March 24, 1953 A. S. WEIGEL 2,632,559

DISTRIBUTOR APPARATUS FOR CINDER AND THE LIKE

Filed June 16, 1949 2 SHEETS—SHEET 1

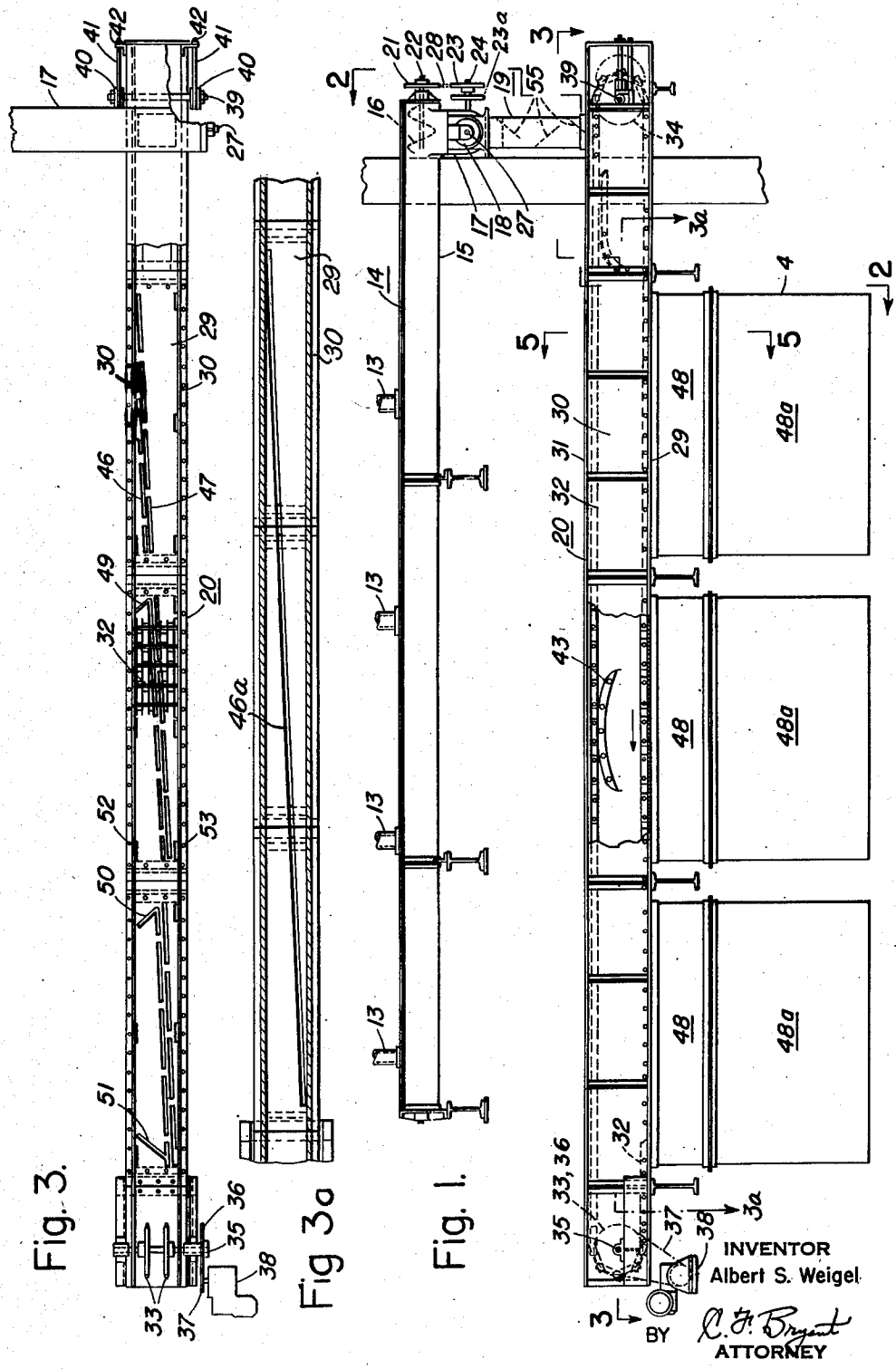


Fig. 3.

Fig 3a

Fig. 1.

INVENTOR
Albert S. Weigel

BY C. F. Bryant
ATTORNEY

March 24, 1953 A. S. WEIGEL 2,632,559

DISTRIBUTOR APPARATUS FOR CINDER AND THE LIKE

Filed June 16, 1949 2 SHEETS—SHEET 2

Fig. 5.

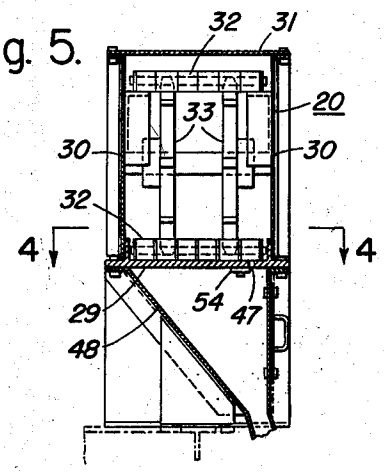
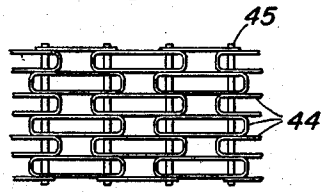


Fig. 4.



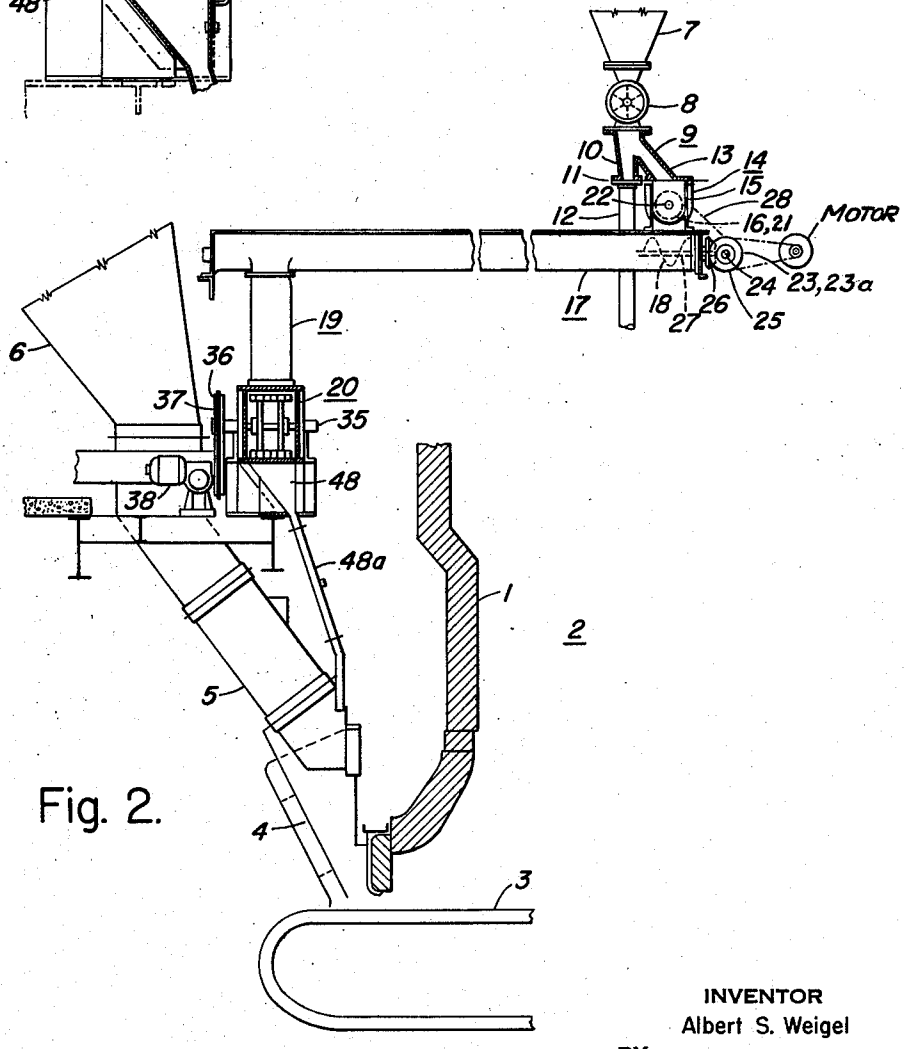


Fig. 2.

INVENTOR
Albert S. Weigel

BY C. F. Bryant
ATTORNEY

Patented Mar. 24, 1953 2,632,559

UNITED STATES PATENT OFFICE

2,632,559

DISTRIBUTOR APPARATUS FOR CINDER AND THE LIKE

Albert S. Weigel, Maplewood, N. J., assignor to Combustion Engineering-Superheater, Inc., New York, N. Y., a corporation of Delaware

Application June 16, 1949, Serial No. 99,413

7 Claims. (Cl. 198—169)

1

This invention relates to improved apparatus for uniformly and continuously distributing material along a path and in particular for so distributing cinder into the fuel across the length of a stoker hopper to thereby deliver it uniformly into the fuel bed upon the stoker.

The improved distributing apparatus is especially useful when used in conjunction with traveling grate stokers to which fuel is supplied through a hopper onto one end of the grate and thence travels with the grate while burning. The ash is discharged from the opposite end of the grate into an ash hopper. The improved apparatus may also be used in conjunction with a traveling grate to which fuel is supplied by means of a spreader stoker, or to other types of overfeed or underfeed stokers where cinder is to be delivered uniformly into the fuel bed.

When a boiler is associated with a furnace, a portion of the finer, partly burned fuel or cinder will be carried by the products of combustion out of the furnace into the boiler. Some of this cinder or fly ash will separate out of the gaseous products and will settle into hoppers at the bottom of the boiler passes and the remaining will be carried out of the boiler and may be separated out of the gaseous products or flue gases by separating means such as a cyclone separator. When using certain types of firing means and fuels, this cinder may contain as much as 30% to 50% combustible matter and it is desirable to reintroduce it into the furnace so as to burn out its combustible matter and reclaim the heat therefrom.

If the cinder is introduced into a stoker hopper in unequal distribution across the length of the hopper and/or in batches it will flow with the fuel into the furnace in unequal distribution through the fuel bed and will cause objectionable ununiform burning of the fuel. When this cinder is returned to the furnace through jets which deliver it at a substantial distance above the grate into the main portion of the products of combustion flowing upwardly through the furnace, it is found that although the combustible matter in the cinder so delivered is further consumed in the furnace, the remaining portion is again carried back into the boiler with the products of combustion and thereby objectionably increases the loading of cinder in the products

2

passing through the boiler. The thus increased loading of cinder in the flue gases has been found to impair the value as a nuisance eliminator of a separator for collecting the cinder or fly ash, it tending to raise the quantity of cinder or fly ash which escapes from the separator into the atmosphere where it constitutes an objectionable nuisance. Furthermore, this increased loading of cinder in the flue gases has been found to cause serious erosion and consequent failure of the boiler tubes, the external surfaces of which are swept by the cinder loaded flue gases.

To overcome these difficulties, it is desirable to introduce the cinder into the body of the fuel bed so as to retain a large proportion of this cinder in the fuel bed and discharge it into the ash pit and thereby prevent its recirculation through the boiler.

It is an object of this invention to provide novel means for uniformly and continuously distributing cinder into the fuel bed upon a stoker.

Additional objects of the invention will appear from the following description of one preferred embodiment of the invention as illustrated by the accompanying drawings, wherein:

Figure 1 is a front elevation of a preferred form of the improved materials-distributing apparatus.

Figure 2 is part end elevation and part section of the apparatus taken on line 2—2 of Figure 1.

Figure 3 is a part plan view and part section of the apparatus taken on line 3—3 of Figure 1, showing a fragment of the cinder conveyor.

Figure 3a is a section of the apparatus taken on line 3a—3a of Fig. 1, however with the chain conveyor not shown. Fig. 3a also distinguishes from Fig. 3 by illustrating a continuous slot instead of a plurality of slots in alignment.

Figure 4 is a plan view, in larger scale, of a fragment of the cinder conveyor shown in Figure 3.

Figure 5 is a cross section through the apparatus taken on line 5—5 of Figure 1.

In Figure 2 the reference character 1 represents the front wall of a furnace chamber 2 of a boiler setting (not shown) equipped with a stoker 3, in this instance of the traveling grate type, delivering fuel into the furnace through wall 1. The fuel is delivered to the stoker 3 through hopper 4 from spout 5 which is connected to the fuel supply bunker 6.

A supply of cinder or fly ash which has been separated (by means not here shown) out of the products of combustion passing through the boiler is deposited into a receiving hopper 7 therefor. A rotary air seal valve 8 below hopper 7 delivers the cinder from the hopper 7 into a Y fitting 9. One branch 10 of the fitting 9 is provided with a gate valve 11 through which, when open, the cinder may be withdrawn into pipe 12. When gate valve 11 is closed, the cinder will flow through the other branch 13 of the fitting 9 and will be delivered to a conveyor 14, in this instance a screw conveyor.

In this disclosure there are four such fittings 9 shown (see Figure 1) beneath the hopper 7, the branch 13 of each fitting delivering cinder to the conveyor 14. As here disclosed, this conveyor 14 comprises a trough 15 in which a screw 16 rotates, advancing the cinder from the fittings 9 into a second screw conveyor 17 (running at right angles to the first) which in turn advances the fly ash by means of screw 18 into a spout 19 through which it falls into the distributor generally designated as 20.

The conveyor driving means here represented utilizes a sprocket 21 keyed to the shaft 22 of the worm 16 of the conveyor 14 (Figures 1 and 2); a sprocket 23 mounted on one end of a drive shaft 24; and a bevel gear 25 mounted on said shaft 24, the gear 25 meshing with another bevel gear 26 keyed to the shaft 27 of worm 18 of conveyor 17. Sprockets 21 and 23 are interconnected by a chain 28 and are driven at some appropriate speed from a common motor (see Fig. 2) through any suitable means typified by a chain and sprocket 23*a* on shaft 24.

The distributor 20 shown in the drawing views comprises a trough having a bottom 29, side plates 30 and a removable cover plate 31. An endless chain-drag conveyor 32 slides along the bottom of the trough throughout its full length in the direction shown by the arrow in Figure 1 and after passing around sprockets 33 at one end of the conveyor 20 moves in the opposite direction across the top of the trough beneath the cover plate 31 to the other end of the conveyor, thence passing around sprockets 34.

The shaft 35 of sprockets 33 is provided on the outside of the trough with a drive sprocket 36 which in turn is driven through chain 37 by a motor and reduction gearing 38. The other sprockets 34 of chain-drag 32 have their shaft 39 rotating in bearings 40 which are mounted to slide longitudinally of the trough 20 and are held in position by means of take up bolts 41. By adjusting the nuts 42 on the take up bolts 41 outside of the trough end, the tension in the chain 32 may be varied. As shown in the broken section of Figure 1, curved shoes 43 are provided to carry the top run of the chain 32.

As shown in Figures 3, 4 and 5 the chain 32, of which there is a fragment shown, comprises a multiplicity of hollow, rectangular links 44 which are assembled by means of pins 45. The bottom 29 of trough 20 is provided with slots 46, 46*a* and 47 (see Figs. 3, 3*a* and 5) which extend diagonally across the full length of the bottom overlying the three hoppers 48 into which the distributed cinders drop. A continuous diagonal slot (46*a*, Fig. 3*a*) can be used or a plurality of slots in alignment (46 and 47, Fig. 3) can be provided. These hoppers 48 extend in length over substantially the full length of the stoker hopper 4.

Additional slots 49, 50 and 51 are provided in the bottom 29 where shown which extend from the diagonal slots 46 transversely thereto to a side wall 30 of the trough 20. Still other slots 52 and 53 are provided through the bottom adjacent side walls 30 of the trough 20. Plates 54 are mounted by bolts to the bottom side of bottom plate 29 adjacent slots 47. These plates 54 may be moved to serve as a gate for adjusting the width of slot 47 to thereby throttle the flow of material through the slot.

In operation the cinder from the boiler hopper 7 passes through rotary valves 8 hence branches off the Y fittings 9 into conveyor 14 whence it is conveyed to conveyor 17 and thence through chute 19 into the distributor 20. In order to uniformly deliver the cinder across the width of the chain 32 in the distributor trough 20, the chute 19 is provided with baffles 55 (see Fig. 1). The cinder in cascading onto the successive baffles 55 is spread uniformly over the width of the bottom edge of the lowermost baffle and is so delivered uniformly over the width of the chain 32.

The cinder thereupon falls through the open chain links 44 of the top run of chain 32 and into the pockets formed by the chain links 44 resting on the bottom 29 of the trough 20. As the chain moves across the bottom 29 (from right to left in Figs. 1 and 3) it drags the pockets, now substantially uniformly filled with cinder, across the slots 46, 47 or 46*a* in said bottom 29. Because the slots 46, 47 or 46*a* extend diagonally across the width of the bottom 29 for the combined length of the hoppers 48, the cinder in the pockets of chain links 44 will spill through the slots as the links pass over the slots.

The first pockets to be emptied, considered in direction of chain travel, will be those at the right wall of the trough, then, as the chain advances, successive pockets will empty from right to left as they pass over the slots and finally the pockets adjacent the left wall of the trough will empty. Because the slots 46, 47 or 46*a* are substantially in a straight diagonal line, the flow of the cinder through the slots will be substantially uniform over the total length of the slot or slots and hence a uniform distribution of the cinder is effected across the combined length of the hoppers 48 and thence through spouts 48*a* to the stoker hopper 4.

Slots 49, 50 and 51 serve to remove any material from trough 20 which may not have passed through slots 46 and 47 and is being carried onward by the chain 32 on the right side of slots 46 and 47 with respect to the direction of chain travel. Slots 52 and 53 serve to remove any material from trough 20 that may lodge along the corners of the trough at the sides of the chain 32. The material that may pass through slots 49, 50, 51, 52 and 53 will be a minor portion of the total material passing through the distributor trough 20, so that the distribution of material into hoppers 48 will be substantially uniform and continuous across the combined length of these hoppers.

Obviously the plate 29 may be placed under the top run of the chain 32 and the material falling through the slots will then pass through the lower or return run of the chain. In this instance the chain would travel in the opposite direction to that disclosed heretofore.

While the preferred embodiment of the invention has been shown and described, it will be understood that changes in construction, combination and arrangement of parts may be made with-

out departing from the spirit and scope of the invention as claimed.

What I claim is:

1. In apparatus for distributing fine material substantially uniformly along a path of given length, the combination of a trough extending over said path for at least the length thereof and having a flat bottom of narrow width with respect to its length and sides; a substantially continuous slot extending through said bottom and diagonally across the width thereof over the length of said path; an endless chain drag conveyor, a portion of which rests upon and moves along said bottom while covering its entire surface over the length of said slot; means for guiding said chain drag conveyor onto and off of said bottom adjacent its ends and supporting the returning portion of the chain at a spaced distance from said bottom; means for moving said chain along said bottom; and means for delivering material into said trough uniformly across the width of said bottom adjacent the chain's entering end.

2. Apparatus for distributing fine material continuously and substantially uniformly along a substantially straight path of given length, comprising a trough extending over said path for at least the length thereof having a flat bottom of narrow width with respect to its length and sides; a plurality of slots in alignment extending through said bottom and diagonally across the width thereof over the length of said path; an endless chain drag conveyor, a portion of which rests upon and moves along said bottom over the length of said slot, said chain comprising a multiplicity of hollow rectangular links extending across the width of said bottom which when resting upon the bottom form juxtaposed pockets open at the top for the reception of said material; sprockets guiding said chain-drag conveyor onto and off of said bottom adjacent its ends and supporting the returning portion of the chain at a spaced distance from said bottom; means for rotating one of said sprockets to move said chain; and means for delivering material into said trough uniformly across the width of said bottom adjacent the chain's entering end.

3. In apparatus for distributing fine material continuously and substantially uniformly along a substantially straight path of given length, the combination of a trough extending over said path for at least the length thereof and having a flat bottom of narrow width with respect to its length and sides; a plurality of slots in alignment extending through said bottom and diagonally across the width thereof over the length of said path; an endless chain drag conveyor, a portion of which rests upon and moves along said bottom while covering its entire surface over the length of said slot, said chain comprising a multiplicity of hollow rectangular links extending across the width of said bottom which when resting upon the bottom form juxtaposed pockets open at the top for the reception of said material; sprockets guiding said chain-drag conveyor onto and off of said bottom adjacent its ends and supporting the returning portion of the chain at a spaced distance above said bottom; means for rotating one of said sprockets to move said chain; and means for delivering material through the returning portion of said chain into said trough uniformly across the width of said bottom and into the pockets of the chain adjacent its entering end.

4. Apparatus for distributing fine material continuously and substantially uniformly along a substantially straight path of given length, comprising; a trough extending over said path for at least the length thereof and having a flat bottom plate of narrow width with respect to its length and sides; slotted outlet means through said bottom plate extending from one side longitudinally of and diagonally across the width of said bottom over the length of said path to the other side; at least one other slot extending transversely across the bottom from said diagonal slotted outlet means to said one side; at least one slot through said bottom extending parallel to and along said walls; an endless chain drag conveyor a portion of which rests upon and moves along said bottom while covering its entire surface over the length of said diagonal slotted outlet means; sprockets guiding said chain-drag onto and off of said bottom adjacent its ends and supporting the returning portion of the chain at a spaced distance from said bottom; means for rotating one of said sprockets to move said chain; and means for delivering material into said trough uniformly across the width of said bottom adjacent the chain's entering end.

5. In apparatus for distributing fine material substantially uniformly along a path of given length, the combination of a trough extending over said path for at least the length thereof and having a flat bottom of narrow width with respect to its length and sides; a plurality of slots in alignment extending through said bottom and diagonally across the width thereof over the length of said path; an endless chain drag conveyer, a portion of which rests upon and moves along said bottom while covering its entire surface over the length of said slot; means for guiding said chain drag conveyer onto and off of said bottom adjacent its ends and supporting the returning portion of the chain at a spaced distance from said bottom; means for moving said chain along said bottom; and means for delivering material into said trough uniformly across the width of said bottom adjacent the chain's entering end.

6. In apparatus for distributing fine material substantially uniformly along a path of given length, the combination of a trough extending over said path for at least the length thereof and having a flat bottom of narrow width with respect to its length and sides; slotted outlet means extending through said bottom and diagonally across the width thereof over the length of said path; an endless chain drag conveyer, a portion of which rests upon and moves along said bottom while covering its entire surface over the length of said outlet; means for guiding said chain drag conveyer onto and off of said bottom adjacent its ends and supporting the returning portion of the chain at a spaced distance from said bottom; means for moving said chain along said bottom; and means for delivering material into said trough uniformly across the width of said bottom adjacent the chain's entering end.

7. In apparatus for distributing fine material substantially uniformly along a path of given length, the combination of a trough extending over said path for at least the length thereof and having a flat bottom of narrow width with respect to its length and sides; slotted outlet means extending through said bottom and diagonally across the width thereof over the length of said path; an endless pusher conveyor, a portion of which rests upon and moves along said bottom while covering its entire surface over the length of said outlet; means for guiding said pusher conveyor onto and off of said bottom adjacent its

ends and supporting the returning portion of the conveyor at a spaced distance from said bottom; means for moving said conveyor along said bottom; and means for delivering material into said trough uniformly across the width of said bottom adjacent the conveyor's entering end.

ALBERT S. WEIGEL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
461,632	Humphrey	Oct. 20, 1891
586,451	McKellar	July 13, 1897
621,744	Bowden	Mar. 21, 1899
835,288	Patterson	Nov. 6, 1906
1,512,654	Troy	Oct. 21, 1924
1,635,925	Carlson	July 12, 1927
2,053,038	MacKenzie	Sept. 1, 1936

FOREIGN PATENTS

Number	Country	Date
636,865	Germany	Oct. 16, 1936