Jan. 5, 1943. E. B. THOMPSON 2,307,549

FURNACE DOOR LIFT

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Fig. 7.

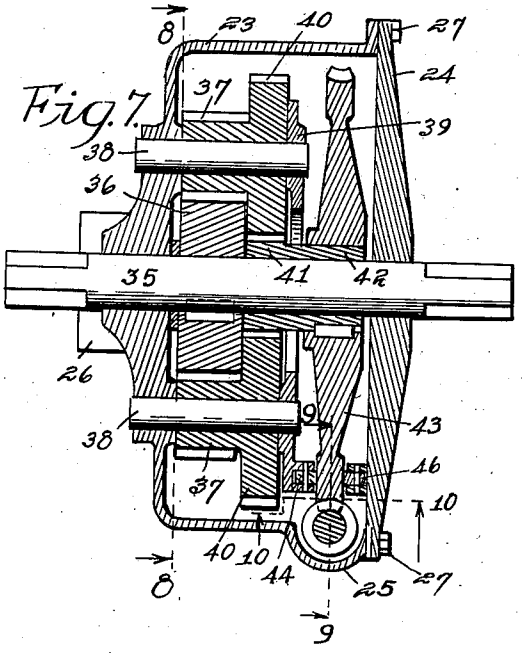


Fig. 8.

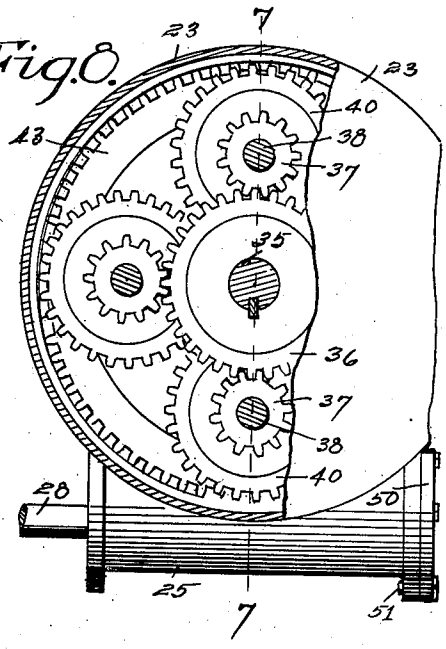
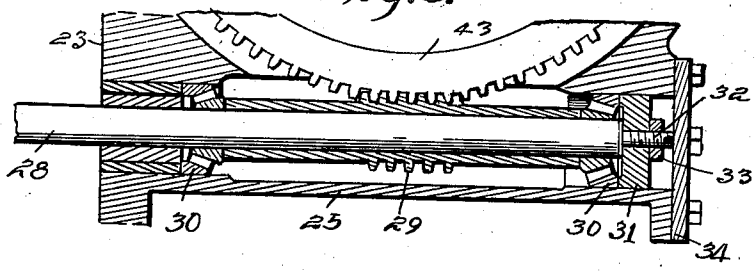


Fig. 9.



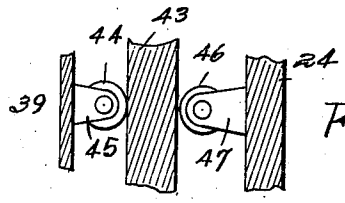


Fig 10.

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FURNACE DOOR LIFT

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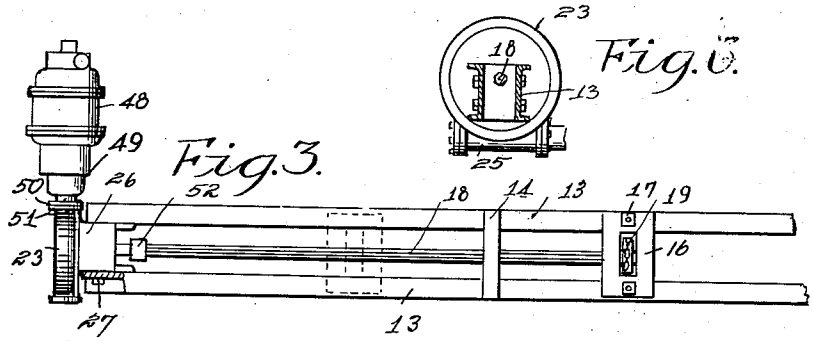


Fig. 3.

Fig. 6.

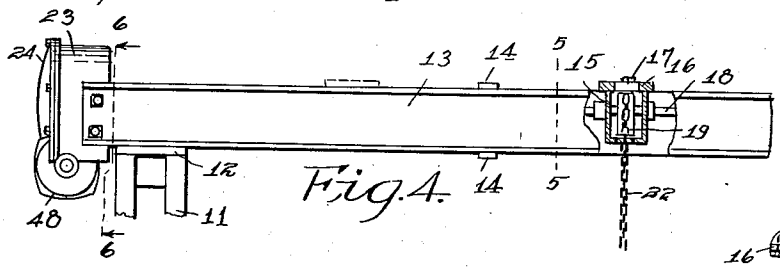


Fig. 4.

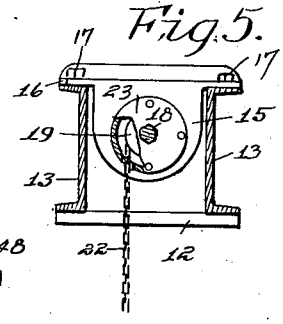


Fig. 5.

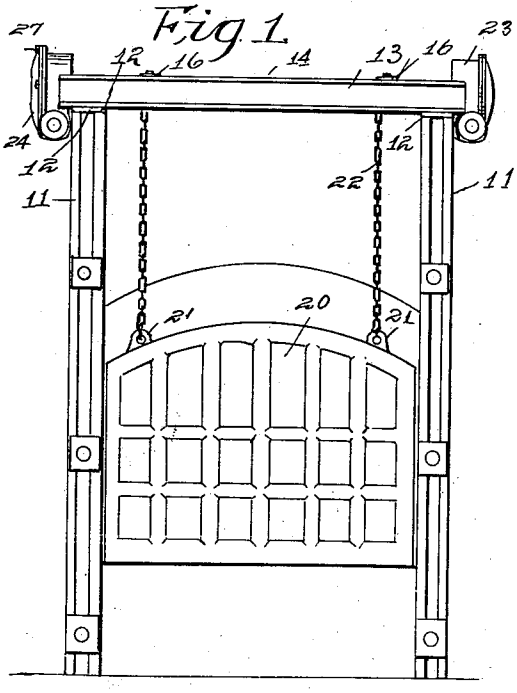


Fig. 1.

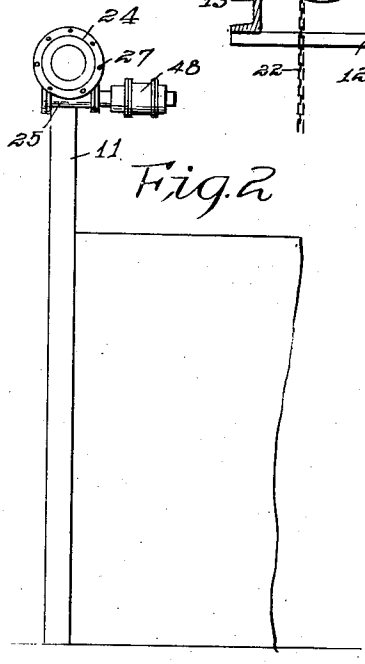


Fig. 2

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Patented Jan. 5, 1943 2,307,549

UNITED STATES PATENT OFFICE

2,307,549

FURNACE DOOR LIFT

Elmer B. Thompson, Des Moines, Iowa, assignor to Globe Hoist Company, Des Moines, Iowa, a corporation of Iowa

Application December 29, 1941, Serial No. 424,752

7 Claims. (Cl. 268—59)

The large industrial furnaces now in general use are usually equipped with furnace doors which slide vertically and are equipped with cast iron counter-weights and operated manually by means of a chain and pulley device.

The object of my invention is to provide a furnace door lift in the form of a small, compact, unitary structure which may be readily and easily applied to a furnace frame and a furnace door, without the necessity of discontinuing the use of the furnace during the removal of the aforesaid counter-weights and pulleys and during the installation of my improved lift.

More specifically, it is my object to provide improved and simplified mechanism for adjustably and reversibly connecting the motor element to the rest of the unitary structure and whereby the motor member may be applied at either end which is most accessible, or two motors may be used for extra heavy doors, and whereby such adaptation may be accomplished quickly and easily.

A further object is to provide simple and inexpensive means for bracing the large gear which is driven by the worm, against lateral strains or stresses applied to it by the worm during heavy lifting operations, and also for balancing and equalizing strains and stresses transmitted to the pulley shaft from the worm gear wheel.

In the accompanying drawings—

Figure 1 shows a front elevation of a furnace having my improved furnace door lift applied thereto;

Fig. 2 shows a side elevation of same;

Figure 3 shows a plan view of my improved furnace door lift;

Figure 4 shows a side view of same;

Figure 5 shows a sectional view on the line 5—5 of Fig. 4;

Figure 6 shows a sectional view on the line 6—6 of Fig. 4;

Figure 7 shows an enlarged detail vertical central sectional view of the gear element of my lift, taken on the line 7—7 of Fig. 8;

Figure 8 shows a sectional view on the line 8—8 of Fig. 7, a part of the gear case being shown in side elevation;

Figure 9 shows a sectional view on the line 9—9 of Fig. 7; and

Figure 10 shows a sectional view on the line 10—10 of Fig. 7.

Industrial furnaces are usually provided with a front frame member 11 projected above the furnace and having supporting plates 12 fixed to the upper ends of its uprights.

My lift comprises a frame to connect and support the various members of the lift. This frame is formed of two channel bars 13, spaced apart, with the flanges extended outwardly and the channels are rigidly connected by the cross pieces 14.

Two or more pocket wheel housings are provided, each comprising a body portion 15 having flanges 16 at its top to rest upon the channel bars 13, with the body portion contained between the channels. Bolts 17 are extended through said flanges 16 into the channel bars for firmly fixing the housings in any desired position relative to the channel bars.

A hexagon-shaped shaft 18 is extended through both of the housings 15, and a pocket wheel 19 is slidingly and non-rotatably applied to the shaft within each housing. When installing my lift the furnace door 20 is usually provided with two loops 21 to receive the door lifting chains 22, and it is desirable that the pocket wheels be directly above said loops. With my structure the pocket wheels are freely slidable along the shaft to the desired positions, and then are firmly bolted in said positions.

The chains 22 are passed through the housings 15 and around the pocket wheels.

My improved gearing mechanism for transmitting power from an electric motor to the pocket wheel shaft comprises an enclosed gear casing member 23 having a cover 24 bolted thereto. At its lower portion is a casing member 25 for the worm, and these two casing members are cast integral. For supporting these casings to the channel bars 13 I have formed integral with the casing member 23 a flange 26 which projects between the channel bars 13 at one end, and is secured thereto by bolts 27. Within the casing members 25 is a shaft 28 having a worm 29 thereon. Roller bearings 30 are mounted within the casing member 25 for the shaft 28, and an end thrust block 31 engages the end of the bearing 30 on the shaft 28, and is made adjustable by the screw 32 having a lock nut 33 thereon. A detachable plate 34 covers the end of the casing member 25 adjacent the end of the shaft 28.

Mounted centrally within the casing 23 is a shaft 35 having a pinion 36 fixed to it. This pinion is in mesh with four pinions 37 rotatably mounted on shafts 38 fixed to the casing and equally spaced apart. These shafts 38 are braced and supported at their inner ends by a disc 39 to which the shafts are fixed. This disc holds the pinions 37 against end thrust movement.

Each of the pinions 37 has a larger pinion 40 formed integral with it, and these large pinions are in mesh with a pinion 41 on the sleeve 42 loosely mounted on the shaft 35. Fixed to the sleeve 42 is a large worm gear wheel 43 which is in mesh with the worm 29, as shown in Fig. 9. When power is applied to the shaft 28 to rotate the worm 29, a considerable lateral stress is applied to that portion of the gear 43 which is in engagement with the worm. In order to counteract this stress and make it possible to use a gear 43 of comparatively light weight, I have provided a roller 44 mounted on a bracekt 45 formed integral with the partition 39—see Fig. 10—and this roller is in engagement with the side of the gear 43 adjacent its point of contact with the worm 29—see Fig. 7. Another similar roller 46 is mounted on a bracket 47 formed integral with the casing member 24, and the roller engages the gear 43 at the side opposite from the roller 44.

By means of the construction of the gear mechanism just described I attain several advantageous results. The use of the partition member 39 makes it possible to firmly brace and support the shafts 38 and the roller 43, and at the same time all of the parts may be assembled in the casing or removed without removing any bolts, screws or the like, and at the same time lateral strains or stresses applied by the worm are not transmitted either to the gear 43 or to the shafts 38 or the pinions thereon.

The electric motor 48 is provided with a casing 49 which is formed with a circular flange 50 shaped to fit against the casing member 25—see Fig. 8—to which it is connected by bolts 51. The shaft 28 extends into the electric motor and is driven thereby. The shaft 18 is connected to the shaft 28 by a detachable shaft coupling 52.

For convenience in shipping and handling, and to simplify and reduce the cost of installing, the parts are all assembled in a unitary structure, including the channel bars 13 which constitute the main frame or support for the unit. In some instances it is necessary to have the motor assembly at the left of the furnace, and in other instances it is necessary to have it at the right side, and in some instances it is necessary to have a motor at each end of the shaft 18. When it is desired to reverse the position of the motor assembly the operator simply removes the bolts 27 and withdraws the flange 26 from between the channel bars. He then removes the plate 34 from the worm casing and slides the worm casing off of the shaft 28. He then reverses the position of the flange 26, so that it will extend toward the left of the motor assembly instead of to the right, as shown in Fig. 3, replaces the shaft 28, and finally returns the plate 34 to its original position. A similar procedure may be used in applying a motor assembly to each end of the pulley shaft The installation is completed by connecting the chains 22 to the furnace door and positioning the pocket wheels directly above the points of attachment of the chains with the furnace door.

The electric motor is controlled in any ordinary manner, such as an electric switch located far enough away from the furnace so that the operator is not subjected to excessive heat from the furnace.

I claim as my invention:

1. A furnace door lift, comprising a main frame consisting of two channel bars fixed together in laterally spaced apart position, two sprocket wheel assemblies, each comprising a housing having a flange at its top resting on the channel bars and supporting the housings between the channel bars, a pocket wheel in each housing having a central shaft opening, a shaft extended through the pocket wheels, a chain for each pocket wheel, a gear assembly unit, comprising a gear casing formed with a flange at one side, fitted between and supported by the channel bars at one end thereof, an electric motor having its driven shaft extended into said gear casing and having a worm thereon within the gear casing, bearings for the worm shaft carried by the worm shaft and being insertable into the gear casing or removed as a unit, whereby the gear casing may be easily and quickly removed from one end of the channel bars and fitted to the other end by removing the gear casing from the motor shaft reversing it so that said flange extends in an opposite direction and inserting said flange in the space between the other end of the channel bars, a worm gear wheel within the casing in mesh with the worm, a gear wheel on the said pocket wheel shaft within the casing, and a series of speed-reducing gears between the worm gear wheel and the gear wheel on the pocket wheel shaft.

2. A furnace door lift, comprising a main frame consisting of two channel bars fixed together in laterally spaced apart position, two sprocket wheel assemblies, each comprising a housing having a flange at its top resting on the channel bars and supporting the housings between the channel bars, a pocket wheel in each housing having a central shaft opening, a shaft extended through the pocket wheels, a chain for each pocket wheel, a gear assembly unit, comprising a gear casing formed with a flange at one side, fitted between and supported by the channel bars at one end thereof, an electric motor having its driven shaft extended into said gear casing and having a worm thereon within the gear casing, bearings for the worm shaft carried by the worm shaft and being insertable into the gear casing or removed as a unit, whereby the gear casing may be easily and quickly removed from one end of the channel bars and fitted to the other end by removing the gear casing from the motor shaft, reversing it so that said flange extends in an opposite direction and inserting said flange in the space between the other end of the channel bars, a detachable plate covering the end of the gear casing adjacent the end of the worm shaft, an end thrust bearing block for engaging the bearing from the outer end of the worm shaft, a screw for adjusting the bearing block, said screw being engaged and held by said detachable plate, a worm gear wheel within the casing in mesh with the worm, a gear wheel on the said pocket wheel shaft within the casing, and a series of speed-reducing gears between the worm gear wheel and the gear wheel on the pocket wheel shaft.

3. A furnace door lift, comprising a main frame consisting of two channel bars fixed together in laterally spaced apart position, two sprocket wheel assemblies, each comprising a housing having a flange at its top resting on the channel bars and supporting the housings between the channel bars, a sprocket wheel in each housing having a central shaft opening, a shaft extended through the sprocket wheels, a chain for each sprocket wheel, a gear assembly unit, comprising a gear casing formed with a flange at one side, fitted between and supported by the channel bars at one end thereof, an electric motor having its driven shaft extended into said gear

casing and having a worm thereon within the gear casing, bearings for the worm shaft carried by the worm shaft and being insertable into the gear casing or removed as a unit, whereby the gear casing may be easily and quickly removed from one end of the channel bars and fitted to the other end by removing the gear casing from the motor shaft, reversing it so that said flange extends in an opposite direction and inserting said flange in the space between the other end of the channel bars, a worm gear wheel within the casing in mesh with the worm, and means for transmitting rotary movement to the sprocket wheel shaft from the worm gear.

4. In a furnace door hoist, the combination of a shaft, sprocket wheels thereon, a chain for each sprocket wheel having means for attachment to a furnace door, an electric motor, a shaft having a worm thereon operated by the motor, a gear assembly for transmitting rotary motion from the worm shaft to the sprocket wheel shaft, comprising a gear casing having a detachable end member and having said sprocket wheel shaft extended through the casing, a pinion fixed to the sprocket wheel shaft, a partition member within the casing, a series of shafts fixed to the partition member and to the casing forming the support for the partition member and supporting the inner ends of said shafts, a pinion rotatable on each of said shafts and in mesh with its pinion on the sprocket wheel shaft, a sleeve rotatably mounted on the sprocket wheel shaft, a pinion formed thereon, pinions formed integral with each of the said pinions on said shafts and each being in mesh with the pinion on said sleeve, and a worm gear wheel fixed to said sleeve and in mesh with the worm on the motor shaft and whereby the entire gear mechanism may be assembled as a unit and placed in the casing or removed therefrom as a unit without other support for the pinion shafts.

5. In a furnace door hoist, the combination of a shaft, sprocket wheels thereon, a chain for each sprocket wheel having means for attachment to a furnace door, an electric motor, a shaft having a worm thereon operated by the motor, a gear assembly for transmitting rotary motion from the worm shaft to the sprocket wheel shaft, comprising a gear casing having a detachable end member and having said sprocket wheel shaft extended through the casing, a pinion fixed to the sprocket wheel shaft, a partition member within the casing, a series of shafts fixed to the partition member and to the casing forming the support for the partition member and supporting the inner ends of said shafts, a pinion rotatable on each of said shafts and in mesh with its pinion on the sprocket wheel shaft, a sleeve rotatabaly mounted on the sprocket wheel shaft, a pinion formed thereon, pinions formed integral with each of the said pinions on said shafts and each being in mesh with the pinion on said sleeve, a worm gear wheel fixed to said sleeve and in mesh with the worm on the motor shaft and whereby the entire gear mechanism may be assembled as a unit and placed in the casing or removed therefrom as a unit without other support for the pinion shafts, and a roller carried by said partition member and engaging the adjacent side of the worm gear wheel to counteract side stresses applied to the worm gear wheel.

6. In a furnace door hoist, the combination of a shaft, sprocket wheels thereon, a chain for each sprocket wheel adapted to be attached to a furnace door, an electric motor, a shaft having a worm thereon operated by the motor, a gear assembly for transmitting rotary motion from the worm shaft to the sprocket wheel shaft, comprising a gear casing having a detachable end member and having said sprocket wheel shaft extended through the casing, a pinion fixed to the sprocket wheel shaft, a partition member within the casing, a series of shafts fixed to the partition member and to the casing forming the support for the partition member and supporting the inner ends of said shafts, a pinion rotatable on each of said shafts and in mesh with the pinion on the sprocket wheel shaft, a sleeve rotatably mounted on the sprocket wheel shaft, a pinion formed thereon, pinions formed integral with each of the said pinions on said shafts and each being in mesh with the pinion on said sleeve, a worm gear wheel fixed to said sleeve and in mesh with the worm on the motor shaft and whereby the entire gear mechanism may be assembled as a unit without other support for the pinion shafts, a roller carried by said partition member and engaging the adjacent side of the worm gear wheel to counteract side stresses applied to the worm gear wheel, and a second roller carried by the detachable cover for the gear casing and engaging the opposite side of the worm gear wheel and being removable with the cover.

7. A furnace door lift, comprising a frame, two sprocket wheel casings mounted within the frame, a sprocket wheel in each casing, a sprocket wheel shaft extended through the sprocket wheels and through their casings, a chain for each sprocket wheel, an electric motor, a gear casing detachably connected to the electric motor and detachably connected to said frame, a worm operated by the motor shaft, a worm gear wheel within the casing and in mesh with the worm, and means for transmitting rotary motion from the worm gear wheel to the sprocket shaft.

ELMER B. THOMPSON.