, 35** are integrally formed with a collector frame bar **37** that is pivotally connected, as at **39**, to one end of another arm **41**. The other end of the arm **41** is pivotally mounted at **43** to a base member **45** that is fixed to the respective unit of auxiliary equipment. Resilient bias means such as a spring **47** is disposed between the arm **41** and an abutment **49** fixed to the respective piece of equipment, so that the spring urges and maintains the rollers **29, 31** in electrical contact with the segmented rail **23**.

FIGURE 3 illustrates a modification o fthe arrangement of the collector rollers of FIGURE 2. In this instance, each of the two collector rollers **51, 53**, are individually journaled on axles **54** supported in separate arms **55, 57** that are each pivotally mounted to base members **59, 61** secured to the unit of auxiliary equipment. The arms **55, 57** support springs **63, 65** that are biased between the arms and spaced apart abutments **67, 69** fixed also to the respective unit of auxiliary equipment. The springs **63, 65**, urge and maintain the arms **55, 57** and the collector rollers **51, 53** in electrical contact with the segmental rail **23**.

In a particular application, such as the spotting of the larry car **13** or the pusher machine **17**, the segmented rail **23** is secured to the brick work, or is insulated from the steel supporting structure, forming a portion of the coke oven. The length of each segment **25** of the segmental rail **23** is substantially equal to the distance between the longitudinal centerlines **71**(FIGURE 2) of adjacent coke oven chambers. The distance between the axles **32** and **54** also is substantially equal to the distance between the longitudinal centerlines of the adjacent coke oven chambers. Thus, when a unit of auxiliary machinery that is associated with a coke oven battery is properly spotted, the two collector rollers **29, 31** and **51, 53** are positioned at the extreme ends of a single segment **25** of the rail **23**, such as rail segment **25*b***, and no part of a collector roller contacts an adjacent rail segment.

FIGURE 2 illustrates two positions of the collector rollers **29, 31**. In the first position, shown by the dotted outline, the collector rollers **29, 31**, and the unit of auxiliary equipment to which they are fixed, are in the vicinity of, but are not properly spotted at a previously selected position. In such first position, collector roller **29** contacts rail segment **25*b*** and collector roller **31** contacts rail segment **25*c***. With the rollers **29, 31** in such position, an electrical circuit is completed through the support arms **33, 35, 37** and such circuit is maintained as long as the two collector rollers **29, 31** contact separated rail segments. In this instance the unit of machinery has over traveled the selected spotting position, which is at the mid-point of the length of rail segment **25*b***, and a reverse jog signal is sent to the drive motor or motors for the larry car **13** or the pusher machine **17**. The unit of equipment then reverses direction and creeps backward until the collector rollers **29, 31** contact only the single rail segments **25*b***. In this second position, shown by the solid outline of FIG. 2, no electrical driving impulse flows in the support arms **33, 35, 37** (though other operational and control signals may be sent to the machine) and the unit of equipment stops in the preselected spotted position.

FIG. 4 illustrates schematically a wiring diagram for the pusher machine, for example, on which are mounted collector rollers **29, 31** that contact a segmented rail **23**. The pusher machine **17** supports a signal reeciver **73** that is connected in circuitry with motors **75** that move the pusher machine **17** along the face of the coke oven battery **11**; a power pack **77**, for operating the door extractor mechanaism; a power pack **79**, for operating the coke leveler bar; and a power pack **81** for operating the coke pusher ram arm.

The segments of rail **23** are connected in circuitry to a central programmer **83** that may be a computer of known type. The computer is connected to each segment of rail **23** to a source of power **85**.

In the operation of the coke battery, a typical unit of equipment, such as the pusher machine **17**, moves along the pusher side of the coke battery **11** from one coke chamber to another chamber not immediately adjacent. As the pusher machine **17** moves in the direction of arrow A (FIG. 2) toward an oven to be pushed, the collector rollers **29, 31** engage successive segments of rail **23**. When the pusher machine comes into the vicinity of the coke chamber to be pushed, the leading roller **31** first contacts rail segment **25*a***, while following collector roller **29** is still in contact with rail segment **24** just before rail seglent **25*a***. The central programmer **83** has already been set to stop the pusher machine **17** when the collector rollers **29, 31**, are in contact with only rail segment **25*b***, in which situation, the pusher machine is accurately spotted with respect to the particular coke chamber to be pushed. Now, at the time the leading collector roller **31** contacts segment **25*a*** and the following conductor roller **29** contacts rail segment **24**, a signal is sent through the central programmer **83** to the signal receiver **73** on the pusher machine which, in turn, immediately signals a reduction in speed of the drive motors of the pusher machine. The pusher machine then decelerates and creeps toward the selected spotted position, with the rollers **29, 31** contacting only the segment **25*b***. As long as the collector roller **29** is in contact with rail segment **25*a*** and collector **31** is in contact with rail segment **25*b***, the pusher machine receives a creep signal and continues to creep toward the spotted position. When the collector rollers **29, 31** contact only the rail segment **25*b***, the pusher machine stops and the pusher machine is then properly spotted. Should the pusher machine travel beyond the spotted position in which case the collector roller **31** contacts rail segment **25*c*** and collector roller **29** contacts rail segment **25*b*** (the dotted outlines of FIG. 2 show this situation), a signal is sent through the central programmer **83** and the signal receiver **73** to reverse the travel of the pusher machine. The pusher machine then receives a reverse creep signal, whereby the pusher machine travels backward until the collector rollers **29, 31** are positioned in contact with only rail segment **25*b***. The pusher machine then stops as before and the pusher machine is properly spotted in front of the coke oven to be pushed.

FIG. 4 illustrates schematically the wiring arrangements described herein, and the legend of FIG. 4 delineates the type of signal received and sent by the central programmer **83**. It is understood that the central computer is electrically connected to all of the segments of rails **23** in a similar manner.

After the pusher machine stops, brakes automatically set and the unit of equipment is ready to perform its function under the control of the central programmer or operator.

It should be understood that all of the other units of auxiliary equipment are operated in a similar manner. Adjacent each unit of auxiliary equipment is a rail segment **23** mounted to the structure of the coke oven battery, and a central programmer **83** and signal receiver **73** are part of the circuitry controlling the movement of each of the other units of equipment.

It should be understood that the length of the segments **25***a*, **25***b*, **25***c* of rail **23** are not limited only to the distance between the longitudinal center lines of adjacent coke chambers, though such length is preferred. Actually, the length of the segments **25***a*, **25***b*, **25***c*, may be any convenient length, provided the collector rollers **29**, **31** are spaced apart a distance equal to the length of the rail segment. Preferably all rail segments are of equal length to facilitate programming the operation and all rollers are spaced apart equal distances. Thus, in any application, when a pair of collector rollers contact only one rail segment, the unit of equipment is spotted accurately in a preselected position.

A feature of the invention is that accurate spotting of massive units of equipment servicing the coke oven battery is efficiently accomplished with minimum manpower requirements and operating expenses.

A feature of the invention is that accurate spotting of massive units for servicing a coke oven battery is readily accomplished and the separate units that act individually and coordinately with the coke oven battery are readily and quickly spotted with a minimum time delay.

A feature of the invention is that accurate spotting of massive servicing equipment for a coke oven battery is accomplished without taking the time required to align visual targets by operating personnel and the delay inherent in such a system.

Although the invention has been described herein with a certain degree of particularity, it is understood that the present disclosure has been made only as an example and that the scope of the invention is defined by what is here and after claimed.

What is claimed is:

1. The combination comprising:

(a) a coke oven battery;

(b) a unit of equipment operable and movable under a source of driving power adjacent a side of said coke oven battery for servicing said battery;

(c) an electrical power rail comprised of a plurality of individual segments of equal length that are individually insulated from adjacent segments and mounted to said coke oven battery adjacent to the path along which said unit of equipment traverses;

(d) a pair of electrical conductors contacting said power rail and being spaced apart a distance that is not greater than the length of each individual rail segment;

(e) means for maintaining said conductors in contact with said rail as said unit moves alongside of said battery;

(f) a source of electric power connected to each rail segment and to

(g) computer means that transmits control signals through said rail segments and the contactors whereby when a servicing unit approaches a selected location for spotting said unit, the driving power source of said unit receives from said computer a signal that changes the speed of said unit which decelerates, creeps to, and stops at said spotting location.

2. The combination of claim **1** wherein:

(a) said pair of conductors contact only one segment of said power rail when said unit is at said spotting location.

3. The combination of claim **1** wherein:

(a) said pair of conductors are rollers journalled to the ends of an arm pivotally mounted to said unit; and

(b) said means for maintaining said conductors in contact with said rail is a spring resiliently biased between said unit and said arm.

4. The combination of claim **1** wherein:

(a) said pair of conductors are rollers journalled to individual arms pivotally mounted to said unit; and

(b) said means for maintaining said conductors in contact with said rail are springs resiliently biased between said units and said arms.

5. In a coke oven battery including units of auxiliary servicing equipment that traverse paths alongside of the outer surfaces of said battery and that service said battery from preselected spotting locations, the combination with each said unit of equipment of:

(a) an electrical power rail comprised of a plurality of individual segments of equal length, each segment being electrically insulated from adjacent segments, with all of said segments being mounted to said coke oven battery adjacent to the path traversed by said unit of equipment, a segment being associated with each spotting location for said unit of equipment;

(b) a pair of electrical means contacting said rail and being spaced apart a distance not greater than the length of each said rail segment;

(c) means maintaining each of said pair of means in contact with said rail as said unit traverse said path;

(d) a source of electric power connected to each rail segment;

(e) electrical drive means mounted on said unit and connected in circuitry with said rail contacting means; and

(f) computer means connected in circuitry with said source of power and said rail contacting means and arranged to transmit deceleration signals to said unit electrical drive means as said movable unit approaches said spotting location, and creep signals to said unit drive means when one of said contact means contacts the segment next adjacent the segment associated with said spotting location, and stop signal to said drive means when both said rail contacting means simultaneously contact the segment associated with the spotting location.

6. The invention of claim **5** wherein:

(a) said computer means transmits creep reverse signals to said unit power drive means when one of said rail contacting means contacts the rail segments next adjacent and beyond the segment associated with said spotting location.

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