Oct. 15, 1929. E. F. ROGERS 1,731,909

CHARGING APPARATUS

Filed Oct. 17, 1925 3 Sheets-Sheet 1

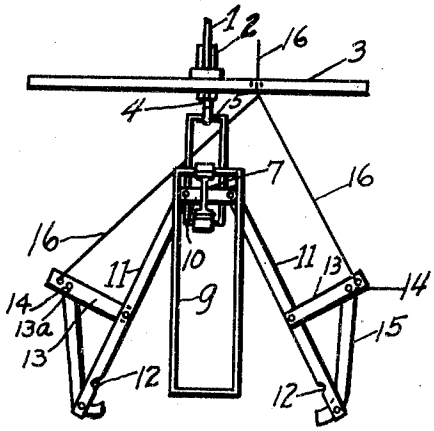


FIG 1

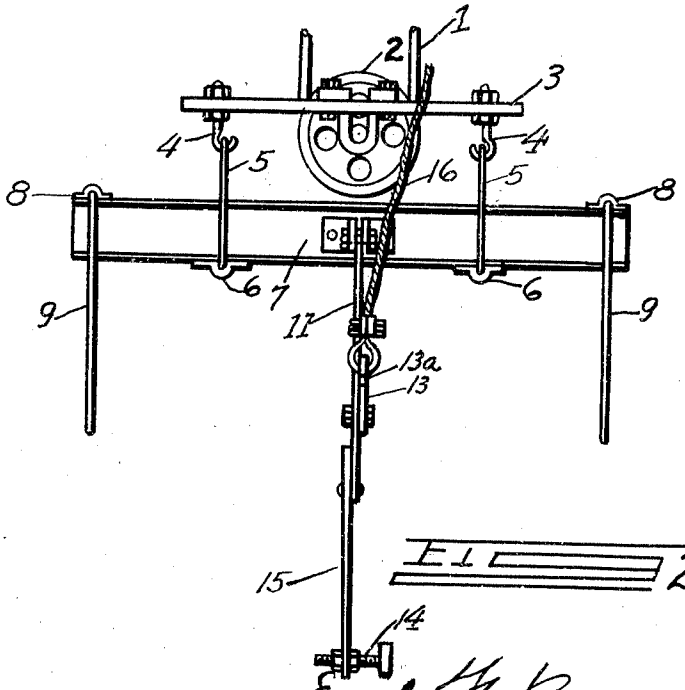


FIG 2

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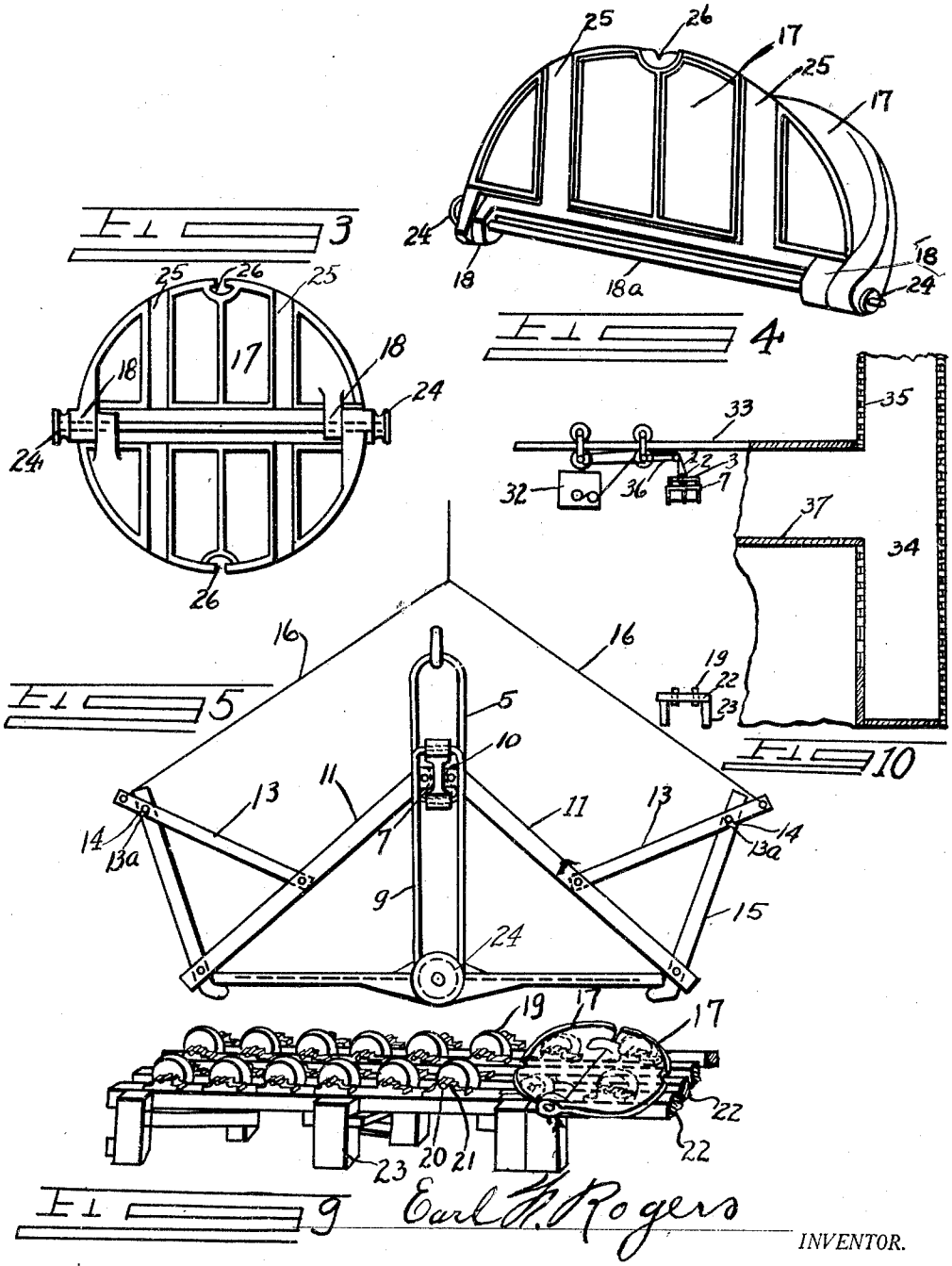
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CHARGING APPARATUS

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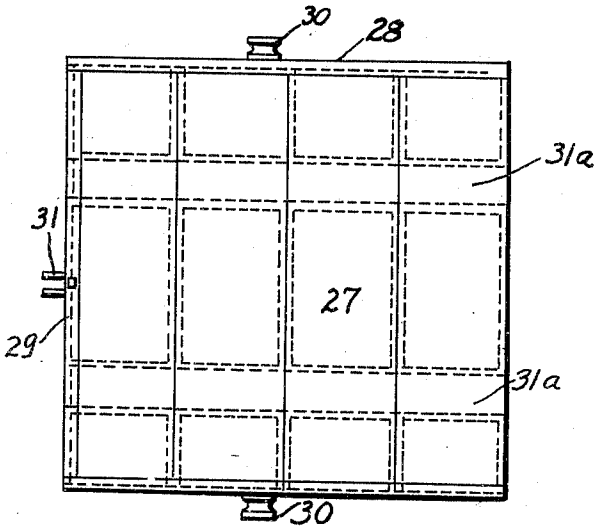


FIG 6

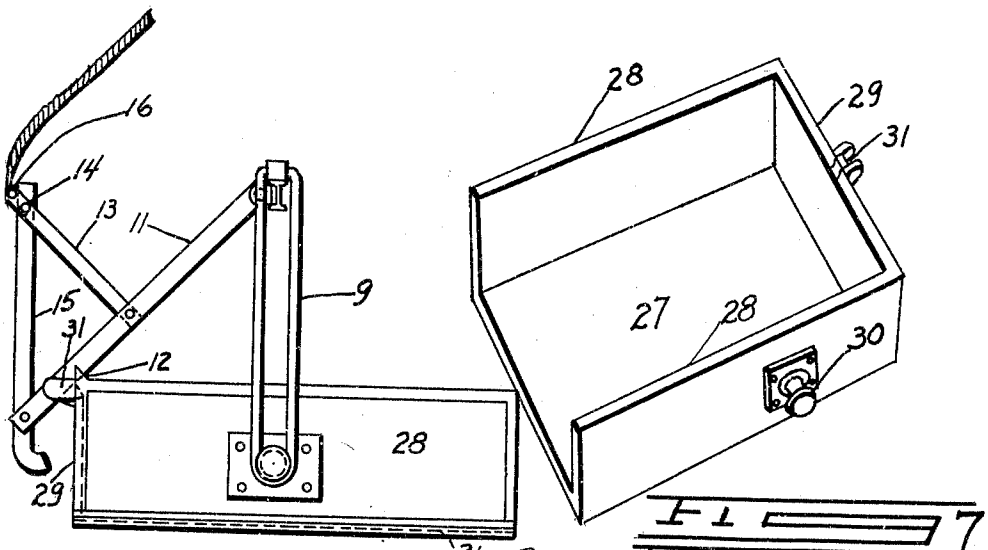


FIG 8

FIG 7

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UNITED STATES PATENT OFFICE

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CHARGING APPARATUS

Application filed October 17, 1925. Serial No. 63,145.

My invention relates to charging apparatus and particularly to cupola charging apparatus for preparing metal for foundry use. In preparing iron and other metals for foundry use, it is customary to employ a shaft furnace for melting the metal. Requirements for labor saving devices for use in the several operations preparatory to and coincident with the operation of shaft furnaces have been long desired, and it is toward the provision of novel equipment which not only simplifies the steps in the process but eliminates much labor and is adapted for use in accordance with a plan of operation which practically insures the production of more uniformly good products, that my invention specifically relates.

It is my object to provide, in connection with a movable hoist adapted for transferring the same, for a novel carrying plate for holding iron pigs and the like. It is further my object to provide a novel tray which is adapted to carry sprue, scrap and other materials required in the shaft furnace. For conveniently elevating and dumping these several carrying devices, it is my object to provide novel lifting members. Finally it is my object to provide conveyors which are especially adapted to provide convenient means for storing and moving the carrying plates and trays.

The practice in a foundry and the proper disposal of the labor is to prepare the charge for the cupola in the morning, start the charge around noon, and then keep the cupola going for the rest of the working day. Before the advent of a charging crane it was the practice to assemble the charge in weighed batches, usually on some kind of a tray, or else merely laid on the charging floor. In any event the men shoveled the various materials into the furnace when required, during the blast.

With the advent of the charging crane which embodied chiefly a travelling hoist with some kind of a rigid charging arm projected from it, the practice was to assemble the charge on the ground and when needed to place it in buckets, which the crane was used to thrust into the charging door of the furnace and dump.

However, it is the best mode of charging a cupola blast furnace to place the pig iron around the sides of the furnace and pile the other materials in the center. To accomplish this with a bucket is not practical, and neither is it practical to dump a load of tangled sprue and scrap from a crane bucket; hence efforts have been made to provide some kind of a tray which would so deposit the pig iron, and would dump readily when used for sprue and scrap. So far as I am advised no practical structure of small expense, and free from complications of mechanism has been devised for this purpose and my novel carrying plate for iron pigs is constructed with this object in view, as is my novel tray.

The moving about of parts of a charge for the furnace is considerable of a problem, because it is heavy to move in the case of the pigs, and so tangled and bulky in the case of the sprue and scrap, that shoveling is very tedious. My conveyor device and method of handling materials is directed to the end of providing for disposing a series of conveyors or roller tables, at the ground level in such a way as to permit wide elasticity of arrangement, providing a series of roller surfaces, leading to the travelling hoist and extending away to any desired part of the yard.

In use with my conveyors the material when assembled is weighed and placed on the roller tables in the novel trays and plates, of which a sufficient number is provided. The material is thus stored until rolled up to the crane by the workmen, when the time comes to charge the furnace. In this way I provide for a single handling and keep all pig iron, sprue and scrap off the charging floor.

In connection with the hoist itself, whether it be a charging crane or some travelling element with a charging arm, and a block and fall, it is my object in the lifting device to provide for an arrangement which trips instantly, without expenditure of any power, in spite of the heavy loads carried, and the pig iron plate and scrap and sprue trays are designed to be selectively engaged and operated by the one lifting device, and to guide

themselves automatically on the conveyor devices, and to dump automatically when released by an element on the lifting device.

Referring to the drawings in which I have illustrated my preferred structures adapted for use in connection with the accomplishment of the above noted objects:

Figure 1 is a side elevation of my novel clamp members.

Figure 2 is a front elevation of the clamp members shown in Figure 1.

Figure 3 is a bottom plan view of the carrying plate.

Figure 4 is a perspective view of the carrying plate with one side swung up to reveal the underneath construction.

Figure 5 is a side elevation of the clamp members in position supporting a carrying plate.

Figure 6 is a top plan view of a carrying tray.

Figure 7 is a perspective view of a carrying tray.

Figure 8 is a side elevation of the clamp members in position supporting a carrying tray.

Figure 9 is a perspective view of a roller table of my novel conveyors.

Figure 10 is a diagram of a cupola and charging apparatus.

Generally indicated at 1 is a cable from any desired type of travelling hoist, which in this instance I have illustrated as monorail crane 32, having an arm 36 for charging. It should be understood that the mechanism for automatically raising and transferring the iron and sprue may be of any suitable type operated electrically or by hand. The cable is adapted to pass though a pulley 2 mounted on a metal plate 3. Hooks 4 bolted to the disc 3 pass through metal loops 5 which are extended through boss plates 6 on an I-beam 7 of approximately the length of the plates and trays on which the iron and sprue is carried. Boss plates 8 on the ends of the I-beam support pivotally mounted metal loops 9 which extend down from the I-beam with sufficient spacing to span the load supported on the trays and plates. Mounted on brackets 10 on each side of the I- beam at the center thereof are pivotal arms 11 which are free to move in positions at right angles to the I-beam. The arms 11 are provided with notches 12 for a purpose which will be hereinafter described. The arms retain other arms 13 which extend out from them and which are notched as at 13a to engage over pins 14 on hook arms 15 which arms are pivotally mounted in the ends of the arms 11. A cable 16 secured to the upper ends of the arms 13 provides a simple method of lifting the arms 13 from engaging the bolts or pins 14 permitting the hook members to swing away so as to release the carrying plate for dumping purposes. The cable preferably passes up to the crane so that the crane operator may operate the clamp releasing mechanism from his seat in the crane.

The novel plate for carrying the pig iron or other metal required in the cupola charging is provided in the form of a sectional plate consisting of two semi-circular portions 17 which have bosses 18 disposed in sufficiently offset relation that they form a hinged connection with a rod 18a which extends through both sets of bosses as a pintle. The plate sections are hinged to be movable in both directions on a horizontal pivot, and are preferably formed with channels 25 on the underside for engaging on the roller table.

The plate sections are formed with trunnions in the shape of grooved heads 24 formed on the opposite corners of the two sections. In the center of the rim of each plate a portion 26 is formed with a notch therein. The loops 9 of the carrying or lifting device engage the trunnions, and the hooked ends of the arms engage about the lips 26.

The conveyors are formed of a sufficient number of roller tables which may be simply built of a frame 23, on top of which are secured spaced two-by-four boards 22. Large sized rollers 19, having pivot pins 21, are arranged within the spaces left between the two-by-fours, with the pins set on bearing blocks 20. As illustrated in Figure 9 the tables will have two rows of rollers lengthwise of the frames, and to form a conveyor for the tables, they are moved about and placed endwise to each other, so as to form a train extending wherever is convenient in the yard.

The channels in the undersides of the plate sections are disposed so as to engage over the rollers, and the roller tables are of a size which will permit one to be set on a platform scale set in the ground in order to weigh out the batches of material. Thus a whole charge of pig iron may be weighed out in batches on the plates, and the plates with their loads may be moved about on the conveyors in any convenient manner.

In lifting the plates charged with pigs to carry them to the cupola, the crane, or whatever elevating mechanism is employed lowers the lifting device so that the loops 9 may be fastened under trunnions 24, and thereupon the hook arms 15 are adjusted about the lips 26 in the outer peripheries of the plate sections. The notches in the lips may be dispensed with but they form a more positive grip on the hook arms.

After elevating and conveying a plate, and thrusting it into the cupola, it will be obvious that, with the pulling of the cable 16 the engagement of the hook arms will be released so that they swing away, permitting the carrying plate to fold down, automatically emptying its contents into the furnace. It

will further be found that the pigs disposed on the plate will be projected in falling from the plate along radial lines extending out from the center of the plate, thereby distributing the pigs in the cupola around the outer periphery thereof, if the plate is released at the proper point. This is due to the shape of the plate and its rapid dumping action.

For charging the sprue and other material which require only dumping into the shaft furnace I have provided a novel tray illustrated in Figures 6, 7 and 8, which is composed of a flat plate 27, with sides 28, and a back 29. The sides are provided with trunnions 30 disposed sufficiently back of the center of gravity of the tray so that it will tilt forward toward the open end when released by the carrying clamps. The arrangement for steadying the tray during transportation which will permit it to tilt with the releasing of the hooks is as follows. Each one of the arms has, as has been described, a notch 12 so that whichever side arm 11 is extended toward the closed back of the tray, is engaged in a lug portion 31 formed in the top of the back end of the tray. The arm 11 holds the tray down and prevents it tipping. The arms 13 and 15 are disposed similarly to the way in which they are disposed when conveying a plate (as shown in Figure 8), and an upward pull of the cable will lift the arm 11, thus releasing the tray and allowing it to dump.

It is preferable to have the tray provided with grooves 31ª in the underside of the bottom so that the trays may be pushed about on conveyors in a similar way to that in which the plates are handled. Being flat the trays may be carried around the shop on elevator trucks, where the load is collected and then moved out to the yard and placed on the conveyor tables.

With my novel equipment for handling pigs and sprue, it will be apparent that the work of loading all the plates and trays may be done prior to the charging of the cupola so that during a suitable period of the day, workmen may be used to load the plates and trays, and place them on the roller tables for temporary storage. With a good crane the speed at which plates and trays may be elevated and dumped is only dependent on the rate of operation of the furnace. One man can easily elevate and dump trays and plates fast enough to keep a large cupola in operation, and it is easy to push the trays and plates along the roller tables to a place available to the crane.

For elevating the plates and trays and charging the cupola I have found that the most suitable equipment is a crane 32 which is preferably of the monorail type and operates on a rail 33 which extends from the yard into the building in which the cupola is built. The cupola is shown diagrammatically with the shaft 34 and the stack 35. In order to be able to dump a plate into the exact center of the shaft the crane is provided with a charging arm 36 which, in position over the shaft, will extend to the middle of the cupola through the charging doors, although the rail on which the crane operates does not extend within the opening.

The advantages possible with my novel equipment are understood when it is considered that the old system of charging a cupola necessitated storing trays of pigs and sprue on the charging floor shown diagrammatically in Figure 10 at 37 from which these materials had to be shoveled into the furnace. As the charging has to be done during the operation of the cupola and as the room in which the cupola has its charging opening, is filled with hot noxious gases, the saving in labor and the health of operatives may be readily imagined.

The simplicity and hence inexpensiveness of the plates and trays, permit of sufficient number being provided to assemble the entire charge preparatory to starting up the furnace, and but little force need be applied to trip the devices which in both instances dump of themselves as soon as released.

Furthermore the operation of the plates and trays and of the lifting devices, is such as to place the charge quickly and accurately at the exact points required, obviating the necessity of leaving the charging doors open for any length of time.

The conveyor system using units of roller tables which can be arranged in any desired series, permits of economical use of yard space, without interfering with passage of trucks to and fro in the yard, while the charge is stored, because any unit lying across a passageway can be left free of materials and be moved out of the way, during the period of assembling the charge.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a storing, conveying and charging means for pig iron in cupola furnaces, a circular detachable plate having downwardly folding semi-circular sections adapted to be held on a roller table, and a lifting device, members on the lifting device supporting the plate so as to permit it to fold down, and additional members on the lifting device adapted to releasably engage the peripheral edges of the semi-circular sections to hold them against folding down.

2. In a storing, conveying and charging means for pig iron in cupola furnaces, a detachable plate having downward folding semi-circular sections adapted to ride on a roller table, said plate provided with means cooperating with members on a lifting device for supporting the plate, said plate also having means cooperating with additional

members on the lifting device adapted to releasably engage said means to hold the sections against folding down, said plate sections provided underneath with grooves for registering with rollers on a roller table.

3. In a lifting device for cupola furnace charging systems, a hoisting member having depending loops for engaging a transporting device, a pair of arms depending pivotally from the hoisting member, hook arms pivotally secured at the lower ends of the pair of arms, and means for retaining said arms in position of thrusting their hooks under a transporting device, and of releasing said arms from said position.

4. In a lifting device for cupola furnace charging systems, a hoisting member having depending loops for engaging a transporting device, a pair of arms depending pivotally from the hoisting member, hook arms pivotally secured at the lower ends of the pair of arms, and means for retaining said arms in position of thrusting their hooks under a transporting device, and of releasing said arms from said position, one or both of said pair of arms having a notch in the edge thereof near the lower end thereof for presenting a shoulder against tipping of an overbalanced sprue tray.

EARL F. ROGERS.